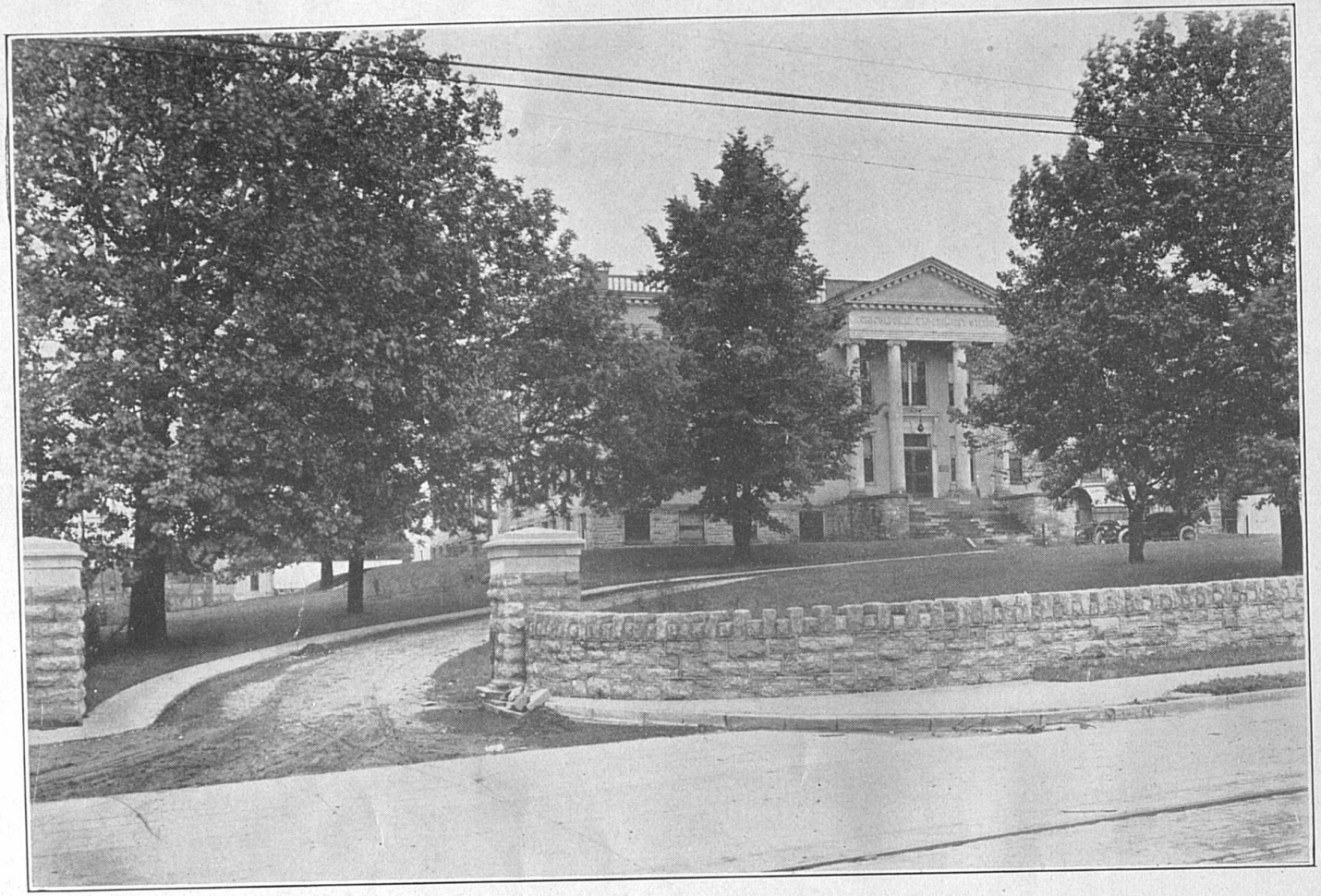


EXPERIMENT STATION BUILDING.

EXPERIMENT STATION BUILDING.

TWENTY-SIXTH ANNUAL REPORT

OF THE

# Kentucky Agricultural Experiment Station

OF THE

## STATE UNIVERSITY

LEXINGTON, KY.

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FOR THE YEAR 1913

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STATE UNIVERSITY PRESS
LEXINGTON, KY.

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# Letter of Transmittal.

*To His Excellency,*

HON. JAMES B. MCCREARY,

*Governor of Kentucky.*

SIR:—

Under the authority of the Board of Control of the Kentucky Agricultural Experiment Station, and in accordance with an act of Congress, approved March 2, 1887, and entitled "An Act to establish Agricultural Experiment Stations in connection with the Agricultural Colleges established in the several States under the provision of an act approved July 2, 1862, and under the acts supplementary thereto," and of the act of the Legislature of the State of Kentucky, approved February 20, 1888, and entitled "An Act to accept the provisions of an Act passed by the Congress of the United States, approved March 2, 1887, for the establishment and maintenance of Agricultural Experiment Stations in connection with Agricultural Colleges established by the several States and Territories under an Act of Congress, approved July 2, 1862," I herewith submit the Twenty-sixth Annual Report of the Kentucky Agricultural Experiment Station.

Very respectfully,

JOSEPH H. KASTLE, *Director.*

February 1, 1914.

# State University

## LEXINGTON, KY.

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## BOARD OF TRUSTEES.

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His Excellency, Governor James B. McCreary, *ex-officio* Chairman.

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JOSEPH H. KASTLE, Director.

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HYWEL DAVIES, Purchasing Agent.
O. L. GINOCHIO, Secretary to Director.
ADDIE LEE DEAN, Librarian.
ANNA WALLIS, Clerk.
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E. J. KINNEY, Assistant Agronomist.
S. C. JONES, Soil Survey.
A. E. EWAN, Supt. Experiment Fields.
H. B. HENDRICK, Extension in Agronomy.
B. F. SCHERFFIUS, Tobacco Expert, U. S. Department Agriculture.

### ANIMAL HUSBANDRY.

(Beef Cattle, Sheep and Swine.)

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ROBERT GRAHAM, Veterinary Science, in Charge Hog Cholera Serum Production.
L. W. McELYEA, Veterinary Science. Hog Cholera Serum.
E. W. MUMMA, Asst. in Charge Hog Cholera Serum Production.
G. C. ROUTT. Asst. in Animal Husbandry.
O. S. CRISLER, Hog Cholera Serum.
W. V. SMITH, Asst. in Animal Husbandry.
M. G. GINOCHIO, Clerk.
C. B. WILSON, Hog Cholera Serum.
LAWRENCE GINOCHIO, Clerk.
E. J. GOTT, Hog Cholera Serum.

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(Horses, Dairy Cattle and Poultry.)

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W. D. NICHOLLS, Asst. in Dairying.
J. W. NUTTER, Supt. Dairy Farm.
D. D. SLADE, Supt. Poultry Farm.
P. E. BACON, Elmendorf Milk Records.
F. WALLACE UTTERBACK. Clerk.

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ETHEL V. T. CASWALL, Clerk.

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MARY L. DIDLAKE, Laboratory Asst.
E. C. VAUGHN, Asst. in Seed Inspection and Plant Breeding.
H. H. JEWETT, Research Asst. Entom.
H. R. NISWONGER, Asst. in Field Work and Nursery Inspection.
LOUISE BEWLAY, Clerk.

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J. H. CARMODY, Horticulture.

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WM. RODES, Assistant Chemist.
ELMER INGRAM, Inspector.
R. W. JONES, Inspector.
ANNA WALLIS, Clerk.

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L. A. BROWN, Chemist, Drugs.
J. W McFARLIN, Chief Food Inspector.
W. R. PINNELL Bacteriologist.
C. S. PORTER, Inspector, Drugs.
J. E. MASTIN, Assistant Food Chemist.
WALTER SCHEPPELMAN, Inspector, Bakery Sanitation.
E. F. WORTHINGTON, Inspector, Dairy Sanitation.
W. G. TERRELL, Inspector, Foods.
LILLIE LISTON, Chief Clerk.
AMY V. LYONS, Clerk.

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J. H. CARMODY, Extension in Horticulture.
F. W. HOFMANN, Asst. in Horticulture.
G. B. WURTZ, Consulting Meteorologist.
MURIEL CASWALL, Clerk.

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D. J. HEALY, Bacteriologist.
E. S. GOOD, Animal Husbandry.
O. M. SHEDD, Chemist.
MARY L. DIDLAKE, Asst. Entomologist and Botanist.
G. D. BUCKNER, Chemist.
H. H. JEWETT, Research Asst. in Entom.
G. C. ROUTT, Assistant in Animal Husbandry.

Address
KENTUCKY AGRICULTURAL EXPERIMENT STATION,
LEXINGTON, KENTUCKY.

# THE KENTUCKY AGRICULTURAL EXPERIMENT STATION

In account with the United States Appropriations:

| | Hatch Fund. | Adams Fund. |
|---|---|---|
| Receipts from the Treasurer of the United States, as per appropriations for fiscal year ended June 30, 1913, under Acts of Congress, approved March 2, 1887 (Hatch Fund) and March 16, 1906 (Adams Fund) | $15,000.00 | $15,000.00 |
| Expenditures: | | |
| By Salaries | 10,659.75 | 13,479.60 |
| Labor | 774.55 | 100.54 |
| Publications | 235.43 | |
| Postage and Stationery | 822.10 | 40.60 |
| Freight and Express | 101.94 | 5.39 |
| Heat, Light, Water, Power | 366.96 | 22.07 |
| Chemicals and Laborat'y Sup. | 160.73 | 242.32 |
| Seeds, Plants and Sundry Sup. | 264.52 | 114.83 |
| Feeding Stuffs | | 62.55 |
| Library | 816.39 | 149.96 |
| Tools, Machinery and Appli. | 1.39 | |
| Furniture and Fixtures | 525.65 | 12.25 |
| Scientific Appar. and Specimens | 157.05 | 105.10 |
| Live Stock | | 286.00 |
| Traveling Expenses | 16.55 | 224.29 |
| Contingent Expenses | 20.00 | 142.00 |
| Buildings and Land | 76.99 | 12.50 |
| | $15,000.00 | $15,000.00 |

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Kentucky Agricultural Experiment Station for the fiscal year ended June 30, 1913; that we have

found the same well kept and classified as above; that the balance brought forward from the preceding year was nothing on the Hatch Fund, and nothing on the Adams Fund; that the receipts for the year from the Treasurer of the United States were $15,000.00 under the Act of Congress of March 2, 1887, and $15,000.00 under the Act of Congress of March 16, 1906, and the corresponding disbursements $15,000.00 and $15,000.00; for all of which proper vouchers are on file and have been by us examined and found correct, leaving balances of nothing and nothing.

And we further certify that the expenditures have been solely for the purposes set forth in the Acts of Congress approved March 2, 1887, and March 16, 1906, and in accordance with the terms of said acts, respectively.

(Signed) H. S. BARKER,
RICHARD C. STOLL,
Auditors.

(Seal)

Attest: W. T. LAFFERTY, Custodian.

# ANNUAL REPORT

OF THE

# Kentucky Agricultural Experiment Station

FOR THE YEAR 1913.

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## REPORT OF THE DIRECTOR.

The year 1913 has been one of progress and substantial growth in the work of the Experiment Station. Among the items of general interest affecting our work may be mentioned the following:

Cooperation with the Central Kentucky Millers' Association, looking to the wider and more general distribution of Jersey Fultz wheat for seed purposes, progress in the work and cultivation of the several experimental farms now being operated in various localities throughout the State, the experimental study of infectious abortion in cows and mares, the completion of a new barn for beef cattle feeding experiments and the inauguration of such experiments, also extensive studies in swine feeding, greatly increased facilities for the preparation and distribution of hog cholera serum, the study of inherited characteristics of horses and jacks, the rearing and feeding of jacks, jennets and mules, the organization of a State dairymen's association, the establishment of cow testing associations, the study of the Sharples vacuum milking machine as compared with hand milking, experiments in the feeding of dairy cattle, the establishment of a poultry plant on the Experi-

ment Station farm and the erection of a number of inexpensive poultry houses intended to serve as models to those interested in poultry raising, the study of various injurious insects, the inspection of nursery stock, the analysis of field seeds, the study of forage plants, experimental studies on the corn-ear worm and the nodule-producing bacteria of leguminous plants, the discovery of a Hymenopterous parasite of San Jose scale, progress in the work of agricultural extension, increase in the work of the Departments of Commercial Feeding Stuffs and Commercial Fertilizers and considerable increase in the general scope of the work of the Pure Food and Drug Department, the reorganization of the Department of Horticulture and increase in the amount of land available for horticultural experiments on the Experiment Station farm, the completion and dedication of the new addition to the Experiment Station building and considerable increases in the permanent equipment of the various departments of Experiment Station work, the organization of the various lines of Experiment Station work on a strictly departmental basis. The original investigations of the Experiment Station carried on within the period covered by this report have included a study of fodder poisoning and the possible significance of a corn mold, *Monascus purpureus*, to this disease, the study of milk fever (*parturient paresis*), the effect of calcium on anaphylaxis, the sulphur content of certain typical Kentucky soils, the total sulphur content of certain useful plants, the woody plants of Kentucky, the growing and fattening of hogs in the dry lot, and on forage crops, measurements looking to the standardization of jack stock.

The present organization of the Experiment Station,

together with detailed reports of the several departments are given in the following.

NEW BUILDINGS AND EQUIPMENT. The new addition to the Experiment Station building, reference to which was made in the last annual report, has been completed and is now occupied by the various departments of the Experiment Station. This affords comfortable offices and laboratories for the employees of the Experiment Station and entirely relieves the congested condition which has obtained for the past several years.

A new hog cholera serum laboratory, costing approximately twelve thousand dollars has been erected on the Experiment Station farm, and excellent facilities are now at hand for the preparation of hog cholera serum and virus, so that the Experiment Station is now well equipped for taking care of the extensive demands made upon us for these products.

A barn for the housing and feeding of beef cattle has been erected on the Experiment Station farm, and embodies in its construction the latest and best ideas obtainable along this line.

Considerable additions have also recently been made to the office and laboratory equipment of the Experiment Station which will greatly enhance the general efficiency of our work.

STATION STAFF. APPOINTMENTS. The following men have been secured for the hog cholera serum work: Dr. E. W. Mumma, of Pennsylvania University, as assistant in charge of the laboratory, and Dr. O. S. Crisler, of the Indiana Veterinary College, as assistant in field work in the administration of hog cholera serum, Messrs. C. B. Wilson and E. J. Gott, graduates of State University, Lexington,

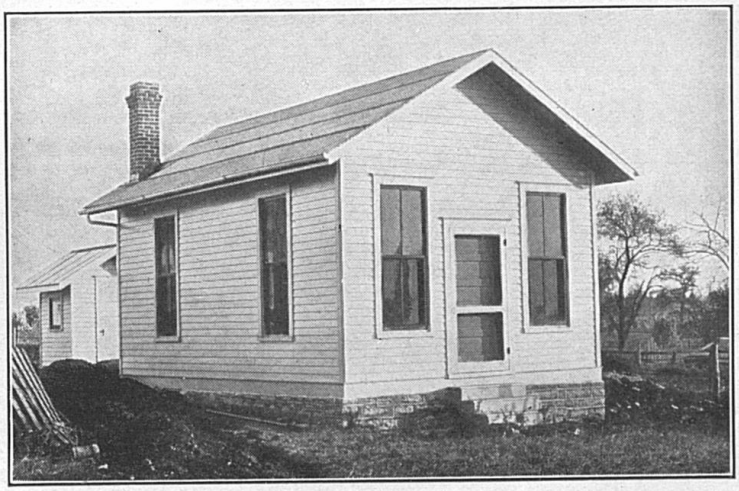


PLATE 1. OLD HOG CHOLERA SERUM LABORATORY.

Kentucky, to assist in the routine work of the laboratory and Mr. Lawrence Ginochio to look after the clerical work in the office.

Mr. Hywel Davies has been appointed Purchasing Agent of the Experiment Station.

Dr. W. S. Anderson, of the Kentucky Wesleyan College, has been appointed a member of the Station Staff to take up the study of inherited characteristics of horses and mules.

Professor F. W. Hofmann, of the Nebraska State College, has been appointed Assistant in the Department of Horticulture.

Mr. G. C. Routt and Mr. Wallace V. Smith, graduates of State University, Lexington, Kentucky, have been appointed Assistants in the Department of Animal Husbandry (Beef Cattle, Sheep and Swine).

Mr. D. D. Slade, a practical poultryman of wide experience has been appointed Superintendent of the poultry farm.

Miss Addie Lee Dean, a graduate of the State University, Lexington, Kentucky, has been appointed Librarian of the Experiment Station, and Miss Amy V. Lyons has been appointed to assist in the clerical work of the Food and Drug Department.

RESIGNATIONS. Dr. F. M. Surface, Biologist of the Experi- Station. Resigned July 1, 1913, to accept the position of Biologist, Department of Biology, Maine Agricultural Experiment Station, Orono, Maine.

L. S. Corbett, Assistant in the Department of Animal Husbandry (Beef Cattle, Sheep and Swine). Resigned August 1, 1913, to accept a Professorship in the Department of Animal Husbandry of the Maine Agricultural College, Orono, Maine.

William C. Matthews, Artist of the Experiment Station.

Resigned September 1, 1913, to take up work as Instructor in Scientific Illustration in the College of Agriculture of the University of California, Berkeley, California.

Dr. R. L. Pontius, Field Expert in Administration of Hog Cholera Serum. Resigned to engage in the practice of veterinary medicine in Lancaster, Kentucky.

Mr. A. J. Reed, Dairy Expert, United States Department of Agriculture. Resigned to take up similar work in North Carolina.

As at present organized, the Kentucky Agricultural Experiment Station includes the following departments:

Department of Administration—Messrs. Kastle, Curtis and Davies.

Department of Agronomy—Professor George Roberts, Head.

Department of Animal Husbandry—(*Beef Cattle, Sheep and Swine*).—Professor E. S. Good, Head.

Department of Animal Husbandry—(*Dairy Cattle, Horses and Poultry*).—Professor J. J. Hooper, Head.

Department of Chemistry—Dr. A. M. Peter, Head.

Department of Entomology and Botany—Professor H. Garman, Head.

Department of Extension—Professor T. R. Bryant, Head.

Department of Feed Control—Mr. J. D. Turner, Head.

Department of Fertilizer Control—Mr. H. E. Curtis, Head.

Department of Food and Drug Control—Mr. R. M. Allen, Head.

Department of Horticulture—Professor C. W. Mathews, Head.

Department of Research—Dr. Joseph H. Kastle, Head.

The work of these departments for the year 1913, may be summarized as follows:

DEPARTMENT OF ADMINISTRATION. As indicated by its name, this Department is occupied with the business affairs of the Experiment Station and with the necessary routine and executive work involved in the administration of the affairs of an institution such as this.

DEPARTMENT OF AGRONOMY. During the period included in this report, this Department has been engaged in experimental field studies in the cultivation of the following crops:

1. *Corn.* Methods of cultivation; rates of seeding; breeding for yield, and to determine relation of ear characteristics to yield. Variety tests, both on the Experiment Station farm and at London, Kentucky. It has been shown as the result of three years' work that on soils in good physical condition and well prepared, frequent cultivation is not necessary, except to keep down weeds. No advantage has been gained by cultivating beyond three or four times. Rates of seeding tests have shown that on strong soils, three stalks per hill will give better yields than two. Variety tests have shown that corn of the type of Boone County White is best adapted to strong soils and that varieties of the Hickory King type are best adapted to the thinner soils.

2. *Wheat.* Tests of varieties, extending over eight years; rates of seeding; fertilizer tests on wheat following corn; wheat grown in different rotations; breeding to increase yield. The test of varieties has shown Jersey Fultz to be the best smooth wheat for soils of the type represented by the Experiment Station farm when both yield and quality are considered, and Turkey the best variety of bearded wheat. Jersey Fultz has also been tried by farmers outside of Central Kentucky and has been found, in most cases, to be superior to other varieties grown in these localities. This variety is being extensively introduced in different parts of the State by farmers

who grow it under the direction of the Experiment Station. About ten thousand bushels were distributed in this way in the fall of 1913. Through cooperation with the Central Kentucky Millers' Association, considerable progress has been made in the introduction of this variety among the farmers of Central Kentucky. It is hoped in this way to increase materially the yield of wheat in the State. The chief problem confronting the Experiment Station in the introduction of this variety is the difficulty in securing a sufficient quantity of this wheat for seed purposes. During the past year, two progressive farmers of Henry County have placed at the disposal of the Director of the Experiment Station, forty-six acres of good land for the production of Jersey Fultz seed wheat. Experiments in rotation have shown that it is almost impossible to get satisfactory yields of wheat following corn. It has been shown that wheat yields especially well following soybeans on soils of the type of the Experiment Station farm.

3. *Oats.* A large number of variety tests of winter oats have been made and cooperative work with the United States Bureau of Plant Industry has been carried out in the test of crosses and selections of spring oats. An effort has been made to develop a strain of winter oats that will stand the occasional severe winters of Kentucky. There is already much promise of success for this effort. The work with spring oats also gives promise of largely increasing the yield of spring oats by developing better types.

4. *Barley.* Our work on barley has included tests of varieties and strains furnished by the United States Bureau of Plant Industry.

5. *Alfalfa.* Our experiments on this important legume have included the effect of time and method of seeding; the



PLATE 2. NEW HOG CHOLERA SERUM LABORATORY.

effect of time upon yield; the effect of dynamiting the soil and of subsoiling upon the life and yield of the crop. In some instances, lime has been found to increase the yield 300 per cent, and under no conditions thus far tried, has it failed to give profitable returns.

6. *Sweet Clover.* Time and manner of seeding; effect of lime. On the Experiment Station farm, lime has increased the yield from 2,100 pounds to 5,300 pounds per acre. On the London experiment field, it has been shown that sweet clover cannot be grown without lime, but with lime a satisfactory growth is obtained, 2,800 pounds per acre having been harvested from a rather poor stand.

7. *Soybeans.* Our studies on soybeans have included rates and methods of seeding; cultural methods; variety tests; harvesting, curing and threshing with ordinary farm machinery. The best rate of seeding and distance between rows have been determined. Also methods of cultivation have been worked out, also methods for harvesting and threshing without the aid of special machinery.

8. *Soiling Crops.* Experiments have been conducted for two years to determine a rotation of soiling crops that will furnish green feed continuously from early spring until frost. Incidentally to this, cows were fed soiling crops and pastured to compare the two systems. The results of this investigation are now being prepared for publication.

9. *Experiment Fields.* A permanent soil experiment field has been laid out on the Experiment Station farm to determine the treatment and cropping system necessary to maintain the fertility of soils similar to that of the Experiment Station farm.

The principal work of the Department of Agronomy for the year 1913 has been the location of four experimental fields in

various parts of the State, namely, one at Greenville, Muhlenberg County, one at Russellville, Logan County; one at Lone Oak, McCracken County; and one at Mayfield, Graves County. With the exception of the field at Russellville, the fiscal court of each of the above named counties has donated the land for these experimental fields on a warranty deed, the Experiment Station to assume all expenses of operation. At Russellville, the land is held on perpetual lease, the rent for same being paid by the county. The collective value of these several experimental fields is estimated at $8,050.00. The experimental cultivation of these fields has already been begun and crop rotations established, although the long, continued drouth prevailing over the State has greatly interfered with the successful operation of these fields during the past season.

In addition to these experimental fields, the cooperative work in this Department has been continued at Burnside with Mr. Charles Roberts. The yield of corn has been increased on this experimental field from seven bushels to forty-six bushels per acre by the use of acid phosphate, at a cost of two dollars per acre per year. Practically all of the phosphate used on this land is still in the soil and will gradually become available for future crops.

On the London field, conducted in cooperation with the Sue Bennett Memorial School, the yield of corn has been increased from 20.7 bushels on the untreated land, to 51.9 bushels per acre on the treated land. The untreated land in this field produced only 950 pounds of cowpea hay, whereas the treated land produced 4,100 pounds of this hay per acre, the treatment consisting of an application of acid phosphate and limestone.

*Tobacco Investigations.* The tobacco investigations, in cooperation with the Bureau of Plant Industry of the United States Department of Agriculture, have been continued during the past year. The object of this work is the improvement of native strains of tobacco by pure breeding and seed selection; the determination by experiment, of the best use of fertilizers for improving the quality and yield of tobacco; the development of a better rotation system with tobacco as the leading crop and, lastly, the effect of environment upon the tobacco plant and improvements in methods of cultivation and curing. Pure bred seeds of a number of varieties of tobacco have been distributed, free of charge, to tobacco growers in the State, upon application, and also a large number of lots of tobacco seed have been cleaned and graded at the Experiment Station.

DEPARTMENT OF ANIMAL HUSBANDRY. (*Beef Cattle, Sheep and Swine*). Among the more important lines of work carried out in this Department of Animal Husbandry during the past year is the investigation of infectious abortion in mares. A great many valuable foals are lost annually through this disease which it seems is becoming increasingly prevalent in many sections of the State. Professor Good has been successful in isolating the organism causing this disease and has found it to be different from the organism causing the disease in the cow. The disease has been experimentally produced in the mare with pure cultures of this organism, and the germ recovered from the uterine exudate. It has been found further that the disease can be diagnosed in mares by means of the agglutination and complement fixation tests. The effort is now being made to discover a preventive and cure for this malady. In this department the study of contagious abortion of cows has

been continued with encouraging results. A biological test has also been devised whereby this disease may be readily diagnosed, the test having been tried on approximately 800 cows with good results. Attempts have also been made to prepare a vaccine for the prevention and cure of this disease, with good indications of success.

Experiments in feeding beef cattle have been begun with the view of studying the effect of feeding in the dry lot as compared with the open range, and also with the view of determining the advantage or disadvantage of finishing steers fed by these two methods on blue grass pasturage in the spring. This last phase of the problem involved in beef cattle feeding is of special importance to this live-stock industry in Central Kentucky.

An outbreak of cerobro-spinal meningitis among live stock, during the fall and winter months, has also been studied in this department and proven to be due to the extensive use of moldy feed.

Extensive studies in pig feeding have also been carried on during the past year and valuable comparisons made as to fattening hogs in the dry lot and with forage crops. Our experiments go to show that the hog is the most profitable meat-producing animal grown on the farm; that on properly balanced rations, at least one dollar per bushel can be realized on the grain fed at the present price of hogs, to say nothing of the value of the manure obtained which, from our estimate, is worth 21.25 cents for every bushel of grain consumed.

From the results of analyses made in the chemical laboratory of the Experiment Station, the young plants of rye, barley, wheat and oats contain as much protein as do the legumes, and our feeding tests, so far, tend to show that about as good

PLATE 3. THE BEEF CATTLE BARN, EXPERIMENT STATION FARM.

results can be obtained from the pasturing of hogs on these crops when young as by pasturing on legumes. Charging against the experiments, the grain consumed by hogs running on such crops, as high as $33.68 per acre has been made by the use of such pastures. A decided advantage of these crops over the legumes is that they are green during the late fall, winter and early spring months, after the clovers, etc., have been killed by freezing. The climate of Kentucky is such that hogs can graze these crops to a considerable extent even during the winter months. This fact should contribute greatly to the success of pork production as a part of a general system of farming. In fact, with judicious systems of feeding, nothing can prevent the raising of hogs in this State from being very profitable, except the ravages of hog cholera. With the elimination of this disease through the use of hog cholera serum, an effort should be made to double the number of hogs now being raised in the State.

*Hog Cholera Serum.* As recently pointed out by Professor Good, the State of Kentucky is admirably adapted to the raising of hogs, provided that adequate means can be taken to prevent the ravages of hog cholera. It has been estimated that the farmers and hog raisers of our State suffer an annual loss from this disease among their swine amounting to one and one-half million dollars. Realizing the enormity of this loss to the swine interests of the State, the Kentucky legislature in 1910 appropriated to the Experiment Station, the sum of two thousand dollars for the erection of a laboratory for the preparation of hog cholera serum and virus. Out of this appropriation, the small laboratory shown in Plate 1, was erected and equipped with the necessary apparatus and appliances for the production of the serum. The first output of serum from this laboratory was made in

April, 1911, and for a time after its first production in our laboratory, the demand for serum far exceeded the quantity which we were able to furnish. Realizing the entire inadequacy of this small laboratory, further provision for the production and distribution of hog cholera serum and virus, was made in the appropriation granted to the Experiment Station by the General Assembly at their last session. Out of the proceeds of the State appropriation, a new hog cholera serum laboratory was erected and equipped for operation by June 1, 1913, at an approximate cost of $15,000. (See Plate 2). This laboratory has been pronounced by one of the United States Government experts of the Bureau of Animal Industry to be one of the most complete and convenient laboratories for the production of hog cholera serum in the United States. The new serum laboratory has a maximum capacity of 300,000 cubic centimeters of hog cholera serum per week, a quantity sufficient to meet almost any emergency that may arise in the treatment of hog cholera in the State.

During the year 1913, 4,427,120 cubic centimeters of hog cholera serum were produced in the Experiment Station laboratory. From the beginning to January 1, 1914, the total amount of serum produced in the Station laboratories was 5,751,369 cubic centimeters, or the quantity required to vaccinate 287,568 fifty-pound hogs. Our records show that during the year 1913, we vaccinated 47,673 hogs, representing 923 herds, and that since the beginning of this work to January 1, 1914, 1477 herds or 70,994 hogs have been vaccinated.

During the month of October, 1913, alone, we produced 828,983 cubic centimeters of serum at a cost of 0.913 cent per cubic centimeter. On account of the large sums of money needed for hogs, large numbers of which are required

for the preparation of the serum, the production of hog cholera serum has proven the most expensive single line of work ever engaged in by the Experiment Station. Since the beginning of its manufacture, no less than $77,000 have been put into this enterprise alone, but by careful management and through the careful and painstaking cooperation of all concerned, the work of the serum laboratory has been brought to a high degree of efficiency and has practically been made self-sustaining.

During the first part of the period included in this report, the work of hog cholera serum production was under the general direction of Professor Good. Since the latter part of August, 1913, however, the work of the serum laboratory has been in charge of Dr. Robert Graham.

DEPARTMENT OF ANIMAL HUSBANDRY. (*Dairy Cattle, Horses and Poultry*). -The work of this Department has included a study of inherited characteristics in horses and jacks. With the view of discovering the laws of color inheritance, the mating records of over 11,000 horses have been studied, with the result that gray has been found to be the strongest or most dominant of all of the coat colors, while chestnut is the recessive. Other inherited characteristics of the horse will be investigated such as speed, action, gait, endurance, form and intelligence.

In this department, studies have been made as to the breeding, rearing and feeding of jacks, jennets and mules, and in this connection a great amount of interesting information has been brought to light concerning the early history of jack stock in Kentucky. With the object of standardizing jack stock, actual measurements have been made, apparently for the first time in this industry, of a large number of jacks and photographs made of the animals thus measured.

Experiments on the feeding of mules have also been made in this department.

During the past year, the activities of the Experiment Station in dairying have been very numerous and helpful. Large numbers of farmers and dairymen throughout the State have received instruction in the best methods of dairy farming and in the production and handling of milk. A State Dairymen's Association has been organized, the annual meeting of which is held during farmers' week at the College of Agriculture of the Kentucky State University.

This department also had charge of the model dairy rooms and of the dairy cattle exhibits at the State Fair. A cooperative cow testing association was established in Shelby County in May, 1913. Fifteen dairy farmers of this renowned dairy section have been benefited by the services of this association and four hundred cows tested, with the result that many unprofitable cows have been eliminated from these herds. For the past six months or longer, this department has had practical supervision of the great dairy of the Elmendorf Farm and also of the smaller dairy farm at the Odd Fellows Home, near Lexington. The result has been that since the Experiment Station took charge of the Elmendorf dairy, the milk of this great dairy has shown the lowest bacterial count of any milk supplied the city of Lexington, with the possible exception of the milk supplied by the smaller dairy of the Experiment Station. Indeed, it may be said that all of the influences now operating in various parts of the State, for the production of strictly clean, high grade milk, have emanated either directly or indirectly from the Experiment Station.

A series of tests with the Sharples vacuum milking machine have been conducted at the Experiment Station dairy. The efficiency of this machine with regard to its effect on the

bacterial count, the amount of milk produced and the quantity of butter fat obtained, has been compared with hand milking, and some valuable results have been obtained which will soon be in shape for publication.

Experiments on the feeding of dairy cattle with distillers' dried grains have also been made on the Experiment Station herd. Bulletin No. 171 gives the proper methods of feeding dairy cows and also the results of experiments recently carried out in this department on the feeding of calves. A twenty-eight page circular recently issued by this department gives detailed information regarding the actual work of the Experiment Station dairy, such as the separation and cooling of cream, butter-making, and a simple remedy for scours in calves.

For a number of years, a small poultry yard has been maintained at the Experiment Station farm. This work is now being greatly enlarged. Mr. D. D. Slade a practical poultry man of large experience has been appointed Superintendent of the Poultry Farm. Eight poultry houses of different types, costing about forty dollars each, are being erected on the eight acres of ground set apart for this purpose. These houses are being built with the idea of serving as models for the practical farmer, and are shown in the accompanying illustration. They are inexpensive and simple in construction and will doubtless serve as excellent models for Kentucky conditions. Eight hundred birds of seven different varieties will be carried on this farm and experiments will be carried out to determine the value of different feeds, and breeds for egg-laying and meat production and the different kinds of crops that should be grown on a poultry farm. Apple, plum, mulberry, pecan and walnut trees are being

planted to determine their respective values as shade trees and as trees to furnish feeds for poultry.

This department of animal husbandry has also rendered valuable service to farmers and breeders of the State in the selection of live stock suitable to their requirements.

DEPARTMENT OF CHEMISTRY. To a large degree, chemistry is the scientific basis of agriculture. Hence the importance of the chemical work carried on in the Experiment Station can scarcely be overestimated. The most important work of the Chemical Department is in relation to the composition of the soils of the State and to the requirements of Kentucky soils.

In view of the value of limestone to many Kentucky soils, experiments have been made to test the relative speed with which limestone of different degrees of fineness is dissolved by dilute acid of uniform strength. These results have shown that the rate of solution is inversely proportional to the size of particle, and for practical considerations, it has been decided to recommend to farmers that limestone for agricultural purposes should be ground so as to pass through a 10-mesh screen.

In cooperation with the Association of Official Agricultural Chemists, a good deal of attention has been given to work on insecticides in this Department. A very rapid and accurate method has been devised for the analysis of lime-sulphur solutions and the Association of Official Agricultural Chemists has recognized the value of the method proposed by Dr. Peter and Mr. Averitt by authorizing a further comparison of this method with those that have been used in times past in the analysis of such solutions.

In connection with analyses made of tobacco, Mr. McHargue working in this Department, has observed that appreciable

quantities of barium are present in Kentucky tobacco and also in other plants, and further that a part of this may be extracted from the dry plant by means of water. This suggests that the barium present in plant tissue is not altogether in the form of inert sulfate, but that some of it is present in soluble and more active form, and that, therefore, this element may play some part in the mineral metabolism of the plant.

As heretofore, the work of this Department has included analyses of a large number of soils, minerals, rocks, various crops and other agricultural materials, from various localities in the State. The following is a brief summary of the number of samples of various materials analyzed in the chemical laboratory of the Experiment Station during the past year:

| | |
|---|---|
| Limestone and other calcareous materials for agricultural use | 130 |
| Mineral, potable and boiler waters | 111 |
| Tobacco leaf and stalk for plant food elements | 96 |
| Parts of plants, seeds, fruits, etc. for manganese | 83 |
| Soils for farmers | 64 |
| Parts of plants, seeds, fruits, etc. for barium | 44 |
| Coal, for Dept. Mechanical Engineering, Ky. State University, and for individuals | 43 |
| Phosphate rock | 18 |
| Sand used in pot experiments for Dept. of Agronomy | 15 |
| Alfalfa and sweet clover from field experiments at the Experiment Station farm, for Dept. of Agronomy | 7 |
| Lime sulfur solution, for individuals and in A. O. A. C. work | 7 |
| Iron ore for individuals | 6 |
| Ashes of coal and clinker from locomotives for the Q. & C. R. R. | 8 |
| Clay, for individuals | 4 |
| Hydrogen peroxide for the Louisville Lead & Color Co. | 4 |

| | |
|---|---|
| Corrosion tests of culvert steel, for County Engineer | 2 |
| Silicious residue of soil, for potassium investigation | 1 |
| Miscellaneous, including hog cholera serum for copper, hog cholera medicine, cow stomach for poison, commercial feeding stuff, nickel and cobalt ore, metallic packing, | 6 |
| Total | 649 |

In addition to these, more than 100 samples of soil sent in by farmers have been tested qualitatively for phosphate, acidity and calcium carbonate, and their senders advised as to the desirability of applying limestone and phosphate. These and a large number of rocks, ores, minerals and other materials have been examined and reported upon without being entered upon the laboratory register.

DEPARTMENT OF ENTOMOLOGY AND BOTANY. The Department of Entomology and Botany is occupied with work properly coming under laws enacted by the National Government and by the State of Kentucky for the maintenance of the work of the Experiment Station. Thus, the Hatch Act makes provision for the study of injurious insects and plants. Under the same law, seed testing is properly conducted. Seed inspection and nursery and orchard inspection are, however, conducted under State laws. Under the Adams Act, research work is being done in this department on the corn-ear worm and on the nodule bacteria of leguminous plants. The work of this department has included studies of the life-histories and injuries of various injurious insects, and while much of what is being done in this direction is intended to throw light on certain points in the history of pests immediately troublesome, yet in the long run, it has furnished much of the information and experience constantly demanded by farmers and others engaged in agricultural

pursuits, and has laid the foundation for work of a more thorough-going, scientific character.

Two State inspection laws are now looked after in this Department. In 1897, at a special session of the General Assembly, a law was enacted requiring the Entomologist and Botanist to inspect each year all nurseries in Kentucky. During the period of this report several millions of trees have been examined, additional inspection being made in cases of infestation with San Jose scale. This State inspection of nursery stock requires active work from July 1 to about August 15, and some attention is called for until December. The actual field expenses of the inspections are paid by a special State appropriation.

A Federal law, requiring the inspection of imported nursery and florists' stock, was enacted August 20, 1912, and became effective October 1, 1912, making necessary the inspection in each of the States of such importations as are designated to State inspectors as requiring this attention. The Experiment Station was without funds for carrying out the provisions of the act in Kentucky, and by a special and temporary arrangement with the State Department of Agriculture, the Commissioner, Hon. J. W. Newman, has until now paid out of the funds belonging to his Department, the field expenses incurred in the prosecution of this work. Ninety-seven shipments of imported stock, chiefly from Holland, Belgium, France and England, have been examined since this law went into effect, the total number of plants amounting to 174,747. Occasionally, insect pests have been found on some of these shipments, and some fungus parasites, but the law is having a good effect and stock now imported is in much better condition than it was formerly, when it brought to this country the gypsy moth, the brown-

tail moth, elm leaf beetle, cabbage worm and a long list of other pests.

Under another arrangement with the United States authorities, the head of this department is responsible for the inspection of any importations coming from foreign countries having no official inspectors. The expenses for these inspections are paid by the Federal Board at Washington. Up to the present but few such importations have been received and at present this provision is largely precautionary.

In 1904, a law was enacted by the Kentucky General Assembly providing for the inspection of the following field seeds: Orchard grass, Kentucky bluegrass, red clover, mammoth clover and alfalfa. It was known that some of these seeds were being adulterated with trefoil, Canada bluegrass and spent rye grass seeds. Soon after the law went into effect, the samples collected by the Department showed about eight per cent of the bluegrass in the market to be adulterated and nearly twenty per cent of the orchard grass. The percentages of adulteration have gradually fallen as the inspections continued until, in 1913, none of the seeds specified under the law were found to be adulterated. Seedsmen themselves have been quick to take advantage of the work now being done in this field, and at present more samples for testing are received from them than from any other source. During the year, 767 samples of field seeds have been tested for purity and 797 samples for germination, making a total of 1,564 samples of seeds tested. In order to do this, it has been necessary for one of the men of the Department, Assistant Professor Vaughn, to devote a large share of his time to this work during the fall and spring months when seeds are most actively handled in the market, the only other assistance available for the work coming from students who are

PLATE 4. BEEF CATTLE IN PASTURE, EXPERIMENT STATION FARM.

given special training in this line of work. With the rapid increase in the numbers of samples submitted for examination, it will be necessary for the Experiment Station to employ regularly trained assistants to keep this work up to the demands made upon us. The new addition to the Experiment Station building has provided the Department with an excellent seed laboratory which it is proposed to equip completely with the most approved modern apparatus for seed testing and investigation. Good seeds are absolutely necessary to successful agriculture. It is believed, therefore, that this little laboratory has before it a future of very great usefulness to the farmers and seedsmen of this State.

For many years, this Department has been engaged in studying forage plants with a view to testing their adaptability to Kentucky conditions and also with reference to their improvement. During the period covered by this report, we have had under cultivation on the Experiment Station farm at Lexington, 312 plots from an eightieth to a twentieth of an acre in area devoted to testing different forage plants, fiber plants and grains, to experiments with insects and insecticides, and to different systems of rotation. Of forage plants, we have now tested about everything considered at all promising, either native or introduced, that has been brought to our notice. In 1913, we had fifty-six varieties of soy beans in our plots and sixteen varieties of cowpeas. Of wheat we have kept but a small number of promising varieties, which it is our purpose to improve. Special attention is also being paid to strains of timothy, clover, alfalfa and bluegrass.

In this Department, test systems of crop rotation have been conducted for a good many years in cooperation with the Bureau of Plant Industry of the United States Depart-

ment of Agriculture. This work is carried on in part with funds furnished by the United States Department of Agriculture.

Studies have been made in the Department with reference to future bulletins along the following lines: Grape pests, bee-keeping, stinging flies and corn molds, the latter being made in connection with work on the corn-ear worm done under the Adams Act. The work on the corn-ear worm has been continued, and during the summer of 1913, it was also conducted in the extreme western end of the State, where it works on cotton as the boll worm. A bulletin on this insect is now in preparation.

Studies of the nodule bacteria have also been continued and over two thousand cultures have been made in testing these organisms. The cultural and microscopic characters of these bacteria have received some attention and are being studied in detail.

The work of this Department has also included the bacteriological examination of waters for potability. A number of these samples were sent us by physicians or health officers who suspected the waters from which they came of having caused cases of typhoid fever. In the course of tests of this sort, an interesting fact has appeared with reference to the development of gas by water bacteria thought to be derived from the sewage of dwellings. A presumably harmless, water-frequenting bacillus has been isolated in the laboratory, that produces more gas in fermentation tubes than the bacteria of typhoid fever. The gas is, however, produced more slowly. This organism appears to occur in most of our soil water, and when present in drinking water, might easily cause mistakes on the part of workers as to their quality. It has been isolated several times from reservoir waters.

Another interesting discovery made during the past two years is the presence in this State of numerous small Hymenopterous parasites working on the dreaded San Jose scale, the most destructive fruit pest introduced into America in recent years. The work of the parasites was noted by Professor Garman in 1912, and during the past summer they appeared in numbers on scales kept in the laboratory and secured from Lexington and some of the mountain counties. It is hoped that the parasites can be increased in numbers and distributed to localities in which they are not yet at work. At the request of the Illinois State Entomologist, a batch of them has already been sent to Illinois. The San Jose scale has during the past ten years, occasioned more worry to fruit growers than any other dozen pests. If these little parasites multiply and spread as we hope they will, the scale ought in the course of a few years to become much less dangerous. At present, the scale is everywhere present in the fruit growing sections of the eastern and western United States. By our State inspection law, it was for many years kept suppressed in our nurseries, but with no adequate provision in our law for keeping it out of other premises, it has spread in the orchards of the State until it is becoming difficult to keep nursery stock free from it and all of our nurserymen will, it is believed, be ultimately compelled to fumigate their stock. In anticipation of this condition, most of them have now equipped themselves with fumigating houses or boxes. In this condition of things, the little parasites above mentioned, are most welcome visitors in our orchards, and some sanguine person has denominated their discovery, and their distribution among fruit growers, as the most important horticultural work accomplished in recent years. This view of the matter, however, must be accepted with a good deal

of preservation, for the reason that it is well known to biologists that parasites never entirely destroy their hosts, and at best serve only as checks and balances. The parasites of the San Jose scale will undoubtedly prove helpful, but San Jose scale nevertheless is by no means a thing of the past.

DEPARTMENT OF EXTENSION. In its original conception, the purpose of the Agricultural Experiment Station is, as its name indicates, to carry on such investigations and to conduct such experiments as are likely to prove helpful to agriculture. It is one thing, however, to discover new truth, and quite another thing to disseminate it along channels where it may prove most helpful. It came gradually to be recognized, therefore, that a distinct branch or department of the Experiment Station service was needed in order to carry to the individual farmer and into the very heart of the rural community, the valuable results of Experiment Station work. A department of agricultural extension work was, therefore, organized a few years ago and is today one of the most eminently helpful and useful branches of the work of the Experiment Station. Its activities are far-reaching and either directly or indirectly include nearly every phase of our agricultural progress and development. Among these various activities, the following may be enumerated:

1. *Farmers' Week.* Each year during the first week in January, since the organization of the Extension Department, there has been held a series of meetings known as Farmers' Week. The exercises of this week include the annual conventions of the Sheep, Swine, Dairy Cattle, Beef Cattle and Horse Breeders' Associations, the State Horticultural Society and the Kentucky Corn Growers' Association; also the State Dairy Show and the State Corn Show. Speakers of national reputation have been secured for each of these conventions

and the whole enterprise is fostered and encouraged by the Experiment Station. Interest in Farmers' Week is steadily increasing and it has proven a very potent influence in directing the attention of the agricultural public toward the Experiment Station as the natural center of agricultural information. This and other lines of endeavor have served to increase the calls for assistance many-fold, and the possibilities of expansion along these several lines can scarcely be estimated.

2. *Extension Publications.* During the period included in this report, a bi-weekly series of press bulletins has been published through cooperation with the Western Newspaper Union and the Associated Publishers Company. To the Western Newspaper Union, six columns of agricultural educational matter are supplied each month, this material in turn being sent by the syndicate to approximately two hundred county newspapers within the State, in the form of so-called plate matter, which insures its publication by these papers. The Associated Publishers Company issues a colored magazine supplement monthly to fifty newspapers within the State. Such material as we supply to this Company usually appears in this colored supplement once a month in fifty county newspapers of the State.

3. *Itinerant Advisory Work.* One of the most effective lines of our extension work has been that accomplished by our traveling advisers who have given advice and assistance on an infinite variety of farm enterprises. This advisory work has been done largely by members of other departments of the Experiment Station under arrangements made by the extension service.

4. *Educational and Agricultural Exhibits.* Educational and agricultural exhibits have been made at the leading fairs

in Kentucky and at the National Corn Show. Plans have been completed for a systematic canvass of the county fairs of the State, through which agency great good can be accomplished, both by the lessons taught by these exhibits and by personal contact of those having charge of these exhibits with farmers from all sections of the State. At the Kentucky State Fair, not only were such exhibits installed, but other enterprises undertaken, such as the operation of a model dairy, showing the proper methods of producing and handling milk for the certified market, economy of production being the prime consideration. The ordinary operations of an up-to-date dairy have been conducted on the fair grounds during the past two years for the inspection of visitors.

5. *Boys' Encampments.* Upon competitive examinations, 110 boys from ninety counties were given free transportation to and from the State Fair. Camp accommodations during the week of the fair and their meals were also provided. During the forenoons the boys were given agricultural instruction by lectures, demonstrations and inspection of the stock, implements, and other exhibits on the grounds, and in the afternoons were allowed the liberty of the grounds. On returning to their homes, they were required to write an essay upon what they saw and learned at the fair, and these essays were published in their local papers and returned to the secretary of the fair. This encampment is to be continued each year.

6. *Boys' and Girls' Club Work.* During the period included in this report, the boys' and girls' club work of the State has been continued and creditable work has been accomplished in many localities. Thus, during 1912, fifty-three boys of the corn clubs succeeded in producing one

hundred bushels of corn or more per acre, this being approximately one-fourth of the number in all of the Southern States, to accomplish such results.

7. *County Agent Work.* During the year 1912, through cooperation with the United States Department of Agriculture, a beginning was made looking to the installation of a system of county agents in Kentucky, the head of the Extension Department of the Experiment Station being designated as the State Leader. Under this regime, eight counties, namely, Madison, Henderson, Jefferson, Warren, Metcalfe, Christian, Daviess and Muhlenberg, were provided with county agents, the counties paying one-half of the expenses of the work, the federal government providing the remainder. On July 1, 1913, this work was transferred at Washington from the Office of Farm Management to the Farmers' Cooperative Demonstration Work, and a new State Leader appointed. This change in administration completely divorces the Experiment Station and the United States Department of Agriculture in this line of work, so that they are working along independent lines, the federal work in the State being conducted by a newly organized board.

8. *Dairy Extension Work.* During the period included in this report, approximately one hundred silos of different types were constructed in Kentucky, and about fifty barns, milk houses, etc., were built or remodeled. Herd records were kept in from six to twelve herds, the number varying at times. Various other lines of assistance, such as the remodeling of rations, general dairy advice, etc., were provided. This has been one of the most profitable lines of extension activity.

9. *Extension Schools.* The extension school has proven one of the most potent influences in the way of getting defi-

nite agricultural information to the farming public. These extension schools have a faculty of from four to eight instructors, with illustrative material and demonstration equipment, and are held anywhere in the State upon the signed request of not less than fifty farmers to hold a four days' session in any particular locality. These schools were first attempted in the fall of 1912. Eleven were held with a total enrolled attendance of eight hundred.

10. *Agriculture in the Common Schools.* Through the efforts of the Extension Department, instruction in agriculture has been introduced into the curriculum of about fifteen schools of the State, and in the greater number of these, very satisfactory progress has been made.

11. *Alfalfa and Clover Clubs.* About ten of these clubs have been organized and visited periodically, the land selected for them and careful instruction given for the growing of alfalfa and clover. All have succeeded in producing good crops of alfalfa and clover where such had been impossible before. The good example of the members of these various clubs is being followed generally in their local communities, and when it is realized that land which can be gotten into clover or alfalfa at will, is ready not only for reclamation, but for greatly increased crop production, the indications of this line of work are most encouraging.

12. *Reclamation Work.* At Irvington, Kentucky, a twelve acre plot of absolutely worthless land was taken in hand by the Extension Department in February, 1913. By the application of lime and the growth of legumes, this land has been covered with a growth of cowpeas, sweet clover and alsike clover in a single season, thus promising a speedy restoration. Through this and other activities that have been undertaken in that neighborhood, an entirely new community spirit has been constructed, one evidence of which is the establishment

of a neighborhood fair which held its first meeting during the past summer with most gratifying results.

13. *Demonstration Orchards.* Nine unprofitable orchards have been taken under control by our extension department in various parts of the State. These have been pruned, sprayed, cultivated and otherwise cared for. The increased yields and the general condition of these orchards have been most gratifying to all concerned in this helpful undertaking, and the possibilities of such work are limited only by the time and money required.

14. *Special Meetings.* During the past year more than one hundred special meetings have been held under the auspices of the Extension Department, with an attendance of approximately 10,000 persons. These meetings have always been held at the request of the local community and were conducted wholly or in part by the extension service. It is safe to say that during the past year no less than eighty thousand persons have come within the influence of the Extension Department of the Experiment Station work.

DEPARTMENT OF FEED CONTROL. The work of the Department of Commercial Feeding Stuffs for the period covered by this report, has been directed along essentially the same lines as heretofore, namely, the inspection and analysis of commercial feeding stuffs, the education of consumers, manufacturers and dealers, and the economical and moral development of the business. As in previous years, inspectors have been continuously in the field, giving information to manufacturers, dealers, agents and consumers regarding the requirements of the law and the protection afforded thereby; inspecting and weighing shipments; watching for infractions and securing samples from materials on the market to be

sent to the laboratory for microscopical and chemical analysis.

For the year 1913, 1504 different brands of feeding stuffs were registered, representing 529 firms and the sum of $26,142.15 was received in fees.

In connection with the work of the Department, practically every town in the State, where commercial feeding stuffs are sold, or are likely to be sold, has been visited by our inspectors. Special attention has been given to misrepresentation and to the unwarranted claims made by unscrupulous manufacturers of feeding stuffs and a number of feeds and feeding stuffs have been refused sale within the boundaries of the State. The Department of Feed Control has also made a number of examinations of feeding stuffs suspected to be the cause of death of stock and poultry, with the result that some of these were found to contain poisonous weed seeds and fungi. A number of damage suits have been won on information furnished by this Department in such cases.

That part of the feed control law that deals with medicated stock and poultry feeds, tonics, conditioners and regulators, has not as yet been enforced, for the reason that the constitutionality of this specific part of the law is now being tested. In the case of Savage versus Indiana, however, the United States Supreme Court held that this provision of the Indiana law, which is similar to the Kentucky law, is constitutional. It is proposed, therefore, to take up this phase of the work at the earliest possible date.

DEPARTMENT OF FERTILIZER CONTROL. The Department of Fertilizer Control is one of the oldest departments of Experiment Station work and during the past year, the work of this Department has been administered with its

usual efficiency and to the best interests of all concerned.

During the year, 735 brands of fertilizers were registered and samples of these various brands sent by manufacturers have been analyzed, as well as samples collected by deputy inspectors and those sent by farmers. The results of these analyses are given in Bulletin 177, pages 411 to 591 of this report.

Tags and stamps to the amount of 3,347,434 have been issued for which the Experiment Station has received the sum of $38,289.83.

DEPARTMENT OF FOOD AND DRUG CONTROL. Besides the regular inspection and examination of food and drug samples and reports to the State's attorneys thereon, this department has directed special attention towards the following subjects; slaughter-house investigations, including plans for the establishment and control of the municipal abattoir; the sanitary inspection of grocery stores and the proper labeling of retail packages to show adulteration after the product has been taken by the grocer out of properly labeled wholesale packages; sanitary inspection of bakeries and the examination of materials employed in baking; sanitary inspection of dairies, and a bacteriological survey of the State's milk supply, including not only examination of the product from the dairies and milk depots, but also of samples taken from the market and in cooperation with city health departments; the examination of bleached flour; the examination of dried fruits and sausage for sulphites; the analysis of rice to determine coating and polishing, and the perfecting of a better method for determining added talc; an inspection of cold storage warehouses; an inspection of the sanitary condition of the "pop" factories, including an extended bacteriological and chemical examination of carbonated beverages

together with the materials and water employed; the analysis of veterinary supplies, physicians' prescriptions, pharmaceuticals, remedies and liniments intended both for man and animals; the collection of patent medicine labels and the correction of misstatements as to the medicinal value of such preparations.

Within the period covered by this report, the laboratories of this department have made analyses of 1648 samples of foods, 392 samples of drugs and drug preparations and 1774 samples of milk and cream, waters used in food, catsups, oysters, flour and other food products, making a total of 3814 examinations.

The field force of this Department has made grocery, drug, dairy, slaughter-house, cold storage and other inspections in all sections of the State. Special attention has been given to the work of assisting municipal health officers and other officials in surveying local conditions and in recommending proper methods of inspection and ordinances. There is a growing demand throughout the State for this kind of work. Special attention has also been given to the cause for shortage in drug products, not due to criminal intent, such as imperfect weights and measures and the incorrect handling of drugs liable to deterioration. Field tests of milk for sediment and fat have also been made and tests of flour and other foods. Bakery inspections have been conducted, special attention being paid to the handling of bread after it leaves the bakery. The bakery inspection work and the investigation of bakers' materials have led to the establishment of an experimental bakery at the Experiment Station for the study of the baking quality of various flours, the economic value of various harmless substitutes sold to the baker, and other general constructive work of this character.

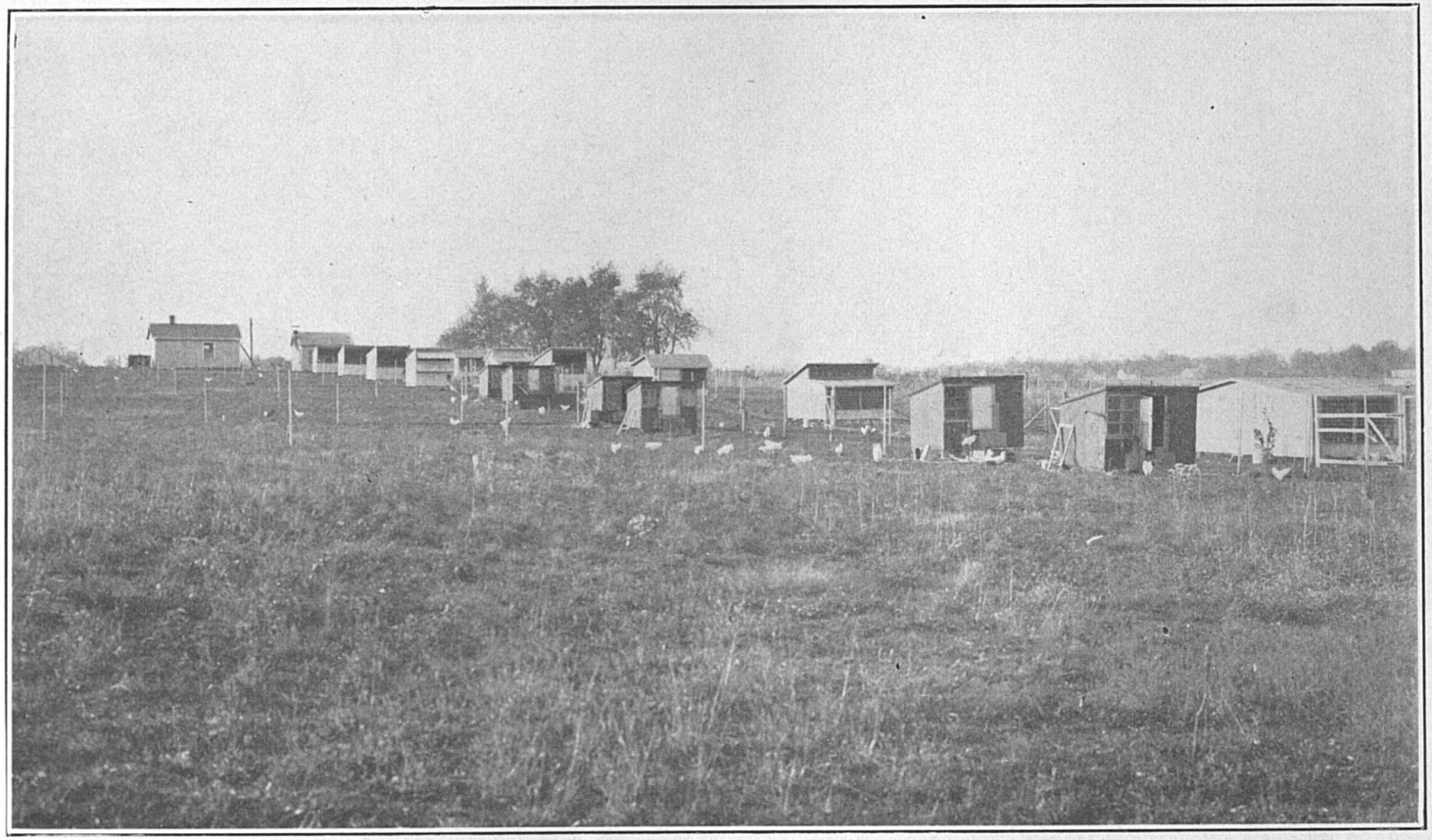


PLATE 5. THE POULTRY YARDS, EXPERIMENT STATION FARM.

There is a growing demand from all branches of the trade for scientific aid and assistance in establishing better methods and more scientific control over manufacturing processes generally. A striking instance of this need has recently been shown in our investigation of "pop" factories. In but few instances were the bottles used in this industry properly cleaned; in many instances, in fact, the bottles were found to contain visible amounts of dirt, and in one instance the bottler was found to be re-using crown corks which had been collected from the floor of a saloon.

Recently, the Mayor of Lexington requested the head of the Department of Food and Drugs Control to aid in the organization of proper municipal food inspection for the City of Lexington. This gave opportunity to put into every day practice what have been found to be the best methods of inspection. A year ago when this work was begun, the general milk supply of Lexington was about on an average with that of other American cities. After a year's cooperative work with the city, however, the monthly report of the entire milk supply shows a very striking improvement. In fact, the present purity of the milk supply of Lexington is ahead of any city of its size in the United States. Paducah, Henderson, and other smaller cities of the State are adopting the methods of inspection suggested by this Department. One of the large Louisville milk depots has placed its plant and the services of a trained inspector at the disposal of this department for the further study of the economic and sanitary handling of milk. Frankfort and Paris have asked for the establishment of a plan of milk inspection similar to that which has been in effect in Lexington for the past two years.

DEPARTMENT OF HORTICULTURE. During the period included in this report, the work of the Department of Horticulture has been chiefly concerned with the horticultural correspondence and with the planting of limited areas of small fruits and vegetables for the joint purposes of furnishing illustrative material for the large and growing classes in horticulture, and for beginning anew the establishment of experimental work in horticulture, which has been permitted to lapse during the past six or eight years.

During this period, the only space available upon the Experiment Station farm was a plot of about two acres, occupied in part with an old orchard standing upon the land before it was purchased for Experiment Station uses.

With a view of extending the Experiment Station work in horticulture as soon as funds should become available, small plots of strawberries, raspberries, currants, etc., were established, and a larger area was planted in grapes, from which, during the past season, the first appreciable returns have been secured from about fifty varieties. The small orchard referred to has been considerably renovated and improved and has borne fair crops of fruit during the past season. In the spring of the present year, the area for horticultural purposes was enlarged by the addition of two fields to the rear of the previously occupied land, giving the department a total of about eighteen acres. We are now engaged in planting about eight acres of this increased area in orchard fruits, including a wide range of varieties, thus giving increased opportunity for direct study and experiment at first hand, with the varieties of those fruits suited to our soil and climatic conditions. It is also proposed, next season, to largely increase the area devoted to small fruits, and to

extend the area set apart to the cultivation of grapes, for experiments in fertilizing, spraying, pruning, etc.

When the appropriation made by the last Kentucky Legislature became available, near the close of the past fiscal year, an assistant in horticulture, Mr. F. W. Hofmann, was secured, from the University of Nebraska, to aid in the enlargement and extension of our horticultural work.

Plans are now being made for the erection of a greenhouse upon our experiment area for such miscellaneous work as naturally falls to the lot of a horticultural department. It would include studies in propagation and later, as the glass area increases, experiments with the forcing of various vegetables and fruits.

There is a rapidly increasing interest in all departments of horticultural activity throughout our State, as shown by the increasing volume of the correspondence which calls for advice upon a wide range of horticultural topics, including the planting and care of orchards, the development of market garden interests, landscape development about homes and public buildings, and even, at times, to the proper care of house plants. With the increased resources of the Experiment Station, it is believed that this department will exert a much larger influence upon the horticulture of the State and be instrumental in promoting many kinds of profitable horticultural enterprises.

DEPARTMENT OF RESEARCH. Although each department of the Station is expected to carry on scientific investigations in its own particular field as an integral and essential part of its work, the Board of Control has recently sanctioned the establishment of a separate Department of Research under the general guidance and control of the Director. In this way, it is hoped the better to be able to comply with the

provisions of the Adams Act and to co-ordinate and, in some measure, properly supervise and control all of the research work of the Experiment Station. In addition to the research work already referred to in this presentation of the work of the several departments, the following lines of work have been carried out in this Department:

A study of fodder poisoning in live stock has resulted in the isolation and identification of a mold, Monascus purpureus, from a corn which was believed to be responsible for an outbreak of forage poisoning at Mayfield, and also of a closely related mold from corn which was possibly responsible for fodder poisoning at the Lexington Stock Yards. Four micro-organisms from the brain of a horse which died of fodder poisoning have been isolated and identified by Dr. Daniel J. Healy. The pathogenic character of these micro-organisms is now being studied on the guinea pig.

In connection with our work on parturient paresis, a study has also been made of the calcium metabolism of the guinea pig by Kastle, Healy and Shedd, the results of which investigation will soon be ready for publication. The effect of calcium on anaphylaxis has also been studied and the results obtained have been published in the Journal of Infectious Diseases, Vol. XII, No. 2, March, 1913.

Some time has been spent by Professor O. M. Shedd in the study of the sulphur content of certain typical Kentucky soils, and also of the total sulphur content of certain plants. It has been found that the sulphur in continuously cultivated soils, without fertilization, has decreased in fifty years to one-third of the amount originally present in the virgin soil. From his experiments, the conclusion seems evident that sulphur is an essential factor in permanent soil fertility, and a bulletin on this subject has been issued.

**Bulletins.**

No.

169. The Woody Plants of Kentucky. H. Garman.

170. Concentrated Commercial Feeding Stuffs. J. D. Turner and H. D. Spears.

171. 1. Feeding Dairy Cows. 2. Experiments in Feeding Cows and Calves. J. J. Hooper.

172. Fumigation and Spraying. H. Garman.

173. The Municipal Abattoir. R. M. Allen and J. W. McFarlin.

174. The Sulphur Content of Some Typical Kentucky Soils. O. M. Shedd.

175. The Growing and Fattening of Hogs in the Dry Lot and on Forage Crops. E. S. Good.

176. 1. Jack Stock of Kentucky. 2. Rearing of Mules. 3. Brood Mares for Producing Mules. 4. Experiments in Feeding Mules. J. J. Hooper and W. S. Anderson.

177. Analyses of Commercial Fertilizers. H. E. Curtis.

**Circulars.**

Survey of Beef Cattle Feeding in Kentucky. J. J. Hooper.

Orchard Spray Calendar. J. H. Carmody.

Soil Fertility. (Reprint). George Roberts.

More and Better Wheat for Central Kentucky. J. H. Kastle.

A Malignant Catarrhal Fever of Horses and Mules. Robert Graham.

Alfalfa. (Reprint). E. J. Kinney.

Anti-Hog Cholera Serum. E. S. Good and Robert Graham.

Crimson Clover. E. J. Kinney.

Sweet Clover. E. J. Kinney.

Hairy Vetch. E. J. Kinney.

Poultry Raising in Kentucky. J. J. Hooper.

Methods Practiced at the Kentucky Agricultural Experiment Station Dairy. J. W. Nutter.

Food Inspection Regulation 8.—Sanitary Regulation of the Killing, Handling, and Sale of Meat and Meat Products. R. M. Allen.

Circulars to Mayors, Boards of Health and Health Officers of Kentucky: Cooperation in Milk Inspection Work during Summer Months. R. M. Allen.

Poster Bulletin 2.—Bad Eggs and the Kentucky Pure Food Law. R. M. Allen.

Circular of Information to Pop Bottlers: Use of Saccharin, Proper Labeling, Re-use of Crown Corks, Old Style Rubber Stopper; Proper Method of Washing Bottles, Use of Contaminated Water, Danger of Lead Poisoning. R. M. Allen.

Circular to Kentucky Master Bakers: As to Use and Opening of Experimental Bakery. R. M. Allen.

**Press Bulletins.**

No.

47. Distribution of Farm Labor. H. B. Hendrick.
48. San Jose Scale in Kentucky. J. H. Carmody.
49. Soil Fertility and Farm Management Problems. H. B. Hendrick.
50. Make the Home Orchard Produce this Year. J. H. Carmody.
51. Rape. E. J. Kinney.
52. Codling Moth. J. H. Carmody.
53. Difficult Churning. J. J. Hooper.
54. Preparation, Planting and Cultivation of the Corn Field. H. B. Hendrick.
55. Summer Courses in Agriculture. T. R. Bryant.
56. Rearing of Chicks. J. J. Hooper.
57. Pear Blight. J. H. Carmody.
58. Agricultural Extension in Kentucky. T. R. Bryant.

59. Lubrication of Farm Machinery. James A. Farra.
60. Rearing of Calves on Skimmed Milk. W. D. Nicholls.
61. Agricultural Extension and the Rural Community. T. R. Bryant.
62. Selecting the Milk Cow. W. D. Nicholls.
63. Cover Crops. H. B. Hendrick.
64. Getting the Most out of the Farm Manure. W. D. Nicholls.
65. Seasonable Suggestions on Seed Corn. T. R. Bryant.
66. Starting an Apple Orchard. J. H. Carmody.
67. A Promise of Relief from the Injuries of the Destructive San Jose Scale. H. Garman.
68. Care of Farm Machinery. J. A. Farra.
69. Farmers' Week at the Agricultural College. T. R. Bryant.
70. Subsoiling. George Roberts.
71. Rejuvenating the Old Orchard. J. H. Carmody.
72. Alfalfa in Kentucky. H. B. Hendrick.

Scientific Papers.

The Inhibiting Effect of Excess Cow Serum in Complement Fixation. F. M. Surface. (Zeit. f. Immunitatsforschung usw.)

Notes on the Maintenance of Virulence by Bacillus Abortus, Bang. F. M. Surface. (Journal of Infectious Diseases).

Studies on the Complementary and Antihemolytic Properties of Normal Sheep Serum. F. M. Surface and G. C. Routt. (Journal of Medical Research).

The Relation of Calcium to Anaphylaxis. Joseph H. Kastle, Daniel J. Healy and G. Davis Buckner. (Journal of Infectious Diseases).

Suggestions Regarding the Treatment of Eclampsia. Daniel J. Healy. (Therapeutic Record).

The Pathology of Parturient Paresis and the Calcium Salts as a Factor in the Onset of Labor. Joseph H. Kastle and Daniel J. Healy. (The Lancet-Clinic

and American Veterinary Review). Read before the United States Live Stock Sanitary Board and before the Cincinnati Academy of Medicine.

A Comparison Ocular. Daniel J. Healy. (Annual Rept., Office of Experiment Stations, U. S. Dept. Agr., for year ending June 30, 1912).

Investigations of the Etiology of Infectious Abortion of Mares and Jennets in Kentucky. E. S. Good and L. S. Corbett. (Journal of Infectious Diseases).

Tympany of the Rumen, or Bloating with a Prompt and Efficient Remedy. Daniel J. Healy and John W. Nutter. (American Veterinary Review).

The Enzymes of the Tobacco Plant. J. du P. Oosthuizen and O. M. Shedd. (Journal of American Chemical Society).



PLATE 6 EXPERIMENT STATION BUILDING, SHOWING ENTRANCE TO NEW ADDITION.

PLATE 6 EXPERIMENT STATION BUILDING, SHOWING ENTRANCE TO NEW ADDITION.

# DEDICATION OF THE NEW ADDITION TO THE EXPERIMENT STATION BUILDING.

The new addition to the Experiment Station building was completed in the spring of 1913. On June 3rd, the new structure was formally dedicated and upon recommendation of the Director, sanctioned and approved by the Board of Control, the Experiment Station building was designated as Scovell Hall in honor of the late Director, Dr. M. A. Scovell, and in commemoration of his distinguished services to the cause of agriculture in the State and Nation. A bronze tablet commemorating this fact has been permanently mounted on the wall of the Experiment Station building to the right of the main entrance. The dedicatory exercises were held in a tent on the Experiment Station grounds, immediately in front of the Experiment Station building. At 9:45 on the morning of June 3rd, the staff and employees of the Experiment Station and invited guests assembled in the office of the Director, and promptly at ten o'clock, the procession was formed by the Commandant of Cadets, Lieut. Gullion, and marched out of the side entrance of the Experiment Station building down Washington Avenue to South Limestone Street, to the north entrance of the Experiment Station grounds and thence to the tent. The following is the program of the dedicatory exercises:

# DEDICATION EXERCISES.

## PROGRAM

Invocation,

DR. CHARLES LEE REYNOLDS

Address—"Research and Demonstration"

DR. EUGENE DAVENPORT

Dean of the College of Agriculture of the University of Illinois, and Director of the Illinois Agricultural Experiment Station.

Music.

Address—"The Open Door."

HON. J. W. NEWMAN

Commissioner of Agriculture of Kentucky.

Presentation of the Scovell Portrait to the University.

Music.

Acceptance of the New Building for and on behalf of the Board of Trustees of the State University of Kentucky.

HON. RICHARD C. STOLL,

Chairman of the Board of Control of the Experiment Station.

Music.

Dr. Kastle presided, and following the invocation by Dr. Charles Lee Reynolds, introduced Dr. Eugene Davenport, Dean of the College of Agriculture of the University of Illinois and Director of the Illinois Agricultural Experiment Station, in the following words:

LADIES AND GENTLEMEN:

We are assembled here today to formally dedicate and set apart to useful and fruitful purposes, the new addition to the Agricultural Experiment Station building.

In a certain sense, the completion of this building symbolizes the gradual growth and development of that great department of the State

University of which it is the home, and the gradual accumulation and spread of those ideas and teachings that form the basis of modern agriculture.

There was a time when the Kentucky Agricultural Experiment Station occupied but a single room in the basement of the main University building. Later, it came to occupy a part of what we call the old Chemistry building; then the older portion of the building that we dedicate today, and now it is gradually adapting and accommodating itself to this new annex, which has been but recently completed. In a certain sense, also, it fittingly commemorates the life work of my distinguished predecessor, the late Dr. Scovell. Twenty-seven years ago he came among us a comparatively unknown and untried man. With the slow passing of the years, however, he grew in power and helpfulness and fullness of knowledge, until at last he came to occupy a position of honor and usefulness in this community and in the State and Nation that was second to but few. During the last year of his life this beautiful building, which we dedicate today, greatly occupied his mind and heart. He took a pride in the solidarity of its structure. As it stands today in all of its beauty and completeness, it is his handiwork. He was mindful of the greatly increased opportunities which it would afford for more efficient service. He had in mind the comfort of his coworkers and associates in this great cause. He would often come into my laboratory to watch its progress, and as it grew under the hands of various artisans, it commanded an ever increasing share of his thought and attention.

I have sometimes thought that all great men are builders. Some have builded those wonderful structures like St. Peter's in Rome, or like Westminster Abbey or the Taj Mahal, that will be the wonder and admiration of all time. Others have built great lines of railway penetrating mountains, reaching out across vast stretches of desert and arid plain, spanning continents, uniting in the intricate web of trade and commerce shores of distant, alien seas. Others have built mighty engines of transportation and gigantic dynamos whose pulses ebb and flow throughout the great commercial fabric of our modern life, and out of words and symbols, others still have builded the subtle, gossamer structures of the mind, and others still "more stately mansions of the soul."

And so it was that in the twenty-seven years of his active service among us, the late Director of the Kentucky Agricultural Experiment Station builded here a great institution whose discoveries and manifold activities reach out and benefit alike the highest and the lowliest among the citizens of this great agricultural commonwealth. It was his constant effort that none that came to this place for aid and assistance should be turned away empty-handed.

It is doubtless known to many here today that Dr. Scovell was an alumnus of the University of Illinois. From this great University he received the impetus that leads to the discovery of new truth, that seeks everywhere and upon all occasions to promote the advancement and wider dissemination of human knowledge. In after years the University of Illinois conferred upon him the degree of Doctor of Philosophy, and in the years to come even as, I doubt not, it is today, his name will be honored and cherished there as one of the most illustrious sons of that great State University.

It is eminently appropriate, therefore, I think, that the principal address, on this occasion, is to be delivered by the Dean of the College of Agriculture of the University of Illinois and Director of the Illinois Experiment Station, and it gives me great pleasure to present to you Dr. Eugene Davenport, who has kindly consented to address us on the subject of "Research and Demonstration."

## The following is Dr. Davenport's address, entitled Experience, Research and Demonstration.

LADIES AND GENTLEMEN:

In many directions agricultural science and the experiment stations are in danger of being injured by the fruits of their own success, and in no direction is the danger greater than in the sudden, widespread, and almost hysterical demand for the traveling advisor, or agricultural expert, as he is frequently termed.

The universal demand is for demonstration without very thoughtful consideration as to just what is to be demonstrated, to what class or classes of farmers the demonstration is to be made, or, what is more important still, who is to do the demonstrating. With it all is exhibited a great confusion of mind as to the relative importance of research and demonstration, and it is to this point that I would invite your special consideration; indeed, a clear understanding of the relative importance of experience, research, and demonstration was never more needed than now.

Certainly I am the last to deplore this new and active interest in better farming, this new and implicit reliance upon science; but if perchance it operate to the confusion of research, if it divert men and money and otherwise check the progress of investigation, or if it overreach itself and present false hopes, extended by those who possess more enthusiasm than knowledge or discretion, then our quarter of a century of systematic research in agriculture may be followed by a reaction introducing a veritable "dark ages" for the important industry of farming. What is needed now is steady progress forward in the establishment of scientific agriculture, not spasmodic or hysterical agitation, and to this end a careful consideration of conditions, past and present, may be somewhat helpful.

Until recently the average man placed implicit confidence in tradition as a guide to practice, and the exceptional man relied chiefly upon his own experience, exalting the incidents, accidents, and even the chance opportunities of his own particular life into great general principles which, if carefully observed, would inevitably bring success. Neither had the slightest use for the investigator and both suffered mightily as they scoffed whenever the findings of the laboratory ran counter to the traditions of the one or to the supposed experiences of the other.

This fairly approximates the condition of the public mind a couple of decades ago when science had been a half-century at work and was beginning to suggest modifications in certain practices that had grown up as the result of popular experience. These suggestions were met first with indifference, then with scoffing, then with savage resistance; but in recent years this opposition has melted away like snow before the summer sun and it has given place to an almost pathetic confidence in the newer sources of truth; indeed, there is arising all about us a tumult of demand for instant and universal demonstration of the fruits of investigation even from fields of research where the surface has as yet been merely scratched.

So rapidly has this transformation come about and so completely has the public attitude been changed that it is almost impossible of appreciation, even by those of us who have been in daily contact with the experiment stations since their origin.

In the early days of agricultural research, the investigator worked away at his problem day after day, uninterrupted and alone. Now he has daily, almost hourly visitors and is continually called upon for public addresses, personal opinion, and advice. In those days he did not even write letters to any extent. In the early nineties the writer was *the* "Professor of Agriculture" at the most prominent college of the kind in this country and he wrote with his own hand all the letters that went out from the Agricultural Department. Now there go out from the institution he represents more than one hundred thousand letters a year, mostly in answer to questions. Let me not be misunderstood: All this is as it should be, but it marks a transformation, if not an era, in agricultural progress. The very inability of the Experiment Station as such to meet all these calls for individual help is what has given rise to the demand for house-to-house and farm-to-farm demonstration. Quite naturally this kind of personal assistance is commonly esteemed more important than further research, because its results are personal and evident. Under this condition of the public mind, we are in danger of halting the business of investigation and of cutting off the supply of new knowledge upon which alone the most progressive farmers rely and on which alone real progress upward is to be conditioned.

What has brought about this changed attitude of the public mind, and what does it mean? Have we learned enough so that we can afford to stop and spend the rest of our lives in demonstrating its application to all men, willing and unwilling? Is individual experience to be dethroned like a wooden god and sent tumbling into the river to be carried away to sea? Has the time come for turning the world upside down and adjusting matters upon an entirely new basis because of a little new truth which we are beginning to see darkly as through a glass? No, none of these things is true. The pendulum is only swinging to the other extreme; but it behooves us who are in research along agricultural lines to set the house in order before the pendulum starts back again.

For as matters are going now, the business of farming is due to suffer and the work of the experiment stations to be injured, if not seriously imperiled, by the confusion of the public mind as to the basic need for research; by the over-demonstration of truths half understood, and by the assiduous propagation of ideas and practices arising neither from experience nor from research, but springing spontaneously from the visionary minds of well-intentioned but impractical and hard-pressed half-trained men, who are agitating the country as professional expert advisors under the respectable and useful but often deceptive title of farm demonstrators.

Let me make myself clear at this point. There are many well qualified and discreet men in this field and their labors will bear good fruit. May their numbers increase and their work prosper. But a veritable mob of incompetents is making entrance and the insistence of the popular demand is favorable to their ambition. When county committees will say, "If you can't recommend a thoroly competent man, recommend some one to get the work started." When men otherwise sane and sober will say this, then the times are somewhat out of joint, and men of discretion will begin to take in sail and prepare for squalls unless haply the tempest can be averted.

The danger of halting the progress of true research; the confusion to agriculture through the propagation of hastily constructed revision of long-established practices; the damage to the experiment stations through a false or inadequate interpretation of their teachings; the disappointments likely to arise from this abnormally hasty and often inconsiderate attempt to make use of the findings of science affecting agriculture; the direct damage to the work of research which is only begun, by the general diversion of men and money to the more spectacular and seemingly more directly useful field of demonstration,—all these are reasons for making at this time a careful study of the relative value and importance of experience, of research, and of demonstration, to the end that we may proceed logically and dig deeper for further riches, not, like children, abandon the diggings and go scampering off with the first few gems we find; and to the further end that we may

preserve and develop, not destroy, that private initiative and community energy upon which we must ultimately rely for all substantial gains in agricultural practice. If we destroy this local initiative through any systems of advisors; if we destroy this newly-born confidence in research, or if we by any means check the effects or undermine the influence of the genuine investigator, the fruits of that destruction will settle down like a blighting curse that will not lift until all remembrance of our folly shall have disappeared by the coming and the going of successive generations. We may yet have a "Dark Age" in agricultural progress. Pray God it may not come and that we may all be wise with the powers He has placed so recently but so abundantly in our hands! Let us analyze the situation somewhat critically and determine, if we can, the nature and the limitations of these three great agents of progress,—experience, research, and demonstration, with a view to availing ourselves of each in its proper sphere and in its proper relation to other influences for progress.

### WHAT POPULAR EXPERIENCE HAS LEARNED.

It is astonishing how near the truth popular experience has frequently arrived. So well has this teacher served the race that much of our best research ends in the justification and explanation of common practice. So accurately have success and failure in multitudes of cases pointed the way, even when the reasons and principles involved were obscure or possibly misconceived, that we have evolved the absurd tradition that experience is the best teacher.

The benefits of thorough cultivation, the advantages of fallow and rotation, the action of manures, the effect of breeding from the best, have all been learned without the aid of the laboratory. These great fundamentals have been acquired not by intuition, not by prophecy, but by the slow and expensive process of natural selection by which, out of a multitude of trials with many failures and a few successes, the road has been ultimately blazed. When we regard roughly the final results of experience, noting only the finished product, we are led to wonder whether after all the old adage may not be true; and expensive and slow as it may have been in the past, mass experience may yet be our safest and best guide for the future.

### LIMITATIONS OF EXPERIENCE.

But when we consider carefully what experience has not learned, what in the nature of the case it could not learn, and when we regard the stupendous errors it has permitted to go unchallenged, then we begin to appreciate the real merits of scientific research.

For example, while experience showed the benefits of thoro cultivation, it required formal experimentation to demonstrate that, in general, cultivation ought to be shallow; it required science to show that it is the

land and not the crop which requires the culture, and that the supposed benefits of root pruning—always theoretical—do not exist.

Again, the general benefit of leguminous crops was early learned, but the reason remained a mystery concealed forever from unaided farming experience. The tubercles were discovered, it is true, but they were popularly known as "seeds." Their function was not even suspected, and in the nature of case could never have been detected with the apparatus of farming.

Within our own recollection, England built fleets of ships to bring guano from the South Sea Islands and wondered where the next supply of nitre was to come from, while over eleven pounds of nitrogen rested upon every acre of Great Britain as, indeed, upon every acre of the world, and the leguminous crops stood waiting to be intelligently set to work.

Certain lands were called "sour"—a marvelously accurate diagnosis, as we now know, and experience learned that lime is good for sour land, but, as usual, it overleaped itself and used the caustic form and in quantities that injured the soil, giving rise to the old adage, "Lime enriches the father, but impoverishes the son," from which we should deduce that no right-minded father would lime his land. Science has corrected the practice and again we are liming the land, while the adage has passed into ancient history as a curious landmark of our wanderings here and there on the way outward to the light.

Diseases of plants and animals were early noticed, but parasitism was a mystery too deep for the unaided vision and it is not strange that the vengeance of God and the presenee of devils were invoked as the causes of disease and that supernatural or foolish methods were adopted for relief. Our word "lunatic" bears permanent witness to this era in our development and while we have not yet solved the mystery of insanity as distinct from degeneracy, yet we all know where the problem lies —that it is in the deranged functions of a particular organ, not in the malevolent influence of our evening luminary.

The practice of breeding was well advanced by empirical methods, both in animals and plants, but the common experience of the most successful men was that the hybrid was unmanageable and in every way undesirable; that it frequently possessed, it was true, most highly desirable qualities, but, as the phrase went, they were "not transmissible." We know now as one of the first results of science working in this field that the characters of the hybrid are transmissible and that the hybrid presents an ever new collection of possibilities for future and modified races. Why had not experience arrived at the same conclusion? Only because the tangle was too much for the casual observer, who had learned to look for the manifestations of heredity in each individual of every generation. The unit character was too refined a fact to be de-

tected except by the most delicate experimentation and the most persistent statistical methods.

I will mention but one more instance showing the class of problems that must be solved by scientific methods and not by popular experience. Of all the events, and they are many, which depend for their occurrence upon the law of chance, not one has ever been correctly solved by popular experience. The evidence on this point is overwhelming in amount and pathetic in character. Every lottery scheme and every gambling den in the country is witness to the fact that in general the unaided human mind is unable to follow the law of chance even in its simpler manifestations. In so common a matter as the determination of sex more than five hundred theories have been advanced for its control; and the average man believes in at least one of them, tho sex has never yet been controlled and undoubtedly depends upon causes which operate according to the law of chance, a law which is not uncertain but exceedingly definite in its final results, or, as we say, "in the long run."

Now the popular understanding of the word "chance" is that it refers to events which occur outside of all law– which just happen; and to say that a thing is due to chance is in general understood to mean that it happens without a cause. The confusion upon this point is not limited to ignorant or stupid men whose heads are befuddled in an opium den. When a man drawing the largest salary on the continent and noted for his business shrewdness undertakes to beat the roulette wheel and wreck the bank at Monte Carlo, he succeeds admirably in demonstrating that simple experience, as its results can be carried in the mind, is an unsafe criterion on which to base action. It is perfectly safe to say that no statistician was ever beaten in a game of chance or could be induced to play; it is an almost equally safe proposition to assert that anybody else can be caught, if not in an actual game of chance, yet by the principles on which it operates.

### EXPERIENCE AND RESEARCH CONTRASTED.

If then, experience be so faulty, are we to throw it over? By no means. We are not to throw it over, but to educate and perfect it, for only as practice can be modified is science useful or worth while, and as practice is modified, experience and its offspring, which is tradition, will be rationalized.

If, however, experience be so inferior to science, wherein lies the difference, and in what respect is research able to assert its claims of superiority? Upon this point a few words are well worth while.

First of all, we shall not get on as rapidly as we ought in agricultural advancement until the men in practice and the men in research understand each other better. We are just emerging from a time when the so-called practical men regarded the scientist as a theorist, not knowing that the man who prides himself on being practical is of all men

most theoretical. Engage in conversation with almost any one who especially prides himself upon being practical, and you will find him full of theories. His head is fairly addled with them, a veritable mass of junk picked up from his forbears or culled out of his own experiences,—all the result of hasty generalizations and constituting a load beside which the old man of the sea was a rollicking and jovial traveling companion.

On the other hand, the scientist has too often disregarded the mass experience of mankind even as a guide to his own labors, not realizing that this experience has at least roughly cleared the ground of much useless rubbish, that frequently the practice is nearer right than are the reasons given to explain it, that in the end his most darling schemes will be tried out in this very crucible and declared true or false, and that they will stand modified or unmodified according as they endure this test of actual experience.

What, now, with all prejudice removed, is the fundamental difference between popular experience which has learned so much and made so many mistakes? For we must not forget that the first botanist to discuss root tubercles regarded them as a disease and recommended that they be bred off. What, then, *is* the essential experience and research?

I am going to be heretical enough to say that in my opinion there is less difference between the two than we have hitherto assumed. All *real* experience is scientific and all *real* science is most intensely practical. Some theory is essential to both. Both are unadulterated truth. The difficulty in common experience is that so many causes are at work and results are so complicated that it is practically impossible to know what has occurred and we instinctively accept the most visible agencies as the direct and impelling cause of whatever happens. The difficulty in science is that the single truth that has been discovered under simplified conditions must be put into practice under complicated conditions in company with other principles, some congenial, others antagonistic.

So far as methods of procedure are concerned, there is no difference between science and practice. Both rely upon observation and both express themselves in terms of facts. The observation of the scientist; what is it? An experience, like any other human experience. It is a thing to be recorded and assessed for what it is worth. The only difference is that the scientist prepares conditions in advance as carefully as he can, simplifying the problem as much as possible, and then is on the lookout to record, not remember, all that may happen. His phenomena are likely due to fewer causes than are those of common experience. Moreover, being on constant watch, he is more apt to note *all* that happens and his record is more accurate. Therefore, his opinions and judgments are more carefully formed, especially as he assiduously attempts to divest himself of all tradition and all prejudice before the experiment begins.

The substantial difference between the man of science and the practical man busy about many things is the record which the scientist makes of his observation. If he is anything, he is a note-taker and a record-keeper. It is his long suit. He trusts nothing to memory, for he knows it to be both fleeting and inaccurate. We could well wish that he were a better statistician and were able to tell us bye and bye all that his notes really mean, but he does record his observation the best he can and files it away for what it is worth.

His methods are those of the common observer, but they are refined and his record is better made. Like any other observer, he may be mistaken in what has actually happened, but he has at least simplified his problem. At every stage of the study he has his own old notes and he has the literature of the world besides. Here is where he has the advantage of the ordinary observer who trusts to memory, and is thus able to beat him at his own game of experience. But his methods are no different; there is nothing uncanny or supernatural about his procedure, and these two men need each other mightily, day by day—this man in the laboratory and that one upon the farm.

The scientist posesses one and only one other distinct and peculiar advantage over the practical man, but it is tremendously potent in its results. He has at his command certain implements and agencies of the laboratory that the farmer as such does not possess. He has the miscroscope with which he sees what to the farmer was and would have remained a hidden world. With this he learned that the tubercles upon the roots shelter living organisms. He has at his hand a vast range of chemical reagents by which he can set up artificial activities quite outside the range of farm experience. He has, in other words, the opportunity of vastly enlarging the range of his observation as well as of greatly simplifying its conditions.

But again it all ends in experience. However, in his case, unlike that of the practical man, the record is more complete and many more cases are covered. The chance of the scientist, therefore, for finding the correct cause of an event is vastly increased over that of the practical man; but again I assert that their methods are the same and that they must be friends. The difficulty with the practical man is that his experiences are too limited in range and time, and too complicated in character; and if he stops to become a scientist, he will starve in his business, because real investigation is enormously costly. He may need the demonstrator if he is unable to take new truth at first hand, but the world as a whole needs above all other men just now the skillful, reliable, and well-equipped investigator.

### DEMAND FOR DEMONSTRATION.

We have learned a few things by the hard work of many patient scientists. A good beginning has been made. Shall we now stop and

spend our time, money, and energy in carrying these bits broadcast while a world of ignorance and error yet remains unconquered? It is a striking phrase to demand that the knowledge we now possess shall be taken out of "cold storage" and put at work among the people; that it is more important to make use of what we know than to go piling up new knowledge where it is unused and for the most part unusable. The public seems to overlook the fact that lectures by the hundreds, bulletins by the thousands and newspapers by the millions, have scattered to the uttermost ends of the civilized world all that either science or practice has learned about agriculture. No fact in life, no business prospect, was ever so thoroly exploited and so generally disseminated as are improved methods of farming; and yet the demands demand a general house-to-house campaign, forgetting that science must not be halted in its search after new truth, of which there is much, forgetting that we are annually graduating thousands of young men who are trained in the methods of science and are amply able to avail themselves of all the findings of both science and practice, and forgetting that after all time and the undertaker are the greatest of civilizers.

Just now it would be easy to secure from State or Nation two dollars for demonstration for every dollar that could be obtained for both research and teaching. The danger is that we shall direct both dollars and men from channels where they are doing the highest and most permanent public service into channels where the service will be uncertain and temporary at best.

It would be deplorable to suffer in this way from the fruits of our own success. Certainly much can be done in many sections by demonstrators, but it must not be forgotten that the work of the professional demonstrator is peculiarly trying and difficult. It must not be forgotten that reformation in certain classes of farmers will cost more than it is worth; it were better for the country that they should be crowded off the land. Last of all, it must not be forgotten that the best of all demonstrators is the educated man succeeding upon his own farm.

### THE SCIENTIFIC VALUE OF EDUCATED FARMERS.

A professional research man was recently guilty of publishing the following:

"Theoretically it is a primary function of the State Experiment Stations to conduct researches of a fundamental character which shall be calculated to discover basic natural laws. Actually, with a few rare and partial exceptions, Experiment Stations do nothing of the sort. On the contrary, what they do engage in is experimental work of a kind carefully calculated to make as strong an appeal as possible on the basis of its supposed 'practicality' to the scientifically uneducated and uncritical farmers who make up its constituency." I would direct attention especially to the phrase "scientifically uneducated and uncritical farmers."

This man betrayed an exaggerated estimate of the infallibility of the scientist together with the grossest ignorance of progressive farmers who are the only ones to concern themselves about Station work one way or the other. More than all, he failed to appreciate the increasing numbers of college-trained men now going to the land and their tremendous value as agents for adopting the findings of the laboratory and adapting them to practice.

The student in his course is not only trained in the methods of science, but he is led to see clearly the difficulties in the way of scientific methods on the farm; to know what are the unsolved problems on which scientists are at work and how sorely the knowledge sought is needed. A student so trained is surely ready and receptive to use it when at last the long-sought truth is discovered.

Such a man does not need a demonstrator. He is as fully informed as the demonstrator himself and he knows equally well how to get his information from original sources. Naturally he prefers it at first hand and this fact must be reckoned with by the professional demonstrator who may be an acceptable advisor to the uneducated but must at all times commend himself to the man with a college training or his career will be both brief and inglorious.

### THE RESEARCH MAN AS A DEMONSTRATOR.

Before proceeding to discuss the real need for the farm demonstrator, it is necessary to call attention to the amount and kind of demonstration that naturally goes with a finished piece of research work.

It is not enough for an investigator to discover a new principle in agriculture; he must also show how it can be applied and put into practice. It is not enough to announce his discovery in bulletin form and leave the matter to make its way like a lost child wholly dependent upon the chance wayfarer for safety and an opportunity for a life of usefulness. The investigator himself must make the application to agricultural practice; he must himself learn and then show *others* how his principles can be made to operate with other principles and conditions to be met in agriculture; he must make the "fit" and show how his discovery may be utilized in farm practice. To this extent he is himself a demonstrator; for this work is like the cutting and the polishing of a diamond or the refining of gold—a necessary process to the utilization of the precious substance. This much of demonstration goes with investigation and is not to be separated from it.

But it is not the business of the experimenter to hunt out the last individual that might profit by his discovery, convert him to its trial, and actually teach him, perhaps against his will, to amend his methods at the new point. This, if it belong to anybody aside from the man himself, is the duty of the professional demonstrator, yet it is true that many otherwise able investigators, having learned a new thing, have

straightway abandoned research and, like the missionary in Africa, spent all their time and talent in promulgating its application to individuals.

It is a pretty safe proposition that the research man should work with principles and with groups of men, troubling himself little with extraneous details or with individuals, further than to get the practice well enough established to insure that it will live and grow. After this he should devote his talent and peculiar opportunities to new discoveries rather than allow his laboratories to lie idle while he preaches to the multitudes or hunts the hundredth sheep, which is the business of the professional demonstrator.

### THE PROFESSIONAL DEMONSTRATOR AND HIS WORK.

But here we arrive at the fundamental question,—What is the real need for this professional demonstrator?

Certainly he is not needed for the college graduate on the farm or for the really progressive man, both of whom are abundantly able to help themselves and who have access to the same material upon which the demonstrator himself must depend.

Clearly the demonstrator is for the man who will not and most likely cannot help himself, and this man's name is legion. This does not mean for the most, the man who is failing on his farm. It certainly does not mean the shiftless or the lazy incumbent of the soil who, for general economic reasons, cannot too soon be crowded off the land. It means that great mass of industrious middle-aged men who are succeeding fairly well but who are making fundamental mistakes by clinging to old methods and old ideals after progress has pointed a better way. It means that numerous class of good citizens who are naturally conservative, if not immovable, who pride themselves upon their own success and who have formed the bad but comfortable habit of comparing themselves and their families with the less successful rather than with the most successful of their neighbors. Such men must be convinced by word of mouth; they will not convince themselves. In this they are only obeying the primitive instincts of human nature, which it is one of the functions of education to rationalize and transform into accurate and impersonal observation, to the extent that one may judge his own cattle and horses as impartially as he would his neighbors.

The Agricultural College has begun to accomplish this work of regeneration with thousands of young men and the Experiment Station has accomplished the same results for other thousands of mature men already on the land. When this good work shall have been in operation a generation or two more, there will be little need for the demonstrator, in my opinion, except as he develops into an officer of some of the many co-operative associations certain to arise in the very near future. But for a considerable time to come, the traveling demonstrator is needed far

beyond the ability of the country to afford suitable material; and an incompetent demonstrator is infinitely worse than none at all.

What is the source upon which we may expect to draw for successful demonstrators?

First of all, there are a few fruitful sources of candidates from which we should not consider applications; physicians and clergymen who have failed in their business and whose only evidence of fitness is that they were born upon the farm. I have been obliged to explain to some of these worthy gentlemen that the donkey was also born upon the farm. Broken-down school teachers will not do, nor will men who are losing their own farms, like a recent applicant in Illinois. Men who have failed in college or station work, because their imagination and flow of words were better than their vision and their stock of knowledge,—these, too, are a source of weariness and vexation of spirit. It is no job for a fresh young graduate, or for any other man who is not in possession of the largest possible stock of *reliable information,* not *spectacular oratory,* combined with a fund of successful personal experience and a degree of industry that gives assurance of ability to do men's work. This is no picnic; it is no child's play; it is no farmer's institute where a man may say what sounds well and looks plausible and get out of town on the next train.

If the demonstrator is to succeed, he must reach with practical advice men who are already successful, and must stay on the job till plans work out and prove him right or wrong.

Men of this kind are always hard to find in any kind of business. Most of the men competent for this work are already engaged upon their own farms. Moreover, they are the same kind of men that colleges and stations need and this competition is therefore as direct as it is dangerous to the stations, particularly when we remember that many a county is paying its demonstrator a director's salary.

The University of Illinois lays down these qualifications that any man must have to be recommended as a farm demonstrator.

1. He must have lived upon the farm and have had practical experience.

2. He must have an education equivalent to a good agricultural college course.

3. He must have had at least five years' successful experience as a man, presumably after leaving college.

The men that best meet these qualifications are the very choicest members of our Experiment Station staffs, and within a year, two of our best employees have left us and gone as farm demonstrators at salaries twice what the Experiment Station was giving or could give.

This is well only so far as is necessary to set standards of demonstration service, but if every county should do this thing, and it is abundantly able to do it, then the station would be compelled to close its laboratories.

At this point I desire to register a word of warning. The supply of good men is inadequate. To draw upon the stations to their detriment is to stop research for the sake of demonstration, and these same demonstrators as well as our college graduates will need the stations sorely to answer new questions bound to arise continually as our agriculture develops year by year.

### RESEARCH AND DEMONSTRATION CONTRASTED.

Yea, verily, the faster our agriculture develops, the more college graduates we turn out, and the more demonstrators we put in the field, the faster and the harder should the stations work. It is easy now to get money for demonstration, but it would be a safe proposition for every state to lay down the principle of spending five dollars for research for every dollar spent for demonstration. Then we should have something to demonstrate bye and bye, and we should go on amassing knowledge against its need to answer questions now unsuspected but certain to arise.

Demonstration is more spectacular than research and seems to give more for the money, but when research comes to an end, then progress stops. To "take science out of cold storage and put it to work" is a catchy phrase, but it carries no element of truth. No knowledge is ever in cold storage. The modern investigator works not in secret places but literally on the housetop, and his results are carried away by wireless, popularized by phonograph, and whoever runs may read if he will.

The demonstrator at best is a missionary, not a prophet or a revelator. The most potent agents of agricultural advancement and the most reliable guarantors of perpetual progress are the endowed investigator in his field laboratory and the educated man upon his farm working together, for all real progress depends upon them. All else is transient and much of it is vexation of spirit.

### THE COLLEGE MEN UPON THE FARM.

We are not to overlook or underestimate the meaning of the hundreds of young men going out every year from our colleges onto their farms. These are amply able to understand and to apply the best results of the most skilled investigators, not only now, but always, until all the problems of the farm shall have been successfully solved; and in this way all that is gained will be held.

The educated man upon the farm is not only able to understand and to apply all the findings of science, but he is himself engaged in research in the sense that he is a constant and an earnest searcher after truth. We do not think of the student as an investigator, and the farmer cannot afford to conduct experiments; but in the broader sense in which the graduate student attacks the field of knowledge from the research standpoint, in this sense the educated farmer is a perpetual

source and inspiration of higher knowledge and better practices on the land. The farmers of a State and the agricultural associations allied with the College and Station constitute a great graduate school, and tho it gives no degrees, its results will be felt in a better and more permanent agriculture and a higher and nobler citizenship.

Here is the place to put the mass of money of the commonwealth. All else is secondary and temporary, for we are bound to build an American agriculture, not upon a peasant foundation, but upon the rock of highest citizenship.

And now is due, if we can say it, a fitting word of tribute to that oldest of directors, that most patient of investigators, and that prince of good men, Dr. Scovell. This building with all it stands for is his monument, commemorating alike his own ambition and the determination of a commonwealth to build an agriculture upon the sure foundation of knowledge.

May it stand devoted to its high purpose until the tooth of time shall have eaten away its wall; when may another rise Phoenix-like to take its place, but built upon larger foundations to carry out the higher purposes of a better agriculture and a greater people than the world has yet produced.

Following the address of Dr. Davenport, Dr. Kastle introduced the Hon. J. W. Newman, Commissioner of Agriculture, in the following words:

LADIES AND GENTLEMEN:

I need scarcely say to an audience such as this that our prosperity as a people and as a nation is dependent to a large degree upon the character of the soil on which we live, and on the degree of skill and industry and common sense displayed in its cultivation. That such is the case needs no proof at my hands. Were this necessary, however, we would only have to look for a moment at the two maps of the State of Kentucky, which I have here, as a simple, yet wholesome and suggestive object-lesson, touching upon this point. On the one, we have outlined (in color) the geology of what we commonly call the Bluegrass region of the State, with its traditional fertility, as contrasted with the rest of the State, and on the other, we have outlined in red, those counties that are revenue-producing, that is those in which the revenues resulting from taxation are in excess of their expenses, and those in which the expenses connected with county administration are in excess of the revenues resulting from taxes in these respective localities. These last, we call, in common parlance, pauper counties. They are pauper counties in the sense that they are dependent, in part at least, upon the bounty of the State at large for funds wherewith to conduct the operations of the local government. It will be observed that, with but a few scatter-

ing exceptions, these two maps are identical. They serve to emphasize the fact that prosperity or pauperism, in the State-wide sense in which it is here employed, depends largely on the natural fertility of the soil, and upon the nature and character of the agricultural practices which prevail in different parts of the State.

How to equalize these differences—how to elevate the productiveness of these soils outside of the Bluegrass to that of the soils of this more favored region, how to better the general economic conditions prevailing in the poorer sections of the State, in a word, how to transform these so-called pauper counties into more productive areas that will bear their full part towards the support of the government and the school system of the State—these, I say, are problems worthy the study of any man or of any institution.

As a part of the more recent work inaugurated by the Experiment Station, I may say that we have already made a beginning in what we hope will be a most fruitful line of investigation and inquiry. We propose to make an exact comparison between one of the wealthier counties of the Bluegrass and one of these so-called pauper counties, with respect to character of soil, rotation of crops, agricultural practices, principal products and crops, market and economic conditions generally. In some of these non-revenue-producing counties, we have already located experimental and demonstration farms, with the object of more accurately studying the soil deficiencies and requirements of these particular areas and with the view of bringing immediately home to the people of these sections of the State, the valuable results of Experiment Station work. Through our Department of Agronomy and through our Extension Department, we propose to give lectures and practical demonstrations in the cultivation of the soil, farm management, dairying and the raising of live stock. The credit of suggesting this line of work belongs primarily to Mr. Robert M. Allen, whose vigorous educational work in the administration of the Pure Food and Drugs Law has already done so much to better our milk and food supplies, and our economic and manufacturing interests generally. In pushing forward this work to a really helpful conclusion, we will have the hearty cooperation and support of every member of the Experiment Station Staff and, I trust, of all public-spirited citizens of the Commonwealth.

In the carrying forward of this and other lines of Experiment Station work, we are fortunate in having the good-will and hearty sympathetic cooperation of the State Department of Agriculture, or what is more to the point, of the progressive and capable man, now at its head. Indeed, there is no man living today who occupies a larger place in the esteem of the farmers of this great agricultural State, and no one who stands to the Kentucky farmer in a more helpful relation than the Honorable J. W. Newman, State Commissioner of Agriculture, who will now address you on the subject of "The Open Door," and whom I now have the pleasure of presenting to you.

Mr. Newman's address, entitled "The Open Door," is given in the following:

MR. CHAIRMAN AND LADIES AND GENTLEMEN:-

I am glad to see so many present at the dedication of this magnificent building. Kentucky should today feel justly proud of what has been accomplished here; save for one fact it should be a day of rejoicing for us all. I look out into the faces and recognize many old friends, but there is one face missing to us all,—our General has gone down in battle, and we would not be true to our training nor true to him if we did not carry on the work. He planned this magnificent structure, little dreaming that he was building his own monument, but what greater monument has any man built in this State than did Dr. Scovell when he founded and erected this elegant building? The marble shaft in yonder cemetery will mark his last resting place and tell when he was born and when he died. This building will show forth to generations to come his magnificent work. While it is nothing but fair and just and appropriate that we here pay tribute to his memory yet as fellow-laborers in a great work, our eyes should not be turned altogether to the past, but we should face about, look into the future and plan for the development of the first and greatest occupation of man, agriculture.

The subject on the program suggests that I should talk on "The Open Door." Probably you would understand more what I mean had I taken the subject "The Harvest, Indeed, Is Great, But The Laborers Few." There are so many people engaged in agricultural pursuits, and yet there is so little known about agriculture. Within the walls of this structure here dedicated today, what great truths will be given out affecting the lives and occupations of these many tillers of the soil! Who would dare to predict the great revelations that will be made here? In the days of Columbus the man who wanted to make discoveries naturally sought to explore the earth from pole to pole hoping to find some new land or some new people. The explorer, in other words, was a geographer. The earth has been circumnavigated, and practically, all existing lands have been more or less explored, and the man with the same trend of mind as Columbus, Balboa and Cortez today, finds pleasure and profit in discovering new fields in the scientific world. It seems to me there is but little new in the ancient languages, or in the modern. The jurist must follow precedent and study statutes enacted often by men who do not know the first rudiments of law. Occasionally a bold mariner strikes out on the judicial seas, but the ties of tradition and of precedent hold him back. The preacher must preach doctrines that have been tried and found true; the statesman usually is best who believes in, practices and holds to the teachings of his fathers, but, in the field of science, including medicine, chemistry, agriculture, horticulture, entomology, and, in fact, all branches, there is a great unexplored field,

worthy of the best minds ever created, and offering an excitement more alluring than the mirage of the Western plains. I would dismiss all other branches of science except that pertaining to agriculture from consideration on this occasion, and permit me to say that I regard this building erected here, with its laboratories, retorts, furnaces and devices as an Open Door to the greatest field for labor that there is in existence in this Commonwealth.

Unquestionably the greatest problem of civilization always has been and always will be the feeding, clothing and housing of humanity. The luxuries and pleasures of life as problems sink into insignificance when the problem of hunger arises. The high cost of living may be studied from every standpoint, and all manner of suggestions may be made for reducing it, but the fact remains that many of these suggestions are only temporary relief if not based upon the fundamental facts of more abundant and economical yields of Mother Earth. For humanity to learn to produce more at less cost and to conserve and upbuild the soil, it must learn new facts and must have old facts brought out in new ways, and this must come through the doors of this institution or through some similar institution somewhere. It is difficult to estimate the advantages of such an institution as the Kentucky Experiment Station to the State of Kentucky. The Kentuckian is too prone to estimate values in dollars and cents alone. To reduce the value of this institution to a dollar and cent basis is impossible.

Its beneficence starting here spreads from one end of the State to the other. Millions of dollars annually are added to the wealth of the State as a result of the work of this institution. Man's mind is too much occupied in making money to individually conduct the experiments that must be made, if we are to progress. It is strictly institutional work, and I hope to see the day when the farmer will not have to conduct an experiment here and an experiment there to find out what his soil is adapted to, but that this institution will be in position to do that work for him. It is true some of this work has already been done, and other work along these lines is planned, but when the State is thoroughly mapped and complete soil surveys made, a man purchasing a piece of land will know the soil content and to what the soil is adapted, and he will not have to depend upon his eye to know the value and uses of a tract of land. It has been my fortune, or misfortune, to have traveled over the greater portion of the United States, and, as far as can be judged by the eye alone, I know the lands of this country quite well, and I believe it can be demonstrated beyond a shadow of doubt, that the cheapest lands in America today, taking soil content, climate and natural conditions into consideration, are right here in the State of Kentucky. I do not hesitate to say that a proper study and survey of Kentucky's lands by this institution will increase the value of our lands sufficiently that the taxes coming to the State as a result of this increased

value will pay many times over the annual cost of this institution. I do not mean that it would increase simply the assessed value of lands, but it would increase the productivity so that their sale values would be increased several dollars per acre. I know that the present director, Dr. Kastle, has in mind a great work along this line, and what farmer is there in the State that would not be glad to have his land increased in productive capacity and in sale value simply by the public knowing for what that land is properly adapted and its soil content? Through the doors of this institution will ultimately come this valuable information as to the soils of the Commonwealth.

Again, with the proper knowledge of our soils naturally follows a series of grain and forage crops and a system of rotation that would bring splendid increased returns to our farmers. Following these comes the question of a live stock industry adapted to our climate and our crops and the uses of our people, and we could go clear on through the list showing how, through the work of this institution, practically every man, woman and child in the Commonwealth would be beneficially affected. Why, then, should we not consider this an open door through which will come information year in and year out for generations to come that will aid in the development of the material resources of Kentucky.

There is another side connected with this work that I do not want to omit, and that is the opportunity offered to young men of Kentucky for work not only profitable but pleasant, and of such value to humanity that the young man who succeeds need not fear that he will not hear, in the world to come, the words for which we all look forward, "Well done, thou good and faithful servant." As indicated in the opening of this address, the supply of well-trained young men for work along agricultural lines is very limited. The young man who fits himself for research work, for work in agronomy, animal husbandry, entomology, etc., is sure of a large field of usefulness, and an occupation as interesting as any in which ever a man engaged. The discovery of the power of leguminous plants to gather nitrogen from the air and leave it stored in the soil for the use not only of leguminous plants, but for other crops as well, has added as much wealth to the world as any other one discovery of which we are aware. The discovery of a means by which hogs can be made immune to that fatal disease, hog cholera, is another instance of the value of the work done at the Experiment Stations. The discovery, right here at this Station, by Prof. E. S. Good, of the germ that produces abortion in certain live stock, will be worth to the world all that the Kentucky Experiment Station has ever cost this State.

What greater pleasure ever comes to any man than the pleasure of discovering some new fact and giving it to his fellow-man? Within the walls of this building what possibilities are offered to the young man seeking an inviting field.

In conclusion, let me say that the door is open, it is open to the young man entering college, to the young man leaving college or to the old man upon the farm. The faces of thousands of Kentucky farmers are turned toward this open door watching and waiting for facts that will aid them in producing more and better crops at a lower cost and with less labor. The late Dr. Scovell and the speaker fought shoulder to shoulder to impress upon the General Assemblies of this State within the last few years the possibilities of this institution if given the right kind of financial support. We believe that Kentuckians are awakening to the value of the work that is being done here, and the new Director, we hope, will not have to battle so hard to maintain this institution for the benefit of the great mass of farmers throughout the Commonwealth. Let us all, therefore, renew today our pledge to the Director and faculty here engaged to stand with them in advancing this institution and thereby advance the interests of the farmer who now struggles year by year to make a living at the head of the creek, on top of the hill or along the valley.

I, therefore, stand here today and congratulate Dr. Kastle and his splendid corps of co-workers upon the completion of this magnificent building. I congratulate the Board of Trustees of the State University, and the head of this institution, Judge Barker, that such splendid work has been done during their administration. I congratulate the farmers of Kentucky that they have an institution second to none pointing the way to them for better, more scientific and more profitable agriculture. And, in fact, the entire State of Kentucky is to be congratulated upon the completion of this building and its dedication to uses that will be of such moment to the people of this Commonwealth.

Following Mr. Newman's address, the Director presented the Scovell memorial portrait to the University in the following words:

PRESENTATION OF THE SCOVELL PORTRAIT TO THE UNIVERSITY.

LADIES AND GENTLEMEN:

As is doubtless known to many of you here today, Dr. Scovell stood to every member of the Experiment Station Staff, to every member of the Faculty of the College of Agriculture, and to every employee of the Experiment Station, not only in the relation of director and wise counselor, but also in the kindlier relation of personal friend. In addition to his qualities of leadership, and over and above his patient industry and acumen as a scientist, he had in large measure those finer human qualities that will always serve to make his name loved and revered by all who knew him. Kindness, sympathy, patience, an abiding faith in the integrity of his fellowman, a cheerful, yet earnest disposition, and a large, optimistic outlook on the world about him, these and many other

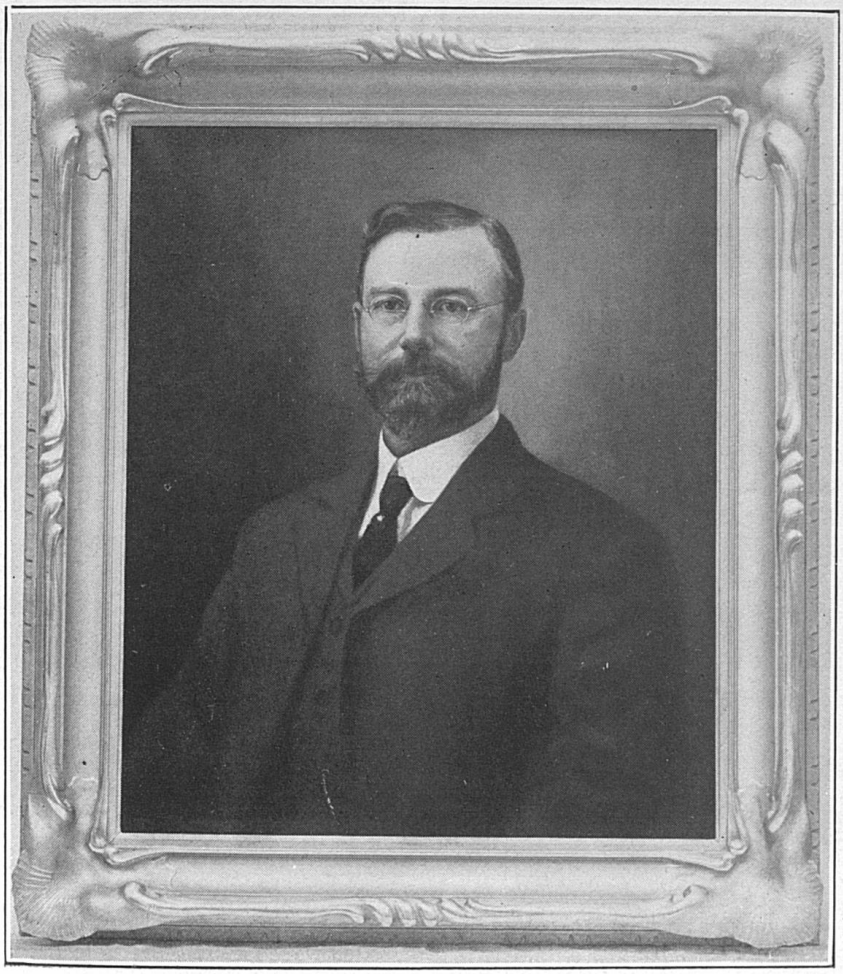


PLATE 7. THE SCOVELL MEMORIAL PORTRAIT.

of the more basic and sterling of the human virtues, served to endear him to those about him. On the occasion of his untimely death, there was not one among our number but felt that he or she had lost a friend. We wished in our humble way to perpetuate his memory. Our wishes and loving thoughts in this connection took the form of a portrait, which has been painted by Mr. Charles Hooven, and which was contributed to by every single man and woman in the employ of the Experiment Station and College of Agriculture.

I have asked Miss Ginochio, for several years his secretary, and one who stood to him in a most helpful relation, to unveil this portrait, and while the portrait is being unveiled, I have asked one of our most talented musicians among the students of the University, to play for us Traumerei as a violin solo. It will interfere with the continuity of our exercises to have Mr. Watts respond to an encore immediately after this selection, but I promise you the pleasure of hearing him again.

VIOLIN SOLO—*Traumerei*

Mr. President, it is my happy privilege, for and on behalf of my colleagues and associates in the Experiment Station and in the College of Agriculture, to present this portrait to the University, with the request that it be allowed to adorn the walls of the Experiment Station building. I have a feeling that the strong, healthful, and kindly features portrayed upon this canvas will, barring unforseen and unavoidable accidents and catastrophes, long prove a source of inspiration to the many generations of young men that shall come to this institution.

During the unveiling of the portrait by Miss O. L. Ginochio, Secretary to the Director, Mr. Tyler Watts, one of the students of the University, and a talented musician, rendered a most beautiful and touching violin solo. On behalf of the University, the portrait of Dr. Scovell was accepted by the President of the University in the following words:

LADIES AND GENTLEMEN:

All who knew Professor Scovell loved him, and it seems to me that when this is said the best that can be said of one whose life work is closed, has been said. We have met here today to do honor to the memory of a good and great man, and to do what we can to perpetuate his fame in the Commonwealth which he loved and served so well. It is natural that we should shrink from oblivion. The thought of being forgotten sends a chill to the most callous heart. The earliest records show that man when he started on his road to conquer and take possession of the earth paused to build the tower of Babel to commemorate his presence in the plain of Shinar. Kings from time immemorial have sacrificed their people and wasted their treasuries to build statues and mausoleums,

walled cities and pyramids in the vain attempt to perpetuate the memory of their lives of crime; even the mighty though fallen angel shrank from the suggestion of relief from misery through annihilation.

> "And that must end us, that must be our cure,
> To be no more; sad cure, for who would lose,
> Though full of pain, this intellectual being,
> Those thoughts that wander through eternity,
> To perish rather, swallowed up and lost
> In the wide womb of uncreated night,
> Devoid of sense and motion?"

The rich and the mean, the infamous and the obscure build monuments upon which are recorded not what they were, but what they should have been to escape the spectre of oblivion.

But the good men and the truly great men need no such self-laudation —they live in the memory of the world which has been benefited by their service—that world which is richer because they have lived and poorer because they have died.

So it is with him we honor today—this great and splendid building —this great and more splendid department which his energy and loyalty to duty erected and created testify to his genius and his worth. We can not compute in terms of money the value of such a life as his—that value will never cease to augment the forces for good in agriculture, pure food and the prevention of diseases in man and in live stock, which he set in motion, and which are only beginning to bear fruit. They will increase and multiply as long as progress is the watchword in Kentucky.

Professor Scovell was a quiet, retiring, modest gentleman, who had a cheery word for all who approached him. I have read somewhere that every good deed done, and every kind word spoken in this life will blossom into a fragrant flower to sweeten the eternity of the life to come— if this be true, and the idea is sufficiently beautiful to be true, then our friend wanders amidst a wilderness of flowers.

I have said that his life was gentle—he in nowise resembled those boisterous, pushing characters which, like the mountain brooks go noisily leaping, dashing and splashing on their shallow way down the rugged hillside to the valley below, but his life resembled rather the deep, quiet river which silently runs its mighty course to the sea—bearing upon its broad bosom the rich freightage of the world's commerce.

Now that he is gone Kentucky, his adopted mother, claims his ashes and his memory as her own; and as she today bends above his grave remembering his worth, his purity of character and his great services and those of her other noble sons who sleep upon her bosom, she can smile through her tears and say with the Roman matron of old, "these are my jewels."

The limner's cunning art has perpetuated the noble countenance of Professor Scovell on this canvas; the portrait is the gift of those who

stood closest to him in his great life work. As we gaze upon the picture we can almost hear his kindly voice and catch the twinkle of his friendly eye—we can almost stand in his immediate presence and feel the magnetism of his generous nature, and we who knew him best and loved him most can thank God that it was our privilege to come within the sphere of his noble influence and that we are able to speak of him as our friend. He is, indeed, gone from us, but his fame is secure, for

> "Fame is no plant that grows on mortal soil
> Nor in the glittering foil
> Set off to the world, nor in broad rumour lies,
> But lives and spreads aloft by those pure eyes,
> And perfect witness of all judging Jove;
> As he pronounces lastly on each deed,
> Of so much fame in Heaven expect thy meed."

Following the acceptance of the Scovell portrait, the Director named the Experiment Station building Scovell Hall and formally turned over the new building to the Chairman of the Board of Control, the Hon. R. C. Stoll, who, for and on behalf of the Board of Control, accepted the building in the following words:

LADIES AND GENTLEMEN:

As Chairman of the Board of Control of the Kentucky Agricultural Experiment Station, it becomes my duty to accept this building for and on behalf of the University and of the Commonweath of Kentucky.

Congress builded wiser than it knew when the first appropriations were made bringing into existence the Experiment Stations as a part, in fact, of the Agricultural and Mechanical Colleges.

From a comparatively small beginning, the Experiment Stations have grown until they have become one of the greatest influences for good not only in the Nation but in Kentucky. Not only does your Experiment Station perform the functions for which it was originally established, but it is charged with the duty of enforcing the Fertilizer Law, the Stock Feed Law, the Pure Food Law, the Pure Drug Law—all of vital importance to our health and industrial development.

The great problem which confronts all Nations is its food supply. Fortunately in America, we have had broad acres and fertile land, but as time goes on and as our population increases these acres must be made more productive.

When man first learned the art of tilling the soil, it was his custom to sow in one place until the land became exhausted, then he would move on to fresh land. Somebody discovered that by rotation of crops and by the use of fertilizers that the same land could be made productive for all times. Then man began to build permanent habitations and communities were formed, and with the foundation of communities came the

beginning of law; with law came order; with order came civilization. Man learned to respect the rights of fellowmen, and to so use his own as to interfere as little as possible with that of his neighbor; and man learned that without law there could be no order; and without order there could be no civilization.

No wonder that the Egyptian worshipped his Isis, and the Hindoo his Brahma.

So then Agriculture, I believe, was the father of civilization, and it is the function of the Agricultural Experiment Stations to advance that civilization.

One of the Stations aims so 'tis said, is to make two blades of grass grow where one only grows, and to increase many-fold the yield of wheat to the acre, to teach us the most economical way to fatten our hogs and cattle and to teach us to rid our land of insects which threaten our crops with destruction.

This is a great aim, and may God grant that in all these things your future success may far surpass that of the past.

But the greatest thing that can be done by our Stations and Agricultural Colleges is, I believe, to educate our citizens. Some one has well said that Education is a greater protection to our republic than a standing army. There are those today in our Nation who are seeking to overthrow our form of Government, and already there are those who are predicting a revolution. There are those who go about the country appealing to men's passions and prejudices, and with fiery rhetoric and high sounding phrases—agitators—seek to make us dissatisfied with the government of our fathers for their own selfish ends.

It is to the educated men that this Nation must look for the preservation of the republic. It is to men who will analyze such statements, and will subject them to the searching test of reason and logic that we must look. It is men who will think that will save our Nation, and keep for our children and our children's children the liberties that we now enjoy.

It was my good fortune, Dr. Kastle, to have been associated with your predecessor. To Dr. Scovell, Kentucky owes a debt of gratitude, and the result of his labors will be felt by this Commonwealth so long as time runs, and this building, Scovell Hall, will be his material monument, for it is to him and to his big brain that we owe it, but his real monument will be the work that he has done for his adopted State.

You take up where he laid down, and I have no fear but that the work begun by him will be continued by you, and that under your administration the Station will go on doing good, and that, when your active life is over, you and and all of us can look back upon the Station under your charge, and say, "Well done. Kentucky did well when she chose Dr. Kastle to succeed Dr. Scovell."

With this knowledge, it is with pleasure that on behalf of the University of Kentucky and of the Commonwealth of Kentucky that I accept this building which has been dedicated today.

Mr. Stoll's address concluded the dedicatory exercises, which proved to be a most notable and inspiring occasion, and one long to be remembered in the history of agricultural advancement in the State.

KENTUCKY

# Agricultural Experiment Station

OF THE

# STATE UNIVERSITY

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BULLETIN NO. 169

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# THE WOODY PLANTS OF KENTUCKY

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LEXINGTON, KENTUCKY.
January 1, 1913.

# Kentucky Agricultural Experiment Station

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The Bulletins of the Station will be mailed free to any citizen of Kentucky who sends his name and address to the Station for that purpose.

Correspondents will please notify the Director of changes in their post-office address, or of any failure to receive Bulletins.

Address
KENTUCKY AGRICULTURAL EXPERIMENT STATION,
Lexington, Kentucky.

# THE WOODY PLANTS OF KENTUCKY.

By H. GARMAN,

ENTOMOLOGIST AND BOTANIST OF THE STATION.

The following list is to be regarded as preliminary to a more complete account of the woody plants of Kentucky. The material for it has been accumulated during a good many years of collecting and observation, both as State Inspector of Nurseries and as Entomologist and Botanist of the Kentucky Experiment Station, tho most of the time spent on native shrubs and trees has been incidental to the other work. It is believed that the list is nearly complete, notwithstanding, but some species are included more to get further information about them as Kentucky plants than because of a belief that they occur here. An example is the long-leaved or Georgia pine, said by Lafayette DeFriese to have been observed by him near Pound Gap. This pine is the common species in the sandy regions of the South Atlantic coast, and it seems very unlikely that it ever extended northward to our limits. But DeFriese wrote many years ago, at a time when our forests were much more extensive than now, and may be supposed to have had an opportunity to observe species here that have since been exterminated by farming and lumbering operations.

Several earlier lists of Kentucky plants have been prepared at different times. One of the earliest, perhaps the first, was written by "Henrico M'Murtrie, M. D.," under the title "Florula Louisvillensis" and was published in Louisville in 1819, coming from the press of "S. Penn, Jun. Main Street." It was printed with other observations made by the author, the whole being described by him as,

> "Sketches of Louisville and its Environs, including, among a great variety of miscellaneous matter, a Florula Louisvillensis; or, a catalogue of nearly 400 Genera and 600 Species of Plants that grow in the Vicinity of the Town, Exhibiting their Generic, Specific and Vulgar English Names."

The list contains the names of both cultivated and wild plants, so that it is sometimes impossible to say whether or not a plant recorded was actually observed growing wild about Louisville. Excluding those evidently introduced, such as the peach, pear and apple, the author appears to have observed 124 woody plants; tho when one finds in the list such species as *Azalea nudiflora, A. viscosa, Castanea pumila, Calycanthus floridus, Kalmia angustifolia* and *K. latifolia,* he is led to wonder as to the extent of the area considered by the author as in the "vicinity of the town," for these species are now pretty closely restricted to the mountains east and southeast of Lexington. The following Kentucky trees and shrubs are recorded in his list:

Amorpha fruticosa, sugar maple, red maple, soft maple (Acer pennsylvania, according to M.), box elder, Aralia spinosa, papaw, common buckeye, smooth-hulled buckeye (Aesculus lutea, according to M.), red bud, black birch, catalpa, trumpet creeper, hackberry, chestnut, chinquepin chestnut, hornbeam (Carpinus), hazel nut, flowering dogwood, Canadian dogwood (Cornus canadensis), upright dogwood (C. stricta), red-osier dogwood (C. sericea), button bush, hawthorn (C. crus-galli, C. coccinea, C. oxyacantha), Calycanthus floridus, persimmon, leatherwood, Epigaea repens, Euonymus carolinensis, E. sempervirens, beech, white ash, blue ash, swamp ash, honey locust, Hydrangea arborescens, witch hazel, American holly, black walnut, butternut, shell-bark hickory, shag-bark hickory, pignut, pecan, red cedar, narrow-leaved laurel, broad-leaved laurel, sweet gum, sassafras, spice wood, tulip poplar, Mitchella repens, mulberry, cucumber tree (Magnolia acuminata), Nyssa aquatica, N. sylvatica, cottonwood, shrub trefoil (Ptelea trifoliata), crab-apple, hemlock, wild cherry, sycamore, black elder, bur oak, white oak, chestnut oak (yellow oak), chestnut oak, willow oak, black oak, Spanish oak, red oak, gooseberry, black currant, great-leaved laurel, Rhus glabra, R. typhinum, R. radicans, R. copallinum, R. suavolens, Rosa caroliniana, R. parviflora, R. lucida, R. palustris, R. rubifolia, wild black raspberry, dewberry, blackberry, black locust, bladder nut, Smilax caduca, S. hastata, black elderberry, red elderberry, Salix nigra, S. sericea, trumpet flower, linden, white elm, red elm, Viburnum acerifolium, V. prunifolium, V. dentatum, V. lentago, Vitis vulpina, V. labrusca, V. aestivalis,

common creeper (Virginia?), whortleberry, huckleberry, cranberry.

In his life of Rafinesque, the author, R. E. Call, intimates that M'Murtrie secured this list from Rafinesque who was at the time actively engaged in studying the botany of Kentucky. If this is true it explains in a manner the mountain plants included. Rafinesque knew the flora of much of the State, whereas M'Murtrie aimed to present the flora of the region about Louisville. It seems hardly credible that the great laurel, red elder, mountain laurel and other species noted in the list have ever been found growing wild at Louisville.

The French-German, Rafinesque, was a remarkable man in his prime, of great mental and physical energy. He left a more enduring mark on the botany of Kentucky than any other pioneer writer. Some of his published species have never been collected by others in the State. He was an indefatigable collector at a time when the botany of the State was almost untouched either by the lumberman, the agiculturist, or the botanist, and thus had opportunities for study in the field not enjoyed by those who followed him. It is unfortunate that he was unable somewhere to leave a complete record of the work he did while here. He was made professor of natural sciences at the old Transylvania University in 1818, and for some years thereafter remained in Kentucky.

In 1833, Doctors Short and Peter, of Lexington, published their list of Kentucky plants in the Transylvania Journal of Medicine. In it are about one hundred and fifty-three species of woody plants, some of them probably observed in cultivation. The list covers the whole State, yet records only about thirty species more than M'Murtrie's Louisville list. This is the most satisfactory of the old lists, and bears evidence of having had the painstaking care which local lists should receive. Both men were good botanists, and appear to have scrutinized the plants of Bluegrass Kentucky with special thoroness.*

*It was my good fortune to know for a brief time Dr. Robert Peter, one of the authors of the list. He was well along in years, a good gray man, whose modesty, unselfishness and industry were most pleasant to witness. But in a selfish world these qualities too often work to the disadvantage of their possessors, and Dr. Peter has not yet, I think, received from Kentucky the appreciation his patient labor in her interest has earned for him.

Members of the old Geological Survey Staff, who published observations on Kentucky woody plants in the reports of 1880-1884, are, Professor A. R. Crandall, and Messrs. John Hussey, Lafayette DeFriese and W. M. Linney. Professor Crandall examined the forest trees of Carter, Boyd and Lawrence counties; Hussey, those of Barren and Edmonson counties. DeFriese seems to have traveled from the vicinity of Columbus on the west to Pound Gap near our east boundary; while Linney gives a good account of the trees and shrubs of Boyle and Mercer counties.

It is a pleasure to bear witness in this relation to the devotion to the study of our native plants by a Kentucky woman also, the late Miss Sadie F. Price, of Bowling Green. Her death from typhoid fever was, I suppose, a result of enthusiasm for botany, being probably contracted on some one of her collecting trips in the region about Bowling Green. Her work was but just begun when the end came.

The immediate incentive to the publication of the present list comes from the project recently set on foot by Attorney General Garnett, of establishing a planting on the Capitol Grounds at Frankfort, to which each county shall contribute a tree of its own selection. It was proposed in the Fayette Committee, consisting of H. F. Hillenmeyer, J. W. Porter and the author of this list, that if agreed to by the Governor and Judge Garnett the plan be extended to provide for a complete representation of the woody plants of Kentucky, thus constituting an arboretum covering some of the ground of the one Rafinesque planned years ago when connected with Transylvania University. The interest in the matter shown by Governor James B. McCreary and the members of his official family promised to make the enterprise a success this time, and a preliminary list of our commoner trees and shrubs was submitted by me in which characteristic species were assigned to each county in the State.

The list here presented completes this list, tho it has been in my hands practically as now printed for more than ten years. The arrangement followed is that of Gray's Manual, Seventh Edition. A question mark precedes the names of species as to whose occurrence in Kentucky I have some doubt. Introduced trees are not included.

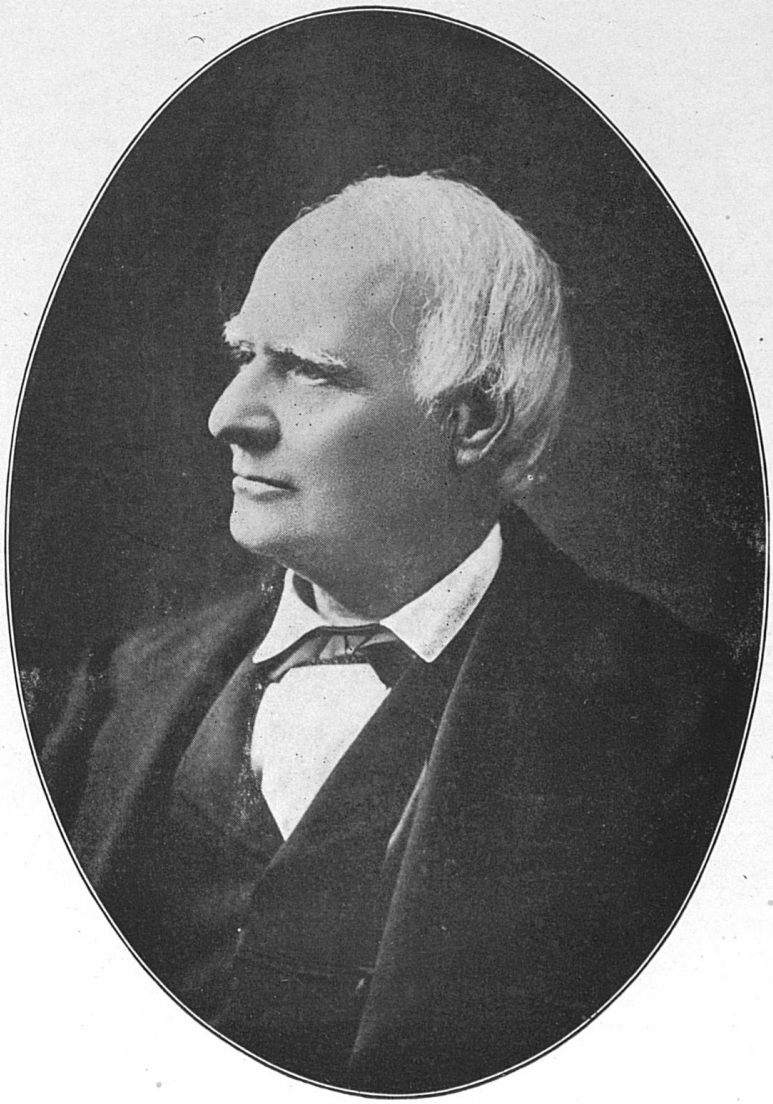


FIG. 1.—DR. ROBERT PETER.

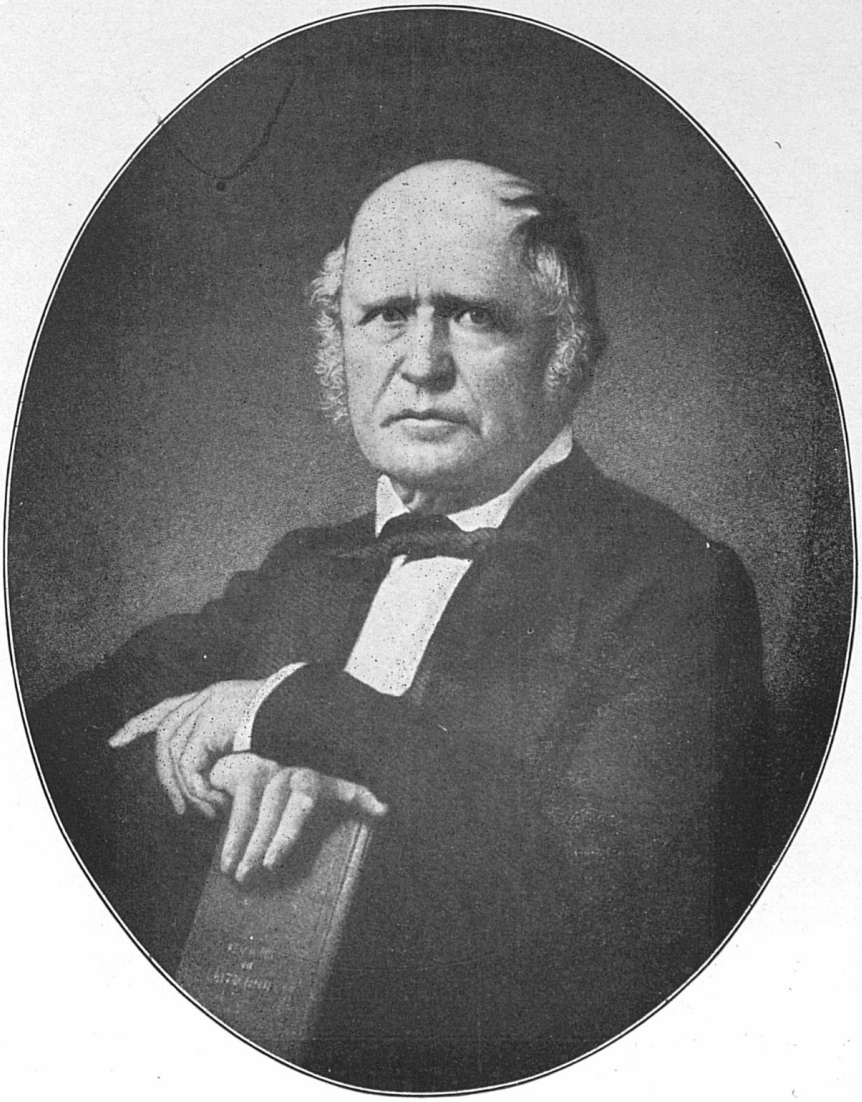


FIG. 2.—DR. CHARLES WILKINS SHORT.

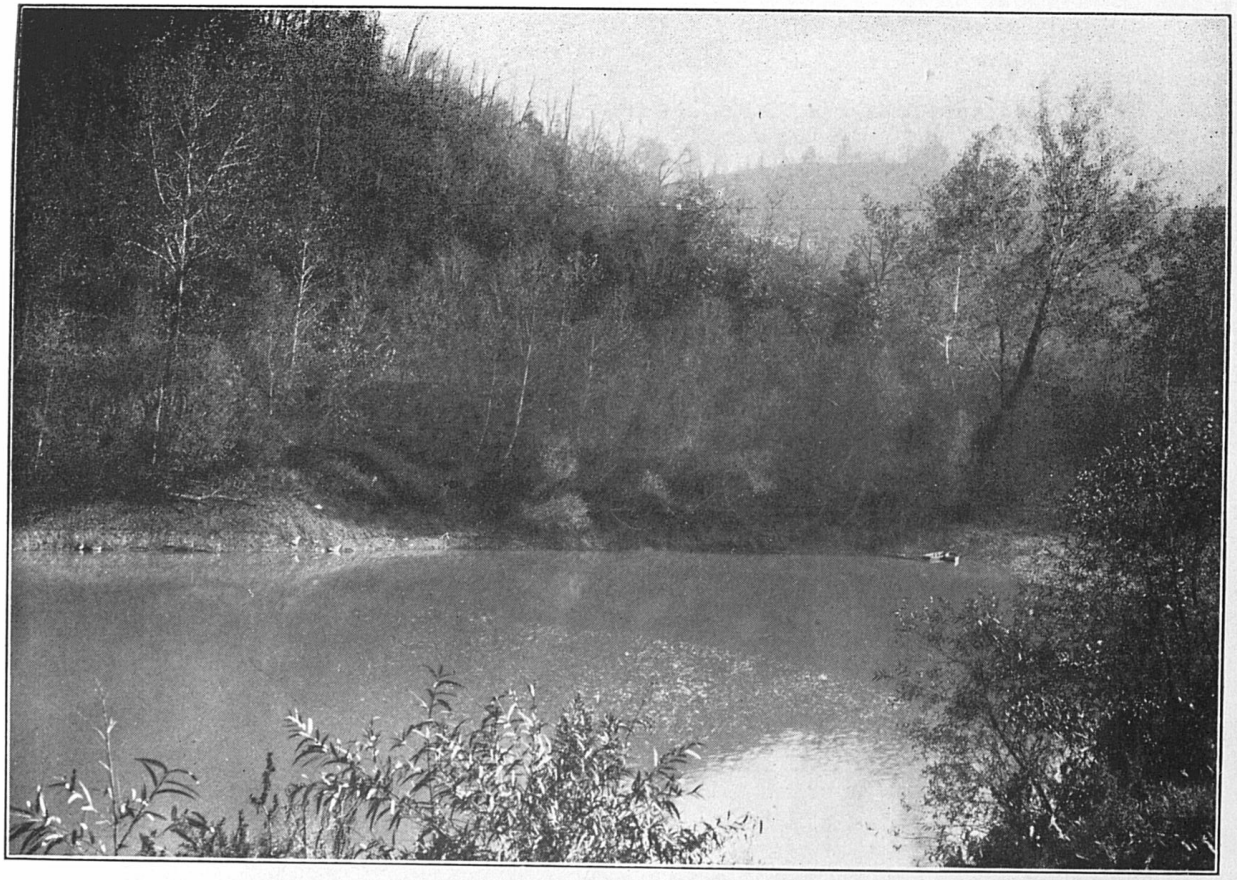


FIG. 3.—SHOWING YOUNG FOREST GROWTH REMAINING ALONG KENTUCKY RIVER. Photographed by H. GARMAN.

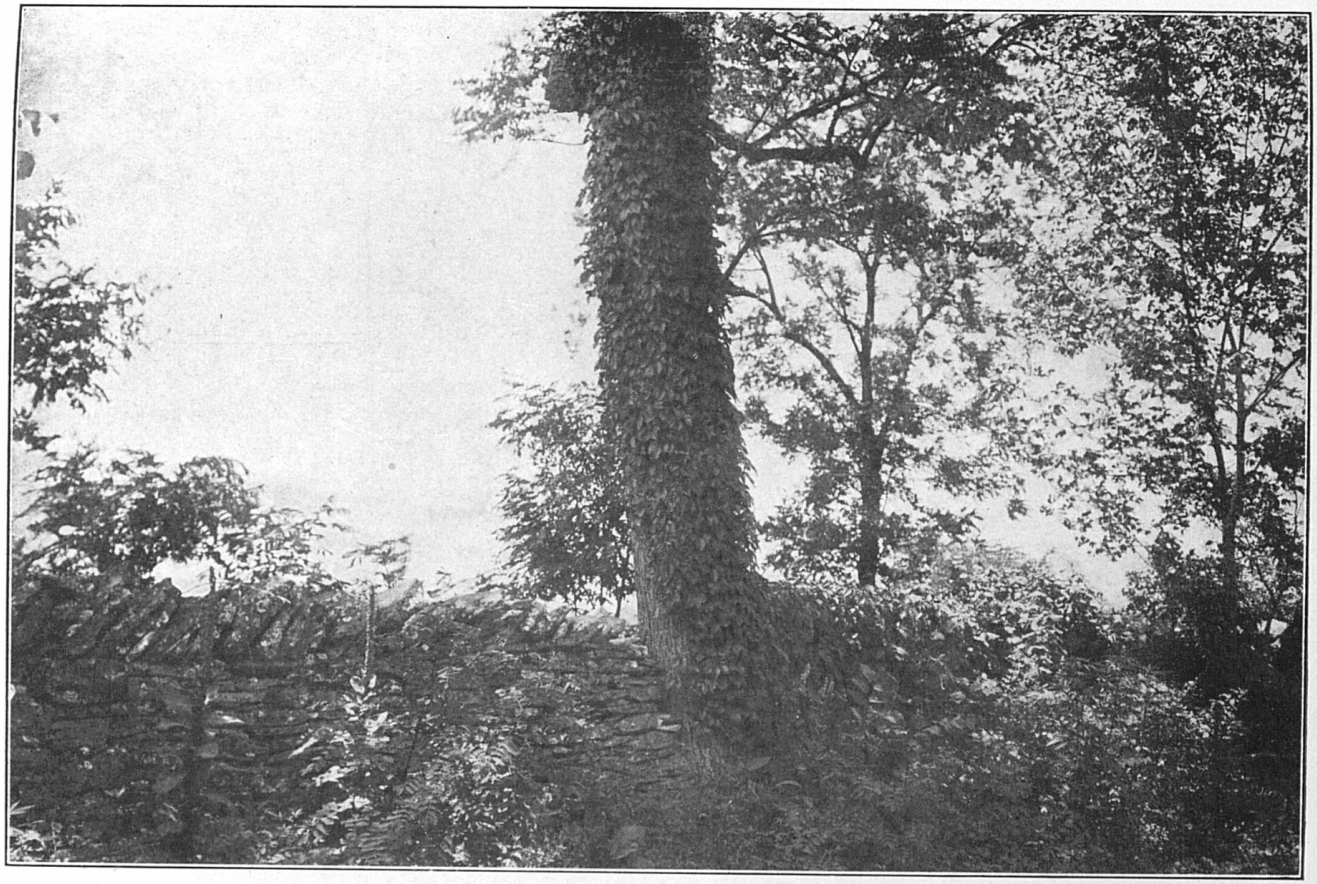


FIG. 4.—AN EXAMPLE OF WOODY GROWTH REMAINING ALONG ONE OF OUR LITTLE-USED PIKES. VIRGINIA CREEPER ON TRUNK OF TREE. Photographed by H. GARMAN.

The records of localities must not be regarded as complete. In this connection I must thank correspondents who have furnished information as to the trees of their respective localities.

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The woody plants of Kentucky are a very miscellaneous assemblage of species which appear to have been brought together by a diversity of influences. Probably the mountains in the eastern part of the State furnished most of them, having constituted a sort of reservoir which overflowed as the land to the westward became habitable. There is little in the present distribution of the species indicating that any large number of them came to the western part of Kentucky directly from the north or west, indeed, it looks as if the states immediately north of us had also received many of their forest trees originally from the Appalachian Mountains, the important route of migration having been along the Ohio River. Nearly all of our species of pines are still most abundant in the mountains, and but one (the scrub pine), has traveled very far to the westward within the State. The red cedar has extended more rapidly and farther than any of the true pines, but appears to have had a similar origin, and this seems to be true even of the swamp cypress. It still occurs locally along the Ohio River, tho now most numerous in the extensive swamps along the Mississippi southward.

This influence of the rivers on the distribution of our species finds a striking illustration in plants regarded as specially characteristic of mountainous country. Some of them grow far to the westward of the mountains, in Edmonson, Warren, Barren and to some extent other adjacent, more northern counties. The mountain laurel, *Magnolia tripetala, M. macrophylla,* hemlock, fringe tree, and some other less well known species occur along the Green River in these counties, having apparently migrated here from the headwaters of the river. Sheltered under its banks and bluffs from the cold north winds and shielded by the heavy growth of vegetation accompanying them, even magnolias have pushed out here as they have done nowhere else in Kentucky. We find no trace of them on the open elevated plateau known as the Bluegrass Region, and they seem never to have occurred here.

The intermediate position of the State results in the presence of a surprising variety of species. Side by side in the mountains

one finds the northern white pine and the tender southern magnolias. Added to these characteristically northern and southern plants is a host of individuals representing most of the trees and shrubs of the eastern United States. Taking the oaks as an example: Twenty of the twenty-two species of Eastern North America occur in Kentucky. The live oak of the Gulf States, and the yellow oak (*Quercus ellipsoidalis*) of the far North are the only oak species not found here. It is probable that every one of the ashes occurs in the State, tho the pumpkin ash (*Fraxinus profunda*) has not yet been collected on our side of the Mississippi River. Every one of the five East-American elms grows in Kentucky, the southern species (*Ulmus serotina*), coming just within our southern limits.

The great Kentucky forests present when the State was settled were, it is believed, not due so much to the diversity and richness of our soils as to this central position and our diversity of surface and climate. Some efforts have been made by early writers to find a relation between the flora of Kentucky and the geological formations exposed in the different parts of the State. The relation has never been clearly and satisfactorily defined and demonstrated, and is certainly not a dominating influence on the distribution of our species. The writer has for many years been accustomed to check the plants of the State, as he observed them, on small maps showing the formations, and after thus tabulating many of them, has been forced to the conclusion that the conditions influencing the distribution and assembling of our trees were largely of the general sort which were in operation before much of the surface of Kentucky was habitable; that moisture, temperature, means of dispersal, configuration of surface, etc., control their distribution more than soil influences. They will grow almost anywhere on any sort of soil, even on that consisting largely of rock, if only the winters are not too cold, the droughts not too severe. They make a better, more rapid growth with an abundance of plant food, but will strike root and make some growth where seemingly there is little or none. Some, like the swamp cypress, the swamp white oak, and pin oak, want a very wet soil and in nature are found quite closely restricted to such soils, yet they will grow when trans-

planted to rather dry situations. Others, like the sycamore, the river birch and the willows, follow the streams pretty closely, yet can accommodate themselves to other situations when transplanted. They depend largely, it seems, upon water for dissemination, and this is a sufficient explanation of their being most numerous along streams. In early spring when streams are at flood and bottom lands are covered one may see the seeds of sycamore dropping upon the water and floating away with the current.

Many of our native trees grow, or once grew, in nearly or quite all of the counties of the State. I have the "Barrens" in mind as a partial exception in writing this. It would tax one's ingenuity, I imagine, to find a vital relation between geological formations and the following widely distributed Kentucky species: Black walnut, sugar maple, soft maple, box elder, mulberry, black cherry, wild plum, white ash, black oak, white oak, shell-bark hickory, bitternut, red bud, black locust, honey locust, flowering dogwood, persimmon, black haw and trumpet creeper. If scattered by birds and small rodents, as in the case of the mulberry, walnut, cherries, red cedar and mistletoe, plants will be found widely and evenly scattered, for they spread both with and against wind and water currents. If disseminated by running waters they are unevenly scattered. If neither of these influences affect them and the seeds are heavy, the dispersal may be slow, and the species local in distribution. With the winds to help, as in the case of the maples, linden and others, the prevailing winds should mark out the path over which in the long course of time the species will travel. I have no doubt that all of these influences have been concerned in assembling the forest flora of Kentucky, but have operated so long that it is now difficult to estimate the part each has taken.

But one native tree, the chestnut, shows in any marked way the influence of *soil* on its distribution. In this State it will be found growing wild only, or almost entirely, in soils containing sand. It can be transplanted to the clay loams of Bluegrass Kentucky, but so far as I know never grew here spontaneously. Yet just outside this region it is a common tree where sandstone appears at the surface. How it has managed to follow so closely these outcroppings is an interesting question. Its dissemination seems

to be effected by squirrels and other animals, but why these animals should not in time have established the trees on new soils is difficult to explain, unless sandy soils exert some favorable influence, lacking in other soils, on the germination of the seeds. Some indications of a *prevalence* of other species on certain geological formations are to be detected, but when the distribution thruout the State and outside our limits is considered one is led to refer most of these cases to other influences than those coming from mineral constituents of the soils.

## Yew Family (*Taxaceae*).

**? Ground Hemlock, American Yew,** (*Taxus canadensis*).—This bushy evergreen is given in M'Murtrie's list, but Short and Peter omit it. Dr. Gattinger, also, does not include the species in his "Tennessee Flora." In John Hussey's list of Barren and Edmonson County plants it reappears under the name "*Taxus baccata,* var. *canadensis,*" but the author says nothing about it in his discussion of the evergreens observed by him. Gray gives the distribution as extending from Newfoundland to Virginia, and, at the north, westward to Iowa and Manitoba. The author of this list is familiar with the plant as it occurs in northern Michigan. He has botanized repeatedly in Barren and Edmonson counties and has never observed it there. It is doubtful if it can be considered a native of this State, but attention is called to it in the hope of getting further information. The leaves are green on both sides, in which respect it differs from young growth of the common hemlock. Its fruit is a red berry instead of a cone.

## Pine Family (*Pinaceae*).

**White Pine** (*Pinus strobus*).—A beautiful evergreen, producing a splendid, white, soft, easily-worked wood. Some very good trees, two feet in diameter of trunk and sixty feet or more high, were noted seventeen years ago at Torrent in Wolfe County. Young trees are still not uncommon. The tree is well adapted to parks and lawns.

Bath, Boyd, Casey, Clinton, Crittenden, Estill, Fleming, Floyd, Lewis, Martin, Menifee, Morgan, Owsley, Perry, Powell, Russell, Wayne, Wolfe, and other mountain counties.

**Loblolly Pine, Oldfield Pine** (*Pinus taeda*).—This is a large pine with cones four inches long and leaves five and a half or more inches in length. Its habitat is the sandy region along the South Atlantic Coast and Texas. In the interior it reaches Arkansas and Eastern Tennessee. It is not common in Kentucky, if it occurs at all now, but may be looked for in the mountains of the southeastern part of the State. It is listed by DeFriese in his Geological Survey Report, but some doubt applies to his determination, since it has not been encountered by other more thorogoing botanists.

**Pitch Pine** (*Pinus rigida*).—Occurs in and near the Cumberland Mountains and is not to be seen elsewhere, except in cultivation. It has been observed in the following counties:

Bath, Boyd, Bullitt, Casey, Crittenden, Elliott, Estill, Hart, Jessamine, Johnson, Knott, Laurel, Lawrence, Leslie, Letcher, Martin, Menifee, Nelson, Perry, Rockcastle, Rowan, Whitley.

**Table Mountain Pine** (*Pinus pungens*).—This small pine occurs in the Cumberland Mountains of Southeastern Kentucky. Its cones are characterized by long spines, sometimes nearly a quarter of an inch in length. Recorded by DeFriese. It is common in Eastern Tennessee, according to Dr. Gattinger.

Hart, Leslie, Morgan and Russell counties.

**Scrub Pine** (*Pinus virginiana*).—One of the commonest and most widely distributed of the pines of Eastern Kentucky.

Boyd, Boyle, Bullitt, Casey, Edmonson, Elliott, Fleming, Floyd, Hart, Jessamine, Laurel, Leslie, Lincoln, Martin, Menifee, Monroe, Montgomery, Morgan, Owsley, Powell, Russell, Whitley.

**Yellow Pine** (*Pinus echinata*).—Slopes of Pine Mountain.

Boyle, Casey, Clinton, Elliott, Estill, Fleming, Floyd, Knott, Knox, Laurel, Leslie, Madison, Martin, Montgomery, Morgan, Owsley, Perry, Pike, Powell, Pulaski, Rockcastle, Rowan.

**Long-leaved or Georgia Pine** (*Pinus palustris*).—Altho DeFriese includes this as a Kentucky species, its distribution outside Kentucky renders his determination doubtful. No one else so far as I know claims to have seen it so far north. Even Gattinger fails to mention it as a Tennessee plant. If here it will probably be found in the vicinity of Pound Gap, where DeFriese claims to have observed it.

**Hemlock** (*Tsuga canadensis*).—A large tree, sometimes seventy-five feet in height, common in shaded ravines in the mountains of Eastern Kentucky, and occurring westward locally along Green River to Edmonson County, and then northward in gullies well toward the Ohio River.

Bath, Bell, Boyd, Clinton, Edmonson, Elliott, Estill, Fleming, Harlan, Hart, Johnson, Knott, Knox, Laurel, Leslie, Letcher, Menifee, Montgomery, Morgan, Owsley, Perry, Pike, Powell, Pulaski, Rowan, Wayne, Whitley, Wolfe.

**Swamp or Bald Cypress** (*Taxodium distichum*).—A large tree found wild only in swamps, but occurring locally along the Ohio River, becoming common in the bottoms of the Mississippi on the west. The small, light green leaves are shed in the fall. The cones are small, globular, with the peculiar scales meeting at the edges. Produces a valuable lumber much used in hothouse construction. Several transplanted trees of medium size are growing on premises about Lexington. They do well, excepting during very dry seasons from which they suffer more than most other trees.

Ballard, Crittenden, Daviess, Fulton, Gallatin, Graves, Henderson, Hickman, Livingston, McCracken, McLean, Muhlenberg, Trigg, Union, Webster.

**? Arbor Vitae** (*Thuja occidentalis*).—Credited to Kentucky in both M'Murtrie's and Short and Peter's lists. To be looked for in the mountains. I have never seen it in any of my numerous trips to mountain counties. The tree is a favorite for lawns and is common in cultivation.

**Red Cedar, Cedar** (*Juniperus virginiana*).—Our commonest and most widely distributed evergreen, occurring from the Big Sandy to Hickman County. The staminate catkins, 4 mm. by 2 mm., observed April 14.

Adair, Allen, Ballard, Bath, Bell, Barren, Bourbon, Boyd, Boyle, Breathitt, Breckinridge, Bullitt, Butler, Campbell, Carroll, Casey, Christian, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fayette, Fleming, Floyd, Fulton, Franklin, Gallatin, Garrard, Grant, Green, Hancock, Hardin, Hart, Henderson, Hickman, Jefferson, Jessamine, Johnson, Knott, Knox, Lawrence, Leslie, Letcher, Lincoln, Livingston, Logan (extremely common, April 14, 1895, 45-50 ft. high), Madison, McLean, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Muhlenberg, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Powell, Rockcastle, Scott, Shelby, Spencer, Simpson, Taylor, Todd, Trigg, Trimble, Wayne, Whitley, Woodford.

## Lily Family (*Liliaceae*).

The species entered under this family are sometimes made a separate family, the Smilaceae. They are commonly known as cat-briers, green briers, etc., the species not being closely discriminated, tho sometimes familiar enough on farms as weedy growths in meadows and orchards.

**Green Brier** (*Smilax rotundifolia*).—Common.

Bell, Fayette, Harlan, Hickman, Henderson, Livingston, Rockcastle and Warren counties.

**Saw Brier** (*Smilax gauca*).—

Bell, Harlan, Menifee and Warren counties.

**Smilax bona-nox.**—

Livingston, Warren.

**Smilax hispida.**

**Smilax pseudo-china.**

## Willow Family (*Salicaceae*).

**Black Willow** (*Salix nigra*).

**Ward's Willow** (*Salix wardi*).—
Kentucky (Gray's Manual).

**Shining Willow** (*Salix lucida*).—
Kentucky (Britton).

**Crack Willow** (*Salix fragilis*).

**Sand-bar Willow** (*Salix longifolia*).

**Salix cordata.**

**Glaucous Willow** (*Salix discolor*).

**Salix petiolaris.**

**Dwarf Gray Willow** (*Salix tristis*).—Common in Hardin County, at Cecilian, Stithton and Tip Top.

**Sage Willow** (*Salix candida*).—
Edmonson and Warren counties (Miss Price). Frankfort, Ky.

**American Aspen** (*Populus tremuloides*).—Short and Peter; Barren and Edmonson (Hussey), Boyle and Mercer (Linney). Not common in Kentucky.

**Large-toothed Aspen** (*Populus grandidentata*).—Not common.
Allen. Barren and Edmonson (Hussey). Gallatin, Hart, Larue, Menifee, Morgan, Ohio. Eastern Kentucky (Crandall).

**Downy Poplar** (*Populus heterophylla*).—Frequent locally in swamps.
Gallatin, Muhlenberg and Todd counties.

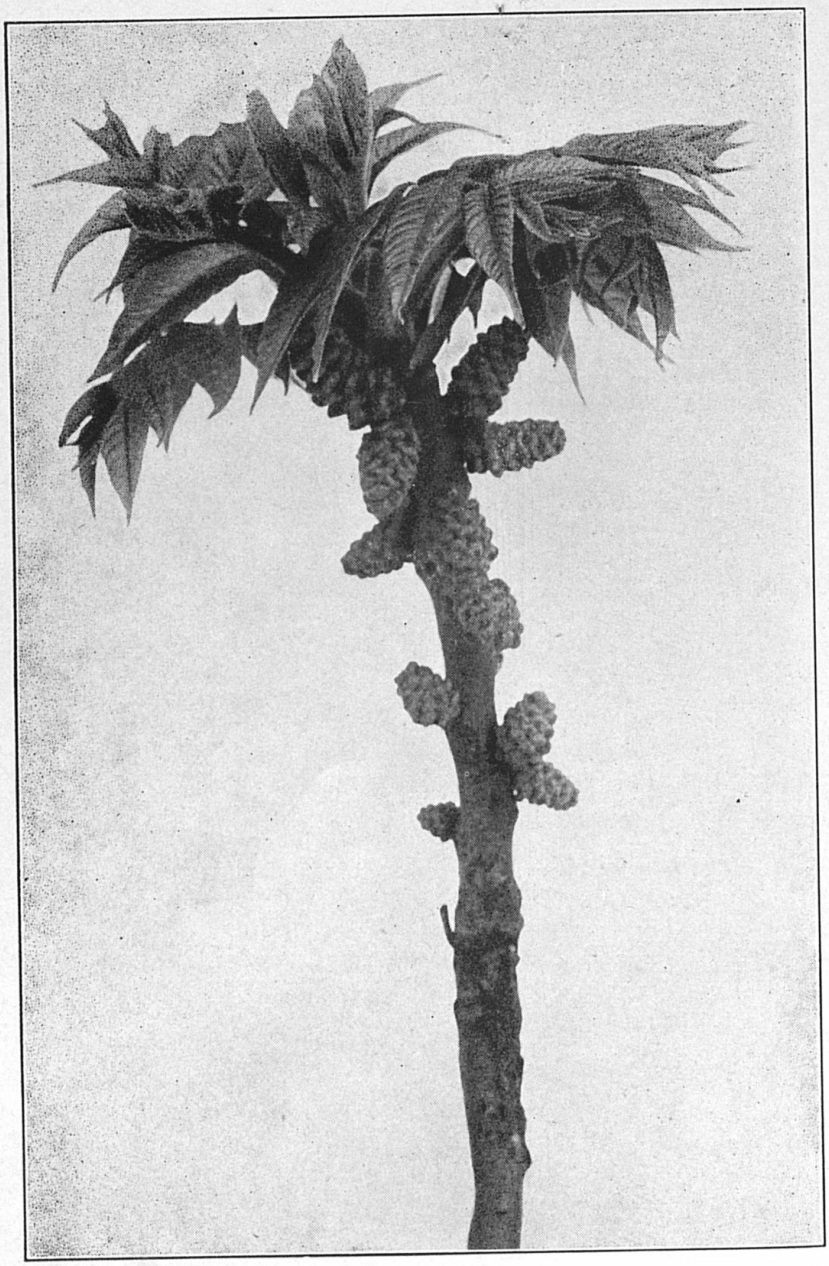


FIG. 5.—STAMINATE BLOSSOMS OF BLACK WALNUT.
NATURAL SIZE.

**Cottonwood** (*Populus deltoides*).—Not a common Kentucky tree, but somewhat widely distributed in the State.

Ballard, Boyd, Boyle, Bracken, Breckinridge, Bourbon, Butler, Caldwell, Carroll, Crittenden, Daviess, Fleming, Floyd, Fulton, Gallatin, Garrard, Green, Hancock, Hart, Henderson, Hickman, Larue, Leslie, Lewis, Livingston, Logan, Lyon, Menifee, Mercer, McCracken, McLean, Monroe, Morgan, Nelson, Nicholas, Ohio, Oldham, Owen, Pendleton, Rowan, Shelby, Simpson, Spencer, Todd, Trigg, Union, Warren, Webster. Edmonson and Barren (Hussey).

## Walnut Family (*Juglandaceae*).

**Butternut** (*Juglans cinerea*).—A small tree as commonly seen in Kentucky, with ash-gray bark and straggling branches. Not very common anywhere, but has been observed in extreme eastern and extreme western counties. From my notes it appears to be unevenly distributed, occurring in more of the central counties than elsewhere, and being scarce or wanting in the Bluegrass Region and in much of the western third of the State.

Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breckinridge, Campbell, Carroll, Cumberland, Daviess, Estill, Gallatin, Garrard, Grayson, Hancock, Hardin, Hart, Hickman, Jessamine, Johnson, Knott, Larue, Letcher, Lewis, Livingston, Madison, Menifee, Mercer, Monroe, Morgan, Oldham, Pendleton, Perry, Powell, Pulaski, Robertson, Rowan, Scott, Spencer, Webster, Woodford.

**Black Walnut** (*Juglans nigra*).—Common thruout Kentucky, formerly even more so. A fine tree, producing a valuable dark brown wood. Merchantable trees are rapidly being sought out and destroyed. Easily grown from the nuts. In bloom May 13, 1900, at Lexington.

During the ten years preceding 1899, $5,000,000 are claimed to have been paid for walnut timber sold out of Bluegrass Kentucky. From $10,000 to $15,000 were paid for walnut timber on single farms, and $30,000 is said to have been offered and refused for the walnut on a very large tract in Woodford County.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breathitt, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Christian, Clark, Clinton, Crittenden,

Cumberland, Daviess, Edmonson, Elliott, Estill, Fayette, Fleming, Floyd, Franklin, Fulton, Gallatin, Garrard, Grant, Grayson, Green, Hancock, Hardin, Harrison, Hart, Henderson, Henry, Hickman, Jefferson, Jessamine, Johnson, Kenton, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Marion, Martin, Mason, McCracken, McLean, Meade, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Muhlenberg, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rockcastle, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Washington, Wayne, Webster, Whitley, Woodford, Wolfe.

**Pecan** (*Carya illinoense*).—This is a large tree pretty closely restricted in Kentucky to bottomlands along the Ohio and Mississippi rivers. Near Columbus in July 21, 1897, it was found rather common, some of the trees three or four feet thru and one hundred feet high. Bark smooth, light gray. Leaflets, 15-17 in number, small compared with those of other hickories.

Ballard, Breckinridge, Carroll, Crittenden, Daviess, Fulton, Gallatin, Hancock, Henderson, Hickman, Livingston, Lyon, McCracken, McLean, Monroe, Ohio, Pulaski, Russell, Todd, Trigg, Union, Webster. Linney, in 1879, credited it to Boyle and Mercer counties.

**Shell-bark Hickory** (*Carya ovata*).—A common tree, well known to every child from the fine nuts it produces, which are, with the exception of those of the pecan, the best produced by any native tree. Trees observed in Todd County, November 11, 1895, were three feet thru and sixty feet or more high.

Adair, Allen, Ballard, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Clark, Clinton, Christian, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fayette, Fleming, Floyd, Gallatin, Garrard, Grant, Green, Hancock, Hardin, Harrison, Hart, Henderson, Henry, Hickman, Jessamine, Johnson, Kenton, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Marion, Martin, Mason, McCracken, McLean, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Washington, Wayne, Webster, Wolfe, Woodford.

**Big Shell-bark Hickory** (*Carya laciniosa*).—The "King Nut" is common in the State, and its nuts are frequently seen with the smaller ones of the common shell-bark hickory in our markets. Tho large and of fine appearance, they are not so highly prized as are those of the preceding species.

Adair, Allen, Ballard, Barren, Bath, Bourbon, Boyd, Boyle, Bracken, Bullitt, Butler, Campbell, Caldwell, Carroll, Casey, Clinton, Crittenden, Cumberland, Daviess, Elliott, Estill, Fleming, Floyd, Gallatin, Garrard, Grant, Graves, Green, Harrison, Hart, Henderson, Hickman, Johnson, Knott, Knox, Larue, Lawrence, Leslie, Lewis, Livingston, Logan, Lyon, Madison, Mason, McCracken, McLean, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Nelson, Nicholas, Ohio, Owsley, Pendleton, Powell, Pulaski, Robertson, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Warren, Washington, Wayne, Webster, Whitley, Woodford.

**Mocker-nut Hickory** (*Carya alba*).—The tree (sometimes fifty or sixty feet high and a foot or more thru) is to be recognized by the close bark, the nuts by their hard, thick, roundish shell, often of a brownish hue. The kernel is not as palatable as those of either of the preceding species.

Boyd, Casey, Edmonson, Elliott, Estill, Floyd, Gallatin, Greenup, Hickman, Knott, Larue, Laurel, Leslie, Letcher, Livingston, Mason, Menifee, Pendleton, Rockcastle, Scott, Spencer, Todd, Whitley.

**Small-fruited Hickory** (*Carya microcarpa*).—Credited to the State, and to be looked for in Western Kentucky.

Boyle and Mercer counties (Linney); Warren (Miss Price).

**Broom Hickory** (*Carya glabra*).—A common tree thruout hilly sections of the State from east to west. Slender, but reaching a height of sixty-five feet.

Christian, Edmonson, Gallatin, Jefferson, Hickman, Logan, Rockcastle and Whitley counties.

**Pignut or Bitternut Hickory** (*Carya cordiformis*).—Common everywhere and well known from its roundish, bitter nuts.

Ballard, Bath, Bell, Bracken, Boyd, Edmonson, Fayette, Floyd, Gallatin, Logan, Mason, Rockcastle, Todd, Trigg, Washington, Whitley, Woodford.

## Birch Family (*Betulaceae*).

**Hazelnut** (*Corylus americana*).—Not a common Kentucky plant, taking the State as a whole, but widely distributed and likely to be encountered anywhere in small numbers.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Breckinridge, Butler, Caldwell, Campbell, Casey, Christian, Clinton, Crittenden, Daviess, Edmonson, Elliott, Estill, Fleming, Fulton, Gallatin, Garrard, Grant, Graves, Green, Hancock, Hardin, Hart, Henderson, Hickman, Hopkins, Jessamine, Johnson, Knott, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Martin, McCracken, McLean, Meade, Menifee, Metcalfe, Monroe, Montgomery, Morgan, Nelson, Ohio, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rowan, Russell, Scott, Simpson, Taylor, Todd, Trigg, Union, Warren, Wayne, Webster, Whitley, Wolfe, Woodford.

**Hop Hornbeam, Ironwood** (*Ostrya virginica*). — Frequent. Known by its fruit which somewhat resembles that of the hop. A tree noted in Whitley County, October 15, 1895, was nine inches thru and forty feet high. Others noted the same year in Shelby County were from twenty-five to thirty feet high.

Ballard, Boyd, Boyle, Butler, Christian, Crittenden, Elliott, Estill, Franklin, Fulton, Gallatin, Grant, Hancock, Hart, Hickman, Jessamine, Knott, Lawrence, Letcher, Livingston, Menifee, Mercer, Metcafe, Monroe, Morgan, Nelson, Oldham, Owsley, Perry, Pulaski, Rockcastle, Rowan, Simpson, Shelby, Taylor, Trigg, Union, Wayne, Webster, Whitley.

**Hornbeam, Ironwood** (*Carpinus caroliniana*).—A common tree.

Adair, Allen, Ballard, Bath, Bell, Boyle, Casey, Clinton, Christian, Cumberland, Daviess, Edmonson, Elliott, Estill, Fayette, Floyd, Franklin, Gallatin, Green, Hart, Hickman, Hopkins, Johnson, Knott, Larue, Laurel, Leslie, Letcher, Lincoln, Livingston, Lyon, Madison, Meade, Menifee, Mercer, Monroe, Morgan, Ohio, Oldham, Owsley, Pendleton, Perry, Pike, Rockcastle, Rowan, Russell, Shelby, Simpson, Spencer, Taylor, Whitley.

**Sweet Birch** (*Betula lenta*).—Not very common, taking the State as a whole. Observed by me only in the mountain counties, but reported by correspondents from Hart, Hickman and McLean. Observed to be rather common in moist ravines in Rockcastle County, October 19, 1895.

Bell, Boyd, Estill, Floyd, Johnson, Knott, Knox, Lawrence, Leslie, Letcher, Menifee, Monroe, Morgan, Owsley, Perry, Pike, Rockcastle, Rowan, Trigg, Wayne, Whitley, Wolfe.

**Yellow Birch** (*Betula lutea*).—
Bath, Gallatin.

**River Birch** (*Betula nigra*).—Our commonest birch. Pretty closely restricted to the banks of streams.

Ballard, Bath, Bell, Boyd, Boyle, Bullitt, Butler Carroll, Casey, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Floyd, Fulton, Gallatin, Hancock, Hart, Hickman, Hopkins, Knott, Knox, Laurel, Leslie, Letcher, Livingston, Lyon, Martin, McCracken, McLean, Menifee, Monroe, Muhlenberg, Ohio, Owsley, Perry, Pike, Powell, Pulaski, Rockcastle, Rowan, Russell, Spencer, Todd, Union, Warren, Whitley, Wolfe.

**Smooth Alder** (*Alnus rugosa*).—An alder presumed to be this is common in the mountains of Eastern Kentucky along streams. Miss Price records the species as occurring in Warren County. The leaves vary from broad oval to lanceolate. Alders are common thruout Western Kentucky in wet places. A specimen in the collection from Aden Springs, Carter County, has closely pubescent twigs, and may represent *A. mollis*. Its catkins are immature.

## Beech Family (*Fagaceae*).

**Beech** (*Fagus grandifolia*).—Very common locally, and widely distributed in the State. Not common on the best soils of Bluegrass Kentucky, but a few may be found on Kentucky River even in Fayette County. The "soggy beech flats of eastern Fayette County" have all but disappeared.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breckinridge, Breathitt, Bullitt, Butler, Campbell, Carroll, Casey, Christian, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fayette (on river), Fleming, Floyd, Fulton, Gallatin, Garrard, Green, Hickman, Hardin, Hopkins, Jessamine, Johnson, Kenton, Knott, Knox, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Martin, Mason, McLean, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Muhlenberg, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rock-

castle, Rowan, Russell, Scott (rare), Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Washington, Wayne, Webster, Whitley, Wolfe.

**Chestnut** (*Castanea dentata*).—Common in soils containing sand; not commonly seen elsewhere except in cultivation. A beautiful tree, well adapted to park and lawn, and furnishing valuable lumber.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Breckinridge, Breathitt, Bullitt, Butler, Caldwell, Casey, Christian, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fleming, Floyd, Garrard, Grayson, Green, Hancock, Greenup, Hardin, Hart, Henderson, Hickman, Jessamine, Johnson, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Logan, Madison, Marion, Martin, McLean, Menifee, Monroe, Montgomery, Morgan, Nelson, Ohio, Oldham, Owen, Owsley, Perry, Pike, Powell, Pulaski, Rockcastle, Rowan, Russell, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Warren, Wayne, Webster, Whitley, Wolfe.

**Chinquepin Chestnut** (*Castanea pumila*).—A dwarf tree or shrub confined pretty closely to the south central part of the State and to a few mountain counties. Not common.

Adair, Clinton, Floyd, Garrard, Green, Knott, Leslie, Letcher, Metcalfe, Owsley, Perry, Pike, Pulaski, Russell, Simpson, Warren, Wayne.

**White Oak** (*Quercus alba*).—Formerly common and generally distributed. Merchantable trees now largely cut out. A splendid tree often of large size.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Christian, Clark, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fayette, Fleming, Floyd, Franklin, Fulton, Gallatin, Garrard, Grant, Grayson, Graves, Green, Greenup, Hancock, Hardin, Harrison, Hart, Henderson, Henry, Hickman, Hopkins, Jefferson, Jessamine, Johnson, Kenton, Knott, Knox, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Marion, Martin, Marshall, Mason, McCracken, McLean, Meade, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Rockcastle, Robertson, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Tay-




*Fig.* 6.—Showing Characteristics of Bark of the two Common Oaks of Bluegrass Kentucky. A., Chinquepin Oak (*Quercus muhlenbergii*); B., Bur Oak (*Q. macrocarpa*). Photographed by H. Garman.

lor, Todd, Trigg, Trimble, Union, Warren, Washington, Wayne, Webster, Whitley, Wolfe.

**Post Oak** (*Quercus stellata*).—A small oak with a leaf bearing a general resemblance to that of the bur oak, but with a rough upper surface. Very common in some of the southern counties. The acorn is small and the cup without fringe.

Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Breckinridge, Bullitt, Butler, Caldwell, Casey, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fleming, Floyd, Fulton, Gallatin, Garrard, Graves, Green, Hancock, Hardin, Hart, Henderson, Hickman, Johnson, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Livingston, Logan, Lyon, Madison, Marion, McCracken, McLean, Meade, Menifee, Metcalfe, Monroe, Montgomery, Morgan, Nelson, Nicholas, Ohio, Oldham (?), Owsley, Perry, Powell, Pulaski, Rockcastle, Rowan, Russell, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Wayne, Webster, Whitley.

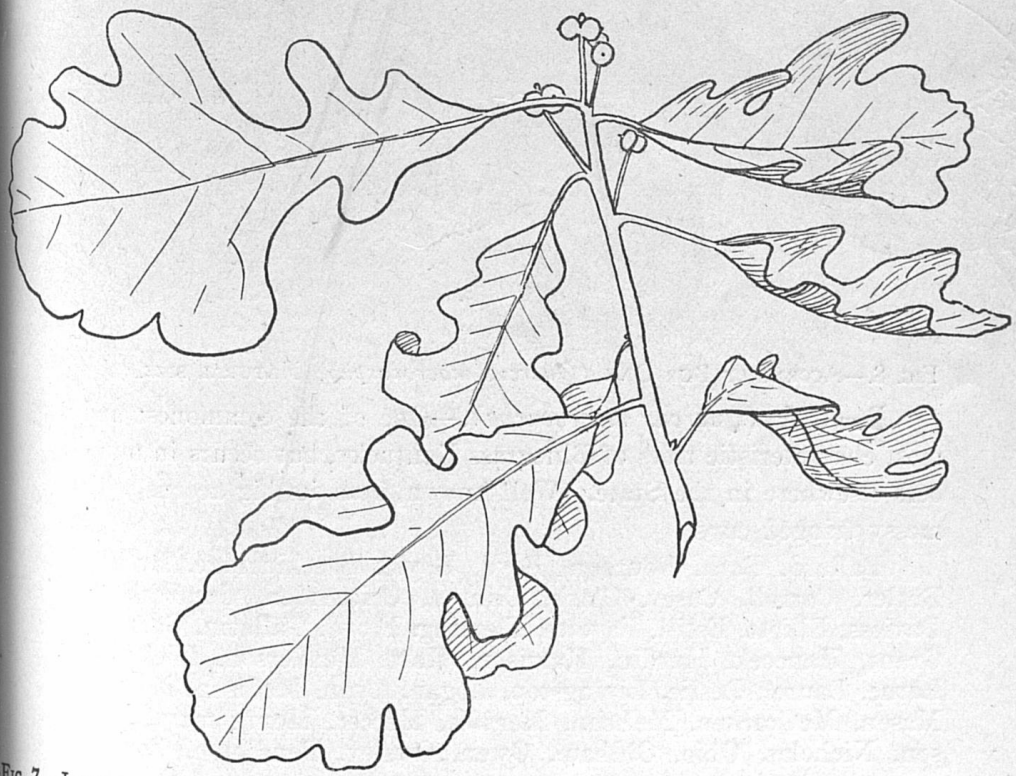


FIG. 7.—LEAVES AND YOUNG ACORNS OF THE BUR OAK (*Quercus macroacarpa*). NATURAL SIZE

**Overcup Oak** (*Quercus lyrata*).—Found only in swamps and thus somewhat local in distribution. The leaf bears a general resemblance to that of the bur oak. The cup often nearly encloses the acorn.

Gallatin, Graves, Greenup, McCracken.

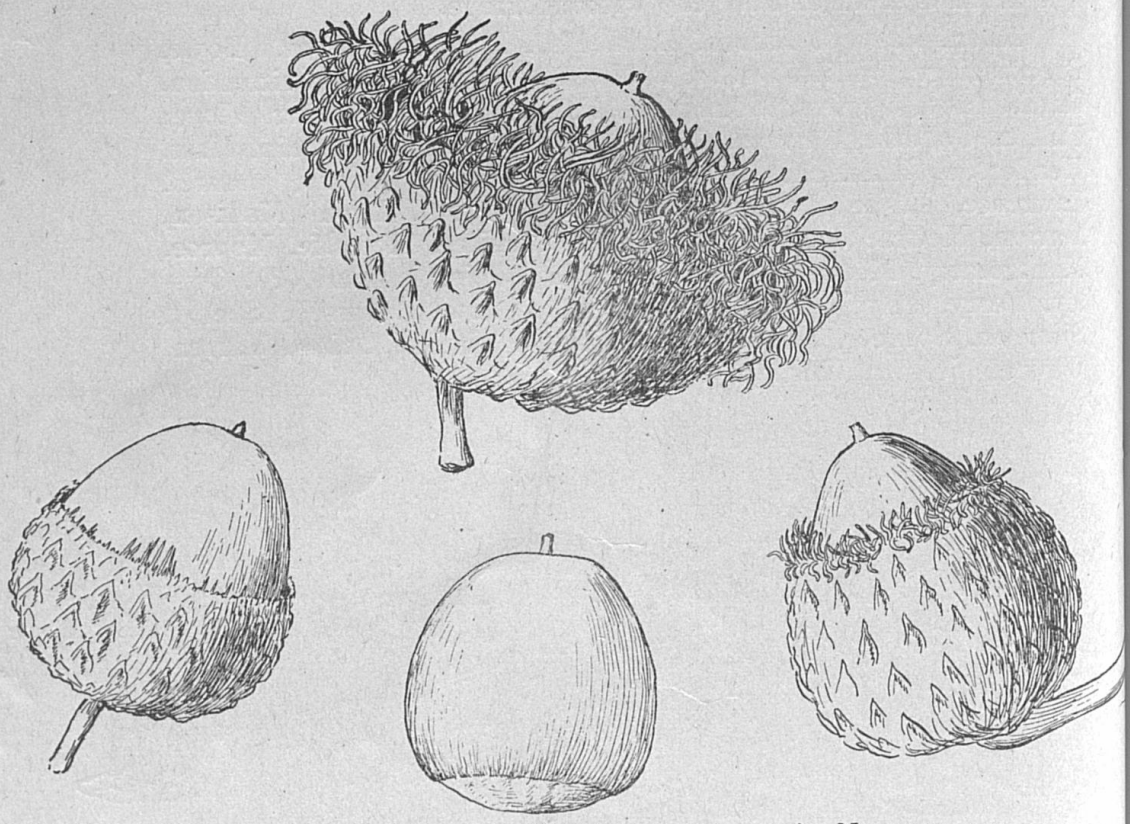


FIG. 8.—ACORNS OF BUR OAK (*Quercus macrocarpa*). NATURAL SIZE.

**Bur Oak** (*Quercus macrocarpa*).—One of the commonest and most characteristic trees of Bluegrass Kentucky, but occurs in numbers elsewhere in the State. Well known from its big acorns with mossy fringed cups.

Ballard, Bath, Bourbon, Boyd, Boyle, Breckinridge, Bullitt, Butler, Carroll, Casey, Clark, Clinton, Crittenden, Cumberland, Daviess, Elliott, Estill, Fayette, Fleming, Floyd, Gallatin, Garrard, Grant, Hancock, Hardin, Harrison, Hart, Henderson, Hickman, Larue, Laurel, Leslie, Livingston, Logan, Lyon, Madison, Marion, Mason, McCracken, McLean, Menifee, Mercer, Montgomery, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Powell,

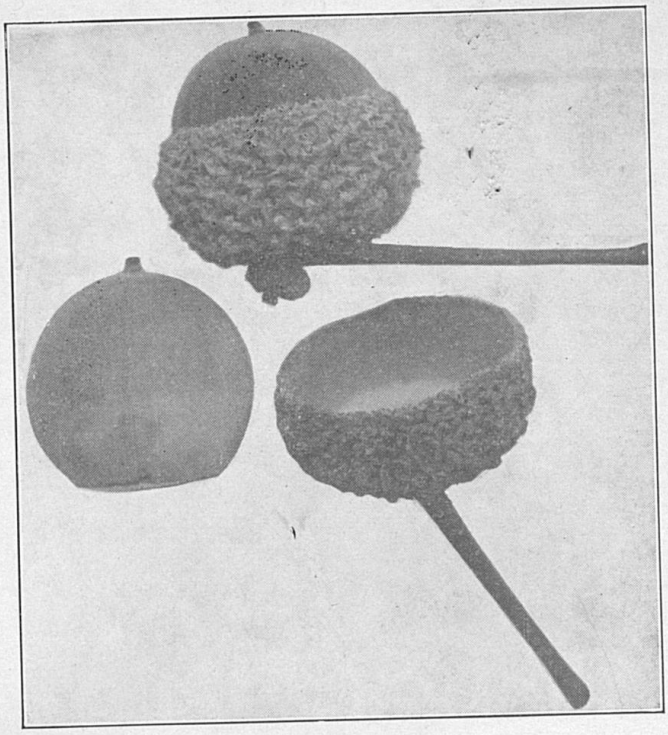


FIG. 9.

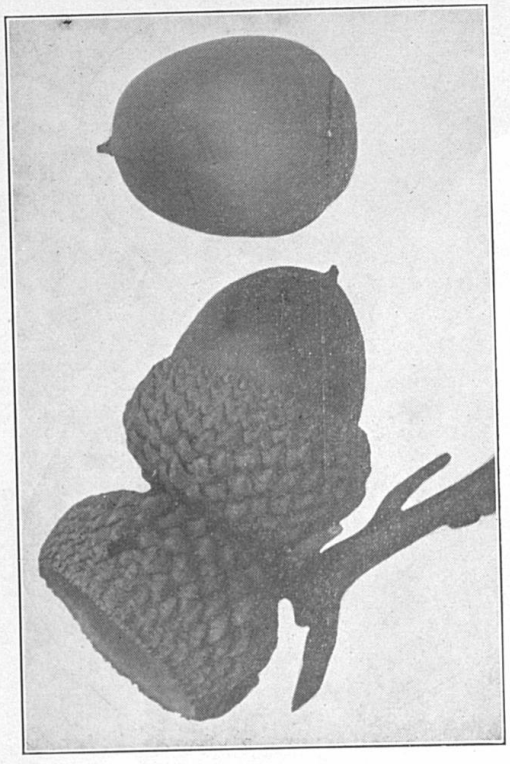


FIG. 10.

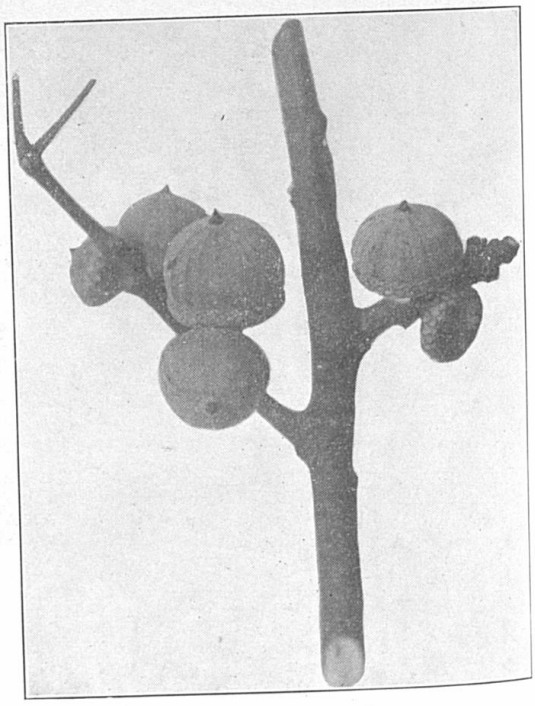


FIG. 11.

FIG. 9.—ACORNS OF SWAMP WHITE OAK (*Quercus bicolor*). FIG. 10.—ACORNS OF BASKET OAK (*Q. michauxii*). FIG. 11.—ACORNS OF PIN OAK (*Q. palustris*). ALL OF NATURAL SIZE.

Pulaski, Robertson, Scott, Shelby, Simpson, Spencer, Taylor, Trimble, Union, Warren, Wayne, Webster, Woodford.

**Swamp White Oak** (*Quercus bicolor*).—A large swamp-frequenting tree, with whitish gray bark somewhat like that of the common white oak. The leaf is, however, more like that of the chestnut oak, being oval in general form, rather coarsely scalloped or toothed, the projections round. The acorn has a long stem which is attached obliquely. Noted as very common and large at Nortonville, September 12, 1899, where it was associated with *Q. palustris* and *Q. michauxii.*

Adair, Crittenden, Daviess, Fulton, Gallatin, Hickman, Hopkins, Livingston, Lyon, McCracken, McLean, Muhlenberg, Ohio, Simpson, Taylor, Trigg, Union, Warren, Wayne, Webster, Whitley.

**Cow Oak, Basket Oak** (*Quercus michauxii*).—A large tree, common locally on low ground. Acorns large, with wide, shallow cup. Common in 1895 about Nortonville, trees two and one-half feet thru and sixty to seventy feet high being observed.

Hopkins, Warren.

**Chinquepin Oak** (*Quercus muhlenbergii*).—A common oak in Bluegrass Kentucky. The leaves are more like those of the chestnut than are those of the next species. The acorns are much smaller.

Adair, Allen, Barren, Bath, Bourbon, Boyd, Boyle, Breckinridge, Butler, Campbell, Carroll, Casey, Clark, Clinton, Daviess, Edmonson, Fayette, Franklin, Gallatin, Garrard, Green, Hancock, Hardin, Harrison, Hart, Hickman, Jessamine, Kenton, Knott, Larue, Laurel, Leslie, Letcher, Livingston, Logan, Lyon, Madison, Martin, McLean, Mercer, Metcalfe, Nelson, Ohio, Oldham, Owen, Owsley, Perry, Pike, Powell, Robertson, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Trigg, Trimble, Union, Warren, Wayne, Whitley, Woodford.

**Chestnut Oak** (*Quercus prinus*).—Frequent on ridges and hill-tops, especially common in Rockcastle and Whitley and again in Edmonson County.

Adair, Bath, Boyd, Boyle, Breckinridge, Bullitt, Butler, Campbell, Casey, Clinton, Crittenden, Cumberland, Edmonson, Elliott, Estill, Fleming, Floyd, Gallatin, Garrard, Grayson, Hancock, Hart,

Henderson, Hickman, Jefferson, Johnson, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Madison, Marion, Martin, Meade, Menifee, Metcalfe, Monroe, Montgomery, Morgan, Nelson, Oldham, Ohio, Owsley, Perry, Pike, Powell, Pulaski, Rockcastle, Rowan, Russell, Taylor, Trigg, Wayne, Whitley, Wolfe.

**Red Oak** (*Quercus rubra*).—A well known Kentucky tree, but not now as common as are several other oaks, probably because it is preferred by the lumbermen.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Christian, Clark, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fayette, Fleming, Floyd, Fulton, Gallatin, Garrard, Grant, Grayson, Graves, Green, Hancock, Hardin, Harrison, Hart, Henderson, Henry, Hickman, Jefferson, Jessamine, Johnson, Kenton, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Marion, Marshall, Martin, Mason, McCracken, McLean, Meade, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Muhlenberg, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rockcastle, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Washington, Wayne, Webster, Whitley.

**Swamp or Pin Oak** (*Quercus palustris*).—Occurs only in swamps where it is associated with a few other water-loving species of the same genus. The leaves are deeply cut into narrow, toothed divisions, about five in number. The acorn is small, the cup somewhat smooth, wide and shallow.

Gallatin, Henderson, Lyon, McCracken, McLean, Muhlenberg, Ohio, Webster.

**Scarlet Oak** (*Quercus coccinea*).—Observed on ridges and hills commonly.

Bath, Boyd, Christian, Edmonson, Fleming, Gallatin, Hopkins, Jessamine, Logan, Oldham, Pulaski, Rockcastle, Todd, Whitley.

**Texas Red Oak** (*Quercus texana*).—

Fayette, Warren, and doubtless other counties.

**Black Oak** (*Quercus velutina*).—A common tree, with dusky bark and coarse large leaves.

Allen, Adair, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Clinton, Crittenden, Cumberland, Daviess, Elliott, Estill, Fulton, Gallatin, Garrard, Grant, Graves, Grayson, Green, Hancock, Hardin, Hart, Henderson, Hickman, Jefferson, Jessamine, Johnson, Knott, Knox, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Marion, Mason, McCracken, McLean, Meade, Menifee, Mercer, Metcalfe, Monroe, Morgan, Muhlenberg, Nelson, Nicholas, Ohio, Oldham, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rowan, Russell, Scott, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Washington, Wayne, Webster, Whitley, Wolfe.

**Spanish Oak** (*Quercus falcata*).—This is one of the most characteristic oaks of the southern counties, but extends northward on the west to the Ohio River. The foliage is very variable with age of tree and location.

Allen, Ballard, Bell, Boyle, Butler, Caldwell, Casey, Clinton, Crittenden, Cumberland, Daviess, Graves, Green, Hardin, Hart, Henderson, Hickman, Larue, Laurel, Lawrence, Leslie, Letcher, Livingston, Logan, Lyon, Marshall, McCracken, McLean, Monroe, Muhlenberg, Ohio, Oldham, Owsley, Perry, Pulaski, Rowan, Russell, Taylor, Todd, Trigg, Warren, Wayne, Webster, Whitley.

**Bear Oak** (*Quercus ilicifolia*).—
Kentucky (Gray's Manual); also DeFriese.

**Water Oak** (*Quercus nigra*).—
Kentucky (Gray's Manual).

**Black Jack Oak** (*Quercus marilandica*).—A small tree, common especially on poor soils of Southwestern Kentucky.

Adair, Allen, Ballard, Barren, Bath, Boyd, Boyle, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Casey, Christian, Clinton, Crittenden, Cumberland, Elliott, Estill, Fleming, Fulton, Garrard, Graves, Green, Hardin, Hart, Henderson, Hickman, Johnson, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Marion, Martin, Meade, McCracken, McLean, Menifee, Metcalfe, Monroe, Montgomery, Nelson, Nicholas, Ohio, Owsley, Perry, Pike, Powell, Pu-

laski, Robertson, Rowan, Russell, Shelby, Simpson, Taylor, Todd, Trigg, Union, Warren, Wayne, Webster, Wolfe.

**Laurel Oak** (*Quercus imbricaria*).—This small oak is one of the handsomest occurring in the State. It was noted in November, 1895, as extremely common in Logan County.

Christian, Fayette, Gallatin, Hardin, Hart, Jessamine, Kenton, Lewis, Livingston, Logan, Madison, Marshall, Meade, Monroe, Nelson, Taylor, Todd.

**Willow Oak** (*Quercus phellos*).—This singular oak is common only in the southern tier of counties, where it often reaches a large size. Examples have been noted in Whitley County two feet thru and seventy-five feet in height. It is generally found on flat and rather wet land.

Ballard, Christian, Clinton, Daviess, Fleming, Fulton, Gallatin, Graves, Hart, Hickman, Knox, Laurel, Lincoln, Monroe, Todd, Trigg, Wayne, Webster, Whitley.

## Elm Family (*Urticaceae*).

**Slippery Elm** (*Ulmus fulva*).—A common tree, sometimes seen on lawns and in parks.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breckinridge, Butler, Caldwell, Campbell, Carroll, Casey, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fleming, Floyd, Franklin, Fulton, Gallatin, Garrard, Grant, Grayson, Green, Greenup, Hancock, Hardin, Harrison, Hart, Henderson, Hickman, Jefferson, Jessamine, Johnson, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Marion, Martin, McCracken, McLean, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Muhlenberg, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rockcastle, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Washington, Wayne, Webster, Whitley, Wolfe, Woodford.

**White Elm** (*Ulmus americana*).—Our most beautiful elm; equals in beauty of form any tree planted in this country. A common Kentucky tree. In bloom March 31, 1895, at Lexington. Seeds ripe May 4, of same year.

Adair, Ballard, Barren, Bath, Bourbon, Boyd, Boyle, Breckinridge, Campbell, Carroll, Casey, Christian, Clinton, Cumberland. Daviess, Estill, Fayette, Floyd, Franklin, Fulton, Edmonson, Gallatin, Garrard, Grant, Green, Hardin, Harrison, Henderson, Hickman, Jessamine, Kenton, Knott, Leslie, Lewis, Livingston, Lyon, McCracken, McLean, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Muhlenberg, Nelson, Nicholas, Ohio, Oldham, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Trigg, Union, Webster, Woodford.

**Cork or Rock Elm** (*Ulmus racemosa*).—Not a common tree in Kentucky at present. I have seen more of it along cliffs on Kentucky River than elsewhere in the State. It can be recognized by the irregular corky growths of the branches, and its glossy many-veined leaves of medium or rather large size.

Bell, Fayette, Gallatin, Jessamine.

**Ulmus serotina.**—Rockcastle County, along Roundstone Creek, October 9, 1895, a tree presumed to be this, sixty feet high and fifteen inches in diameter of trunk. Twigs corky.

**Winged Elm** (*Ulmus alata*).—A small tree, common in southern and western counties. Easily recognized by the flat corky ridges, often one on each side of a twig. Leaves small.

Bell, Boyle, Breckinridge, Casey, Campbell, Christian, Clinton, Edmonson, Hart, Hickman (common), Logan, McCracken, Muhlenberg, Nelson, Ohio, Perry, Rockcastle, Spencer, Todd, Wayne, Whitley.

**Water Elm** (*Planera aquatica*).—This is a small tree, occurring in swamps. The leaves somewhat resembling those of the elms, are very small.

Boyle and Mercer (Linney). Webster.

**Hackberry** (*Celtis occidentalis*).—A common tree thruout Kentucky. The variety *crassifolia* is the prevailing form in Bluegrass Kentucky.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey,

Clark, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Estill. Fayette, Fleming, Franklin, Gallatin, Garrard, Grant, Green, Hancock, Hardin, Harrison, Hart, Henderson, Hickman, Jefferson. Jessamine, Johnson, Kenton, Knott, Larue, Lawrence, Leslie, Letcher, Lincoln, Livingston, Logan, Lyon, Madison, Mason, McCracken, McLean, Menifee, Mercer, Monroe, Montgomery, Morgan, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Rockcastle, Russell, Scott, Shelby, Simpson, Spencer, Trigg, Trimble, Union, Washington, Wayne, Webster, Woodford.

**Dwarf Hackberry** (*Celtis georgiana*).—A shrub three to four feet high. Leaves entire, one-sided. Berries about 0.25 inch in diameter and 0.28 inch in length. Rocky soil in Nelson County. June 29, 1898.

**Mississippi Hackberry** (*Celtis mississippiensis*).—Easily recognized by its narrow, smooth, entire leaves. Common only along the Mississippi River in the western part of the State, but collected by me recently along Benson Creek in Franklin County, showing that it may by close collecting be encountered along streams thruout much of the State.

Franklin, Fulton, Hickman.

**Red Mulberry** (*Morus rubra*).—The tree is moderately common in Kentucky, but generally occurs singly or a few in a place, never constituting any large proportion of the woody growth.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd Boyle, Bracken, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Clark, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fleming, Floyd, Franklin, Fulton, Garrard, Grant, Green, Hancock, Hardin, Harrison, Hart, Henderson, Hickman, Jessamine, Johnson, Kenton, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Martin, Mason, McCracken, McLean, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Powell, Pulaski, Robertson, Rockcastle, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trimble, Union, Warren, Washington, Wayne, Webster, Whitley, Wolfe, Woodford.

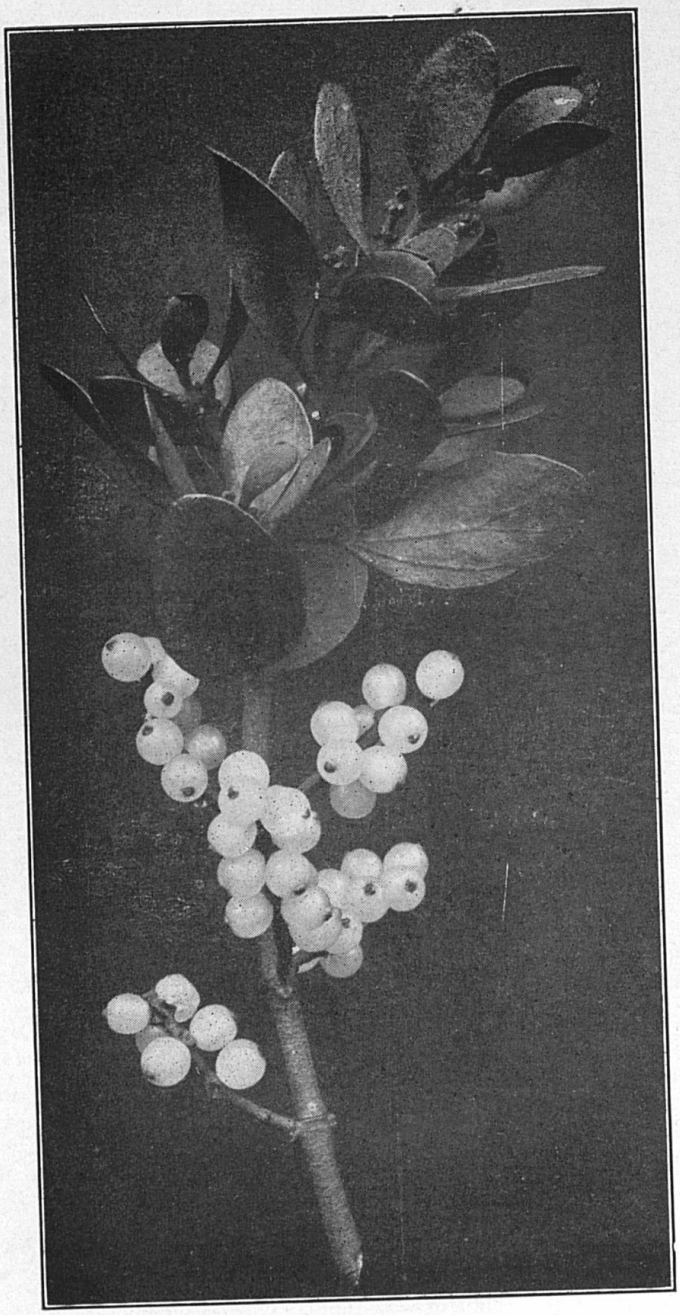


FIG. 12.—MISTLETOE (*Phoradendron flavescens*).
NATURAL SIZE.

## Sandalwood Family (*Santalaceae*).

**Oil Nut** (*Pyrularia pubera*).—A straggling shrub occasionally seen among undergrowth in mountain forests.

Bell, Harlan, Powell.

## Mistletoe Family (*Loranthaceae*).

**Mistletoe** (*Phoradendron flavescens*).—A very common plant parasite in most of the State. In Bluegrass Kentucky largely restricted to black walnut, but occurring less often on black locust, American elm and other trees. In Western Kentucky it is not so closely confined to walnut. Exceptionally severe winters sometimes destroy much of it, but it gradually reappears and becomes common again. The fine green foliage and handsome translucent berries render it a favorite for Christmas decorations, and it is often seen in quantities in our market.

The common blue bird (*Sialia sialis*) seems to be an important agent in its dissemination. The greater part of the food of this bird consists at times in midwinter of mistletoe berries. The mucilaginous substance surrounding the seeds no doubt adheres to its beak and is rubbed off on twigs and branches where on drying it fastens some of the seeds down securely.

Ballard, Boyle, Fayette, Franklin, Hancock, Jefferson, Johnson, Mercer, McCracken (frequent on black gum), Nelson, Todd, Woodford.

## Birthwort Family (*Aristolochiaceae*).

**Dutchman's Pipe** (*Aristolochia macrophylla*).—A trailing, shrubby plant.

Greenup, Warren.

**Aristolochia tomentosa.**—A trailing shrub or vine.

Warren (Miss Price).

## Crowfoot Family (*Ranunculaceae*).

**Clematis** (*Clematis virginiana*).—A vine, commonly clambering over shrubby growths.

Bell, Boyle, Fayette, Harlan, Hopkins, Lawrence, Mercer, Warren.

**Leather Flower** (*Clematis viorna*).—A vine.
Fayette, Warren.

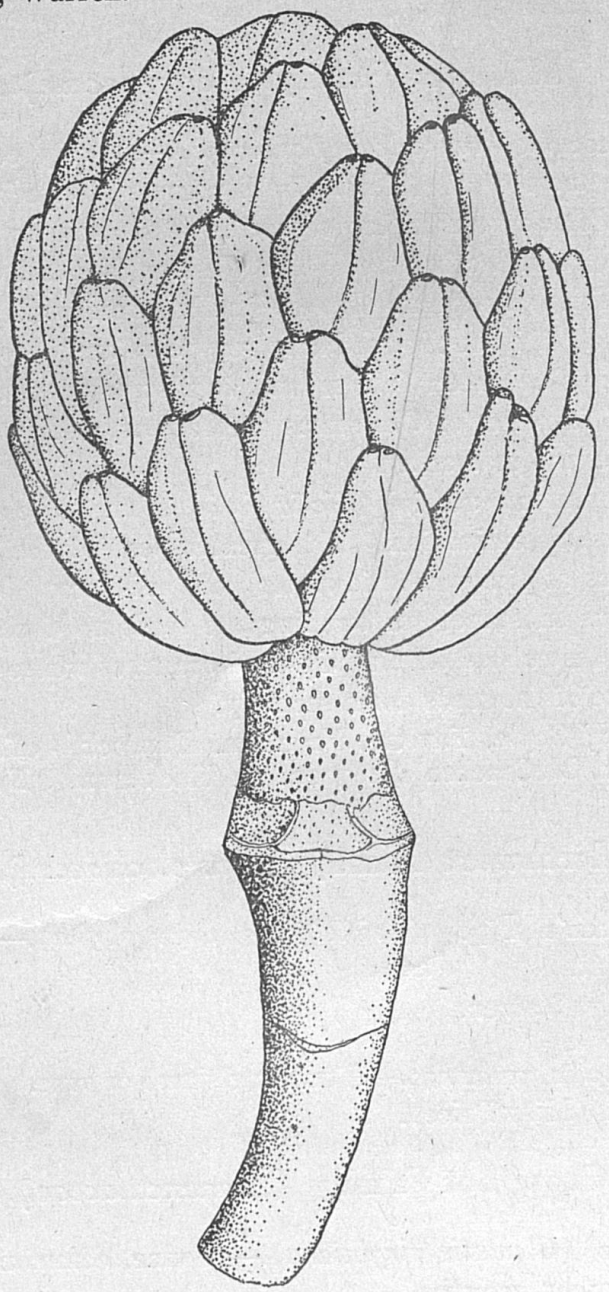


FIG. 13.—FRUIT OF GREAT-LEAVED MAGNOLIA (*Magnolia macrophylla*). NATURAL SIZE.

## Magnolia Family (*Magnoliaceae*).

**Cucumber Tree** (*Magnolia acuminata*).—A large tree, sixty to eighty feet high, occurring thruout the State from eastern to western boundaries. Leaves small relatively to those of the next two species, measuring in a specimen before me eleven and a half inches long by seven inches wide; shape, oval. The flower also is small, the petals one and a half to two inches long.

Bell, Boyle, Edmonson, Mercer, Powell, Rockcastle, Warren. Whitley.

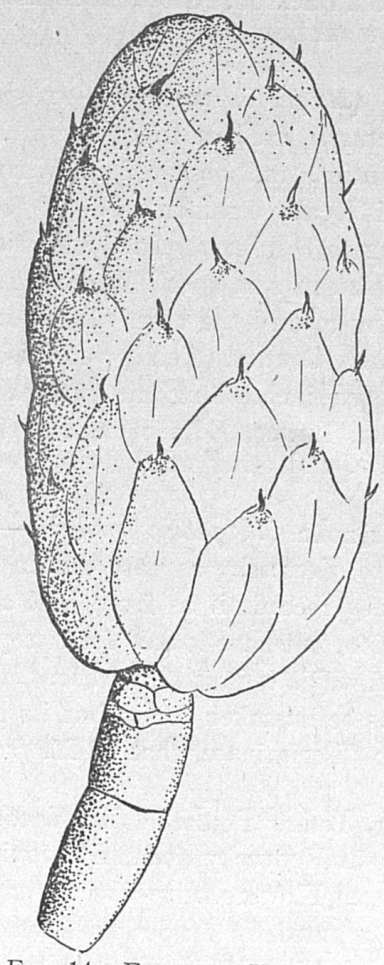


FIG. 14.—FRUIT OF UMBRELLA TREE (*Magnolia tripetala*). NATURAL SIZE.

**Great-leaved Magnolia, Elkwood** (*Magnolia macrophylla*).—A small tree of somewhat straggling growth, with fine large white flowers and globular fruit. Common in mountain counties, and observed by me on one occasion west of Mammoth Cave. The leaves are very large, sometimes measuring in fresh specimens twenty-four inches long by fifteen wide, the greatest width being beyond the middle, the base contracting to a small auricle. Bright green above, decidedly glaucous whitish beneath. Very common along Troublesome Creek.

Bell, Edmonson, Jackson, Knott, Rockcastle, Powell, Whitley, Wolfe, and other mountain counties.

**Umbrella Tree** (*Magnolia tripetala*).—A small tree with large, crowded leaves, actually used at times as umbrellas. Common in the mountain counties, and observed in Warren and Edmonson counties, where it is locally common. 10—20 feet high. Leaves are lanceolate, tapering to both extremities and without auricles. Examples measure thirteen and a half by six and a half inches, the greatest width being toward the base. In bloom May 26, 1895, at Jackson in Breathitt County. Petals yellowish, creamy white, or faintly rose-color; five inches long and two inches wide.

Bell, Breathitt, Butler, Edmonson, Powell, Rockcastle, Warren, Whitley, Wolfe, and other neighboring counties.

**Ear-leaved Magnolia** (*Magnolia fraseri*).—This tree is frequently credited to Kentucky as observed in the eastern part of the State. Kearney records it as from Bell and Harlan. I have seen it in cultivation, but have looked for it repeatedly without success in localities in which it is said to occur. *M. macrophylla* might in some conditions be mistaken for it, but its globular fruit should enable any one to discriminate, that of *M. fraseri* being elongate.

**Tulip Poplar, Yellow Poplar** (*Liriodendron tulipifera*).—A common tree thruout Kentucky, formerly providing large quantities of valuable lumber. Flowers tulip-like, green and orange. Ornamental, and well adapted for shade and lawn purposes. A magnificent forest tree, the trunk sometimes with a diameter of six or seven feet. The "State Tree."

Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Breathitt, Christian, Daviess, Edmonson, Estill, Fayette, Floyd, Fulton, Gallatin, Garrard, Graves, Grayson, Green, Greenup, Hardin, Hickman, Hopkins, Jefferson, Jessamine, Lincoln, Livingston, Mason, Menifee, Mercer, Monroe, Morgan, Muhlenberg, Ohio, Powell, Rockcastle, Scott, Trigg, Webster, Whitley, Wolfe, Woodford.

## Calycanthus Family (*Calycanthaceae*).

**Carolina Allspice** (*Calycanthus floridus*).—A shrub with fragrant flowers.

Bell and Harlan counties (Kearney).

## Custard-apple Family (*Anonaceae*).

**Papaw** (*Asimina triloba*).—Occurs thruout Kentucky. Common.

Ballard, Bell, Boyd, Boyle, Breckinridge, Daviess, Edmonson, Fayette, Fleming, Gallatin, Grayson, Greenup, Jessamine, Lincoln, Mason, Mercer, Powell, Rockcastle, Whitley, Woodford.

## Moonseed Family (*Menispermaceae*).

**Cocculus carolinus.**—A vine.

Christian, Jefferson.

**Moonseed** (*Menispermum canadense*).—A vine.

Bell, Boyd, Fayette.

**Cupseed** (*Calycocarpum lyoni*).—An extensive vine.

## Laurel Family (*Lauraceae*).

**Sassafras** (*Sassafras variifolium*).—A common tree everywhere in Kentucky. Young growth is troublesome at times because of its persistence in orchards and pastures.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breathitt, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Casey, Christian, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fleming, Floyd, Fulton, Gallatin, Garrard, Grant, Graves, Grayson, Green, Hancock, Hardin,

Harrison, Hart, Henderson, Hickman, Jessamine, Johnson, Kenton, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Marion, Martin, Mason, McCracken, McLean, Meade, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rockcastle, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Washington, Wayne, Webster, Whitley, Wolfe, Woodford.

**Spice Bush** (*Benzoin aestivale*).—A moderately common shrub, the bark with an aromatic spicy flavor.

Adair, Allen, Bath, Boyd, Boyle, Breckinridge, Butler, Campbell, Carroll, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fleming, Floyd, Fulton, Gallatin, Garrard, Grant, Green, Hancock, Hardin, Hart, Henderson, Hickman, Jessamine, Johnson, Kenton, Knott, Larue, Laurel, Letcher, Lincoln, Livingston, Madison, McLean, Metcalfe, Monroe, Morgan, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rowan, Russell, Shelby, Simpson, Spencer, Todd, Trigg, Union, Wayne, Webster, Whitley, Wolfe, Woodford.

**Benzoin melissaefolium.—**
Boyle and Mercer (Linney).

## Saxifrage Family (*Saxifragaceae*).

**Wild Hydrangea** (*Hydrangea arborescens*).—A small shrub, common in rocky ground in the mountains and along streams elsewhere.

Bell, Edmonson, Fayette, Jessamine, Lincoln, Nelson, Warren, Woodford.

**Wild Gooseberry** (*Ribes cynosbati*).—Not common.

Brooklyn Bridge, Jessamine County; ravines along Kentucky River. Boyle and Mercer counties (Linney).

**Wild Gooseberry** (*Ribes gracile*).—Not common, but apparently the commonest of the Kentucky species.

Fayette, Franklin, Hardin.



FIG. 15.—BLOSSOMS OF THE SWEET GUM (*Liquidambar styraciflua*).
REDUCED ONE-SIXTH.

**? Wild Gooseberry** (*Ribes rotundifolium*).—Included on the authority of Linney. I have not recognized it. Gattinger reports it from the summits of Roane and Smoky Mountains in Tennessee.

**Wild Black Currant** (*Ribes floridum*).—Short and Peter's list. It is a common plant in damp woods northward. I have not seen it here. Should be looked for in Western Kentucky.

## Witch Hazel Family (*Hamamelidaceae*).

**Witch Hazel** (*Hamamelis virginiana*).—A rather common tree of small size growing along banks of streams and in openings of woods.

Adair, Allen, Ballard, Bath, Bell, Boyd, Carter, Edmonson, Elliott, Estill, Fayette, Floyd, Franklin, Gallatin, Garrard, Green, Hart, Jessamine, Johnson, Knott, Leslie, Letcher, Lincoln, Livingston, McLean, Metcalfe, Monroe, Morgan, Ohio, Oldham, Owsley, Perry, Powell, Rockcastle, Rowan, Russell, Warren, Whitley, Wolfe, Woodford.

**Sweet Gum** (*Liquidambar styraciflua*).—One of our handsomest trees, the fine star-shaped leaves coloring agreeably in the fall. Occurs thruout the State, but partial to rather damp soil, and hence generally seen along streams in Eastern Kentucky. In the west it sometimes constitutes a large proportion of the woody growth on wet flats.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyle, Bracken, Breathitt, Breckinridge, Butler, Caldwell, Campbell, Carroll, Casey, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fleming, Floyd, Fulton, Gallatin, Garrard, Graves, Green, Hancock, Hart, Henderson, Hickman, Hopkins, Jessamine, Knott, Knox, Laurel, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Marion, McCracken, McLean, Metcalfe, Monroe, Montgomery, Morgan, Muhlenberg, Nelson, Nicholas, Ohio, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rowan, Russell, Simpson, Spencer, Taylor, Todd, Trigg, Union, Warren, Wayne, Webster, Whitley.

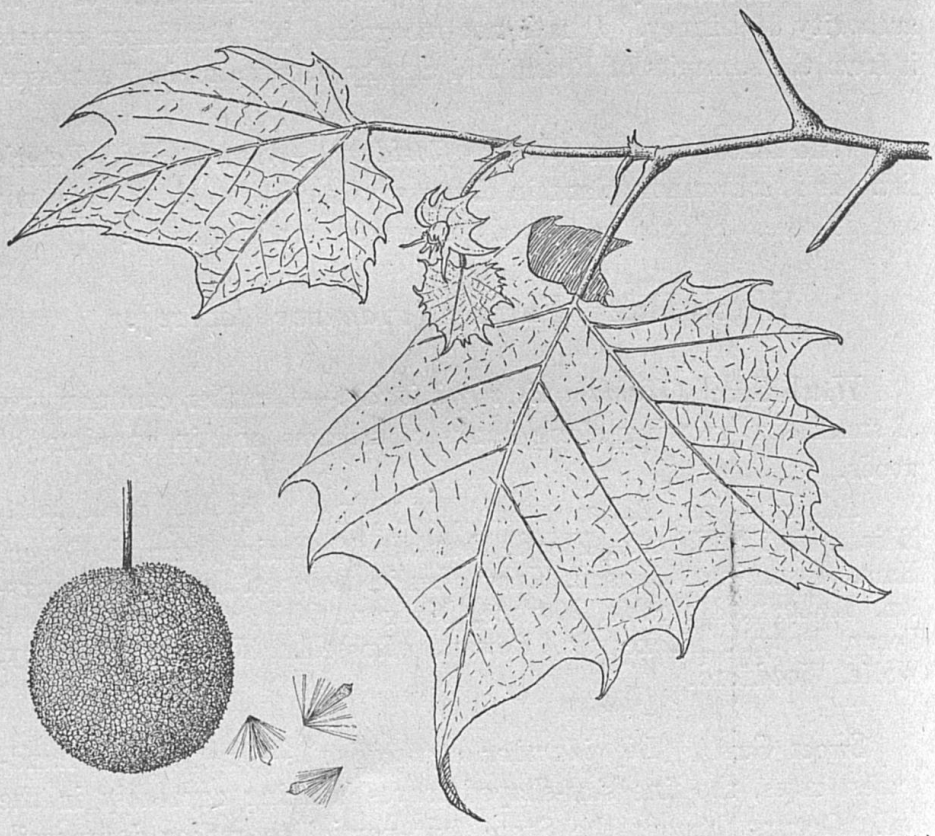


FIG. 16.—LEAVES, SEEDS AND SEED-BALL OF SYCAMORE (*Platanus occidentalis*). REDUCED.

## Plane Tree Family (*Platanaceae*).

**Sycamore** (*Platanus occidentalis*).—Common along streams, but able to maintain itself almost anywhere. A magnificent tree, with fine white branches when the outer bark exfoliates.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breathitt, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Christian, Clark, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fayette, Fleming, Floyd, Franklin, Fulton, Gallatin, Garrard, Grant, Graves, Grayson, Green, Hancock, Hardin, Harrison, Hart, Henderson, Hickman, Hopkins, Jessamine, Johnson, Kenton, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Marion, Martin, Mason, McCracken, McLean, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan,

Muhlenberg, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rockcastle, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Washington, Wayne, Webster, Whitley, Wolfe, Woodford.

## Rose Family (*Rosaceae*).

**Nine-bark** (*Physocarpus opulifolius*).—A shrub.
Jessamine, Warren. Boyle and Mercer (Linney).

**Spiraea corymbosa.**—A shrub. Short and Peter. Hussey.

**Spiraea salicifolia.**—A shrub. Short and Peter.

**Spiraea tomentosa.**—A shrub.
Edmonson, Todd, Warren.

**Narrow-leaved Crabapple** (*Pyrus angustifolia*).—A small tree, not uncommon in Western Kentucky. The abundant rose-colored blossoms make it, with the next, a desirable plant for parks and lawns.

Fayette, Fulton, Henderson, Muhlenberg, Todd, Trigg, Webster.

**Common Crabapple** (*Pyrus coronaria*).—Widely distributed. A fine tree ten feet high was observed October 12, 1895, at Livingston in Rockcastle County. It is not as common as the preceding.

**Red Chokeberry** (*Pyrus arbutifolia*).—A shrub.
Bell and Harlan (Kearney); Warren (Miss Price).

**Black Chokeberry** (*Pyrus melanocarpa*).—Kentucky (Miss Price).

**? Mountain Ash** (*Pyrus americana*).—Frequent in cultivation. Credited to Kentucky by Linney. I have not seen it growing wild in the State. It is a common tree north.

**Service Berry** (*Amelanchier canadensis*).—Frequent and widely distributed. A shrub or small tree.

Adair, Ballard, Barren, Bath, Boyd, Boyle, Breckinridge, Butler, Caldwell, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Estill, Gallatin, Garrard, Green, Hancock, Hart, Hickman, Johnson, Knott, Knox, Laurel, Lawrence Letcher, Lincoln, Livingston, Lyon, Madison, McCracken, McLean, Menifee, Monroe, Morgan, Nelson, Ohio, Owen, Owsley, Pendleton, Perry, Pike, Powell, Rowan, Russell, Spencer, Taylor, Trigg, Trimble, Warren, Woodford.

**Amelanchier oblongifolia.**—Have not seen this species. Kentucky (Linney and DeFriese).

**Red Haw** (*Crataegus crus-galli*).—
Bell, Boyle, Gallatin, Rockcastle, Warren.

**? Red Haw** (*Crataegus coccinea*).—
Caldwell, Harlan, Warren. Bell (Kearney).

**Red Haw** (*Crataegus tomentosa*).—Kentucky (Gray's Manual).

**Red Haw** (*Crataegus polita*).—Lexington, Kentucky.

**Red Haw** (*Crataegus mollis*).—Mason.

**Red Haw** (*Crataegus phaenopyrum*).—Crittenden, Todd.

**Red Haw** ( *Crataegus chapmani*).—S. Kentucky, frequent (Gray).

**Black Raspberry** (*Rubus occidentalis*).—Frequent on banks along streams and elsewhere.

Christian, Edmonson, Fayette, Franklin, Whitley, Warren, Woodford.

**Purple Flowering Raspberry** (*Rubus odoratus*).—Frequent in the eastern part of the State and in hilly regions westward.

Bell, Franklin, Harlan.

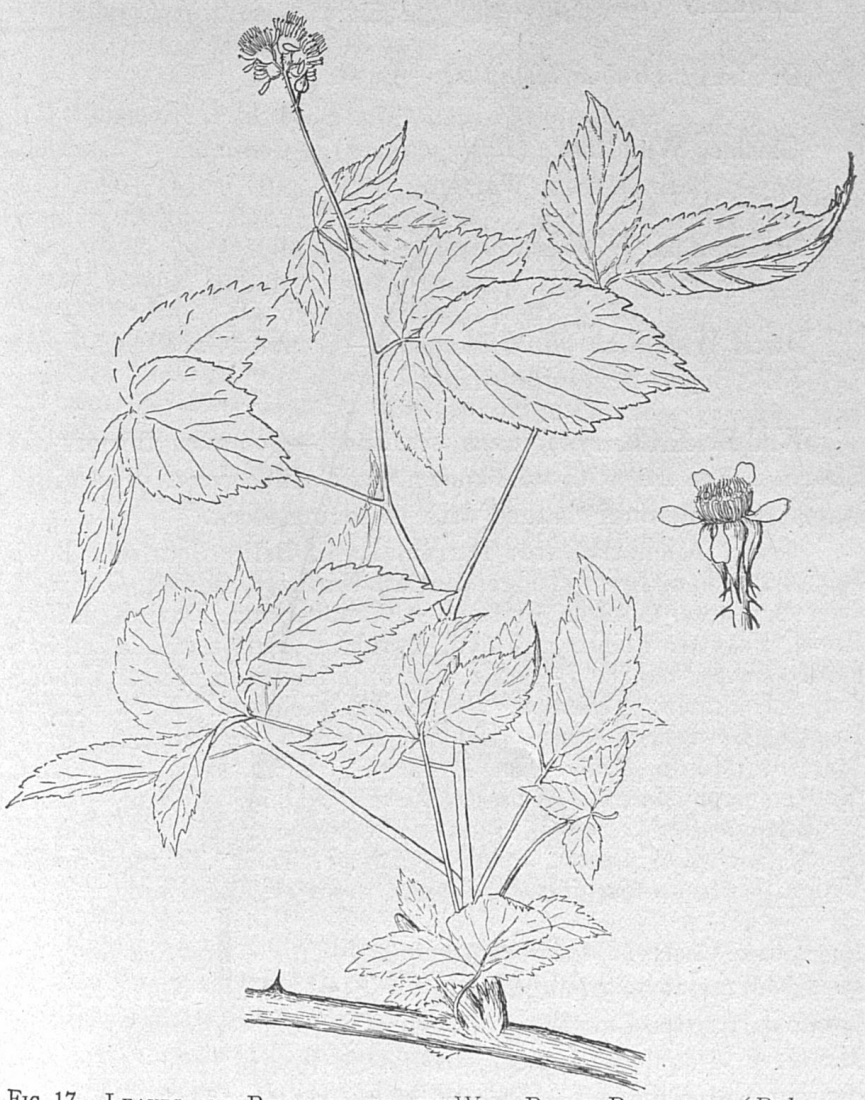


FIG. 17.—LEAVES AND BLOSSOMS OF THE WILD BLACK RASPBERRY (*Rubus occidentalis*).

**Mountain Blackberry** (*Rubus allegheniensis*).—Powell.

**Tall Southern Blackberry** (*Rubus andrewsianus*).—Apparently our common species, and distributed thruout most of the State.

Fayette, Laurel, Knox, Todd.

**Dewberry** (*Rubus procumbens*).—Bath.

**Dewberry** (*Rubus hispidus*).—Bath.

**Climbing Wild Rose** (*Rosa setigera*).—Common.
Boyle, Bath, Mason, Warren.

**Swamp Rose** (*Rosa carolina*).—Frequent.
Mason, Todd, Trigg, Warren.

**Dwarf Wild Rose** (*Rosa humilis*).—Common locally.
Bell, Boyle, Jessamine, Knox.

**Wild Black Cherry** (*Prunus serotina*).—Common thruout the State. A fine tree with well known black edible fruit. The wilted leaves are sometimes charged with poisoning stock.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breckinridge, Butler, Bullitt, Caldwell, Campbell, Carroll, Casey, Clinton, Crittenden, Cumberland, Daviess, Elliott, Estill, Fayette, Fleming, Floyd, Franklin, Fulton, Gallatin, Garrard, Graves, Green, Hancock, Hardin, Harrison, Hart, Henderson, Hickman, Jefferson, Jessamine, Johnson, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lincoln, Livingston, Logan, Madison, Mason, McCracken, McLean, Menifee, Metcalfe, Monroe, Montgomery, Morgan, Nelson, Nicholas, Ohio, Oldham, Owsley, Pendleton, Perry, Powell, Pulaski, Robertson, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Washington, Wayne, Whitley, Woodford.

**Choke Cherry** (*Prunus virginiana*).—This cherry has been observed by me at only one place in the State, on the North Elkhorn Creek in Fayette County. It is reported from Gallatin County by Mr. J. F. Donaldson. I should like to receive information concerning its occurrence elsewhere in the State. It is a common shrubby tree along the shores of Lake Michigan.

**Red or Bird Cherry** (*Prunus pennsylvanica*).—This is another nothern species which seems to have been noted by Professor Crandall and others in Eastern Kentucky. It is a small tree with small coral red berries. Should be pleased to know more about it as a Kentucky plant. Certainly not common.

**? Chickasaw Plum** (*Prunus angustifolia*).—
Boyle and Mercer (Linney).

**Common Wild Plum** (*Prunus americana*). — Frequent in thickets.

Adair, Allen, Ballard, Bath, Bourbon, Boyd, Bracken, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Christian, Clark, Crittenden, Daviess, Edmonson, Elliott, Estill, Fayette, Floyd, Fulton, Gallatin, Garrard, Grant, Green, Greenup, Hancock, Harrison, Hart, Henderson, Hickman, Hopkins, Jessamine, Johnson, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Mason, McCracken, McLean, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Nelson, Nicholas, Ohio, Oldham, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Warren, Washington, Wayne, Webster, Whitley, Wolfe, Woodford.

## Pulse Family (*Leguminosae*).

**Kentucky Coffee Tree** (*Gymnocladus dioica*).—A common tree in Kentucky, especially in the Bluegrass Region.

Ballard, Bath, Bourbon, Boyle, Breckinridge, Campbell, Crittenden, Cumberland, Daviess, Estill, Fayette, Franklin, Gallatin, Garrard, Green, Hancock, Harrison, Hart, Henderson, Hickman, Kenton, Leslie, Madison, Mason, Mercer, Metcalfe, Monroe, Ohio, Oldham, Owsley, Pendleton, Perry, Powell, Robertson, Scott, Shelby, Simpson, Spencer, Warren, Washington, Woodford.

**Honey Locust** (*Gleditschia triacanthos*).— Common everywhere. David Dale Owen says in one of his reports that thousands of these trees were destroyed by the early settlers in capturing coons, which were disposed to take refuge in them.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Christian, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Estill, Fayette, Fleming, Floyd, Franklin, Fulton, Gallatin, Garrard, Grant, Graves, Grayson, Green, Hancock, Hardin, Harrison, Hart, Henderson, Henry, Hickman, Hopkins, Jessamine, Johnson, Kenton, Knott, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Mason, McCracken, McLean, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Nelson, Nicholas, Ohio, Oldham, Owen.

Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rockcastle, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Washington, Warren, Wayne, Webster, Woodford.

**Water Locust** (*Gleditschia aquatica*).—A small tree, the thorns small, the pods small and one-seeded. Observed by me only on the Mississippi River in Fulton County.

**Red Bud** (*Cercis canadensis*).—One of our most abundant and characteristic trees. Notable especially in early spring before the leaves have expanded, from the profusion of its purple blossoms. Later, the foliage becomes handsome.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Breckinridge, Butler, Caldwell, Campbell, Carroll, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fayette, Fleming, Floyd, Franklin, Fulton, Gallatin, Garrard, Grant, Grayson, Green, Hancock, Hardin, Harrison, Hart, Henderson, Hickman, Jefferson, Jessamine, Johnson, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Mason, McCracken, McLean, Menifee, Mercer, Metcalfe, Monroe, Morgan, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Perry, Pike, Powell, Pulaski, Robertson, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Wayne, Webster, Whitley, Woodford.

**Yellowwood** (*Cladrastis lutea*).—One of our rarest and most attractive trees, well adapted for ornamental purposes. The white blossoms are produced in long, slender, pendent racemes. The heart wood is bright yellow, but fades when exposed to the light. I know of but one locality in the State where this tree can be called common, this is in Jessamine County in ravines along Kentucky River. On Hickman Creek near Little Hickman, I have seen some very good trees. At Brooklyn Bridge, southwest of Nicholasville, young trees are not uncommon. It has been reported to me by correspondents from several other localities, but I feel a little doubtful about the identification in some cases. Shall be pleased to receive specimens from other localities than that given above. Linney includes it in his list of Boyle and Mercer County plants. Correspondents from Estill County report this species as occurring in that section.

**False Indigo** (*Amorpha fruticosa*).—A shrub with abundant spikes of purple fragrant flowers. Common in cultivation. Reported by Miss Price as occurring in Warren County. Kentucky (Short and Peter).

Livingston County.

**Black Locust** (*Robinia pseudacacia*).—Everywhere common. The compact clusters of cream-white fragrant blossoms are a source of a good deal of bee forage.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Christian, Clark, Clinton, Crittenden, Cumberland, Daviess, Elliott, Estill, Fayette, Fleming, Floyd, Franklin, Fulton, Gallatin, Garrard, Grant, Graves, Green, Hancock, Hardin, Hart, Harrison, Henderson, Henry, Hickman, Jessamine, Johnson, Kenton, Knott, Knox, Laurel, Lawrence, Larue, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Marion, Martin, Mason, McCracken, McLean, Meade, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Washington, Webster, Whitley, Woodford.

**Wisteria** (*Wisteria frutescens*).—A woody vine with handsome purple flowers.

Adair, Barren, Boyle, Edmonson, Hancock, Hickman, Simpson, Taylor, Union, Warren.

**? Wisteria** (*Wisteria macrostachys*).—Reported from Missouri and Tennessee. Should be looked for in swamps of Western Kentucky.

## Rue Family (*Rutaceae*).

**Prickly Ash** (*Zanthoxylum americanum*).—A shrub. Rather rare, but widely distributed.

Edmonson, Nelson, Trigg.

**Hop Tree** (*Ptelea trifoliata*).—A shrub or small tree. Frequent, but scattered.

Edmonson, Franklin, Gallatin, Jessamine, Nelson, Oldham. Warren.

## Sumach Family (*Anacardiaceae*).

**Staghorn Sumach** (*Rhus typhina*).—A shrub or small tree to be distinguished by the hairy or downy twigs. Local and not very common, taking the State as a whole.

Campbell, Gallatin, Greenup, Lincoln.

**Smooth Sumach** (*Rhus glabra*).—Shrub or small tree, the twigs smooth. Widely distributed. More common than the preceding.

Barren, Bath, Bell (frequent), Christian, Edmonson, Fayette, Franklin, Gallatin, Greenup, Logan, Mason, Rockcastle, Trigg.

**Dwarf Sumach** (*Rhus copallina*).—Our commonest and most widely distributed species. Often producing extensive thickets. Easily known by the flat side extensions of the axis of the leaf.

Barren, Bell, Christian, Daviess, Edmonson, Franklin, Gallatin, Green, Greenup, Hopkins, Lincoln, Logan, Todd, Rockcastle, Warren, Whitley.

**? Poison Sumach** (*Rhus vernix*).—Shrub with 7-13 leaflets. Swamps. Hussey credits this to Kentucky in his list of Barren and Edmonson County plants. Gattinger credits it to Tennessee.

**Poison Ivy** (*Rhus toxicodendron*).—A common vine everywhere in Kentucky, with but three leaflets. The Virginia creeper (with five leaflets) is sometimes mistaken for poison ivy.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Breckinridge, Bullitt, Butler, Campbell, Carroll, Casey, Clinton, Crittenden, Cumberland, Daviess, Elliott, Estill, Fleming, Franklin, Fayette, Floyd, Fulton, Gallatin, Garrard, Grant, Graves, Green, Greenup, Hancock, Hardin, Harrison, Hart, Hickman, Jessamine, Johnson, Kenton, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Martin, Mason, Mc-

Cracken, McLean, Meade, Menifee, Mercer, Metcalfe, Monroe, Morgan, Nicholas, Ohio, Oldham, Owen, Owsley, Perry, Powell, Pulaski, Robertson, Rockcastle, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Washington, Wayne, Webster, Whitley, Wolfe, Woodford.

**Fragrant Sumach** (*Rhus canadensis*).—A common shrub growing along rocky banks and bluffs. Its red berries will enable any one to distinguish it from poison ivy and poison sumach. It has three leaflets.

Fayette, Franklin, Jessamine, Mercer, Warren.

## Holly Family (*Aquifoliaceae*).

**Holly** (*Ilex opaca*).—A beautiful tree with spiny evergreen leaves and red berries. Often gathered for Christmas decorations. Common in the mountains of Eastern Kentucky. Extending westward to Edmonson and Grayson counties, but becoming local and rare in this western territory. The largest tree I have ever seen was observed June 15, 1895, in Wolfe County; it was fully forty feet high and eight inches thru at the base; the bark smooth, opaque gray with whitish splashes.

Adair, Allen, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Butlet, Carter, Clinton, Cumberland, Daviess, Edmonson, Elliott, Estill, Fleming, Floyd, Garrard, Grayson, Hart, Johnson, Knott, Larue, Laurel, Leslie, Letcher, Lewis, Logan, Madison, Metcalfe, Monroe, Montgomery, Morgan, Ohio, Owsley, Perry, Pike, Powell, Pulaski, Rockcastle, Rowan, Russell, Simpson, Wayne, Whitley, Wolfe

**Swamp or Meadow Holly** (*Ilex decidua*).—
Hickman, Madison, McCracken; Warren (Miss Price).

**Ilex monticola var. mollis.**—
Kentucky (Hussey).

**Winter Berry** (*Ilex verticillata*).—
Edmonson, Rockcastle, Warren.

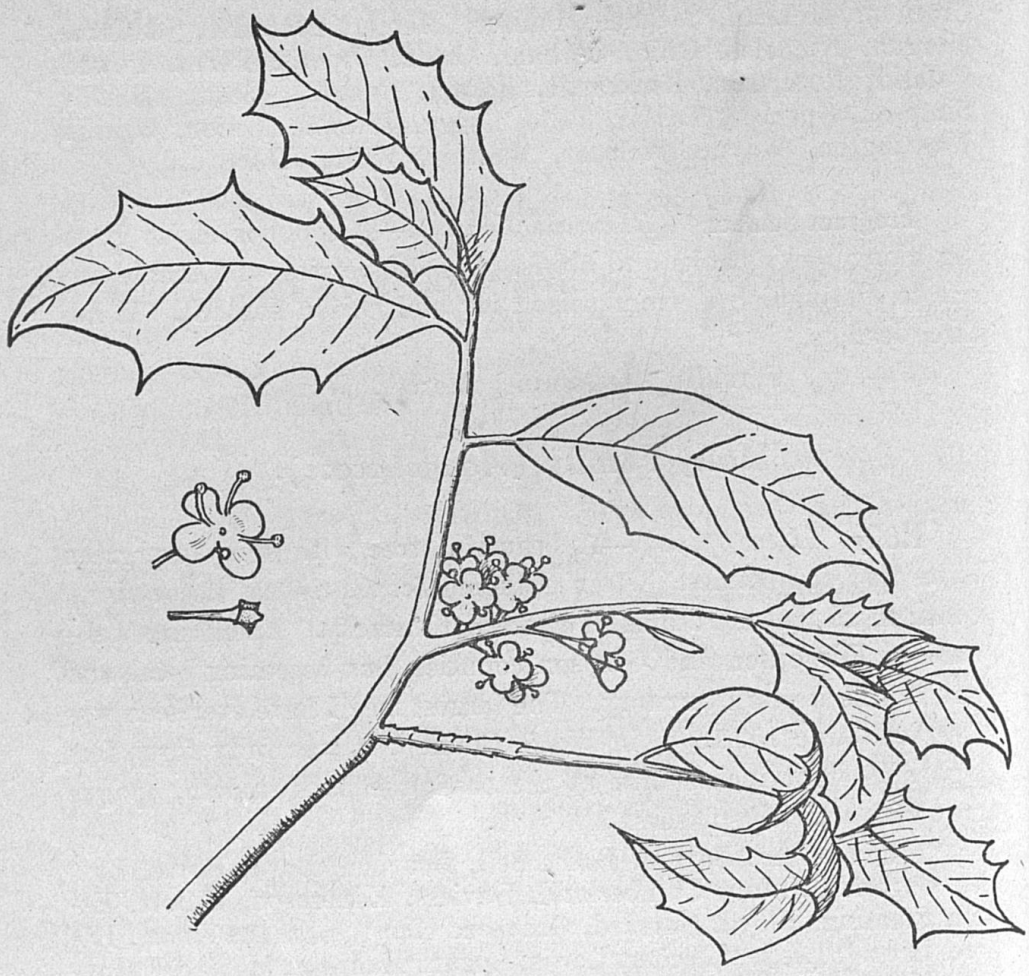


FIG. 18.—BLOSSOMS AND LEAVES OF HOLLY (*Ilex opaca*). NATURAL SIZE.

## Staff Tree Family (*Celastraceae*).

**Waahoo** (*Evonymus atropurpureus*).—A shrub or slender tree, with green twigs and conspicuous lobed crimson fruit, noticeable in the fall after the leaves are gone. Common in Bluegrass Kentucky along fences.

Campbell, Edmonson, Fayette, Franklin, Gallatin, Hickman, Jessamine, Johnson, Leslie, Logan, Madison, Mason, Oldham, Rowan, Warren.

**Strawberry Bush** (*Evonymus americanus*).—Not rare in mountain counties. Fruit similar to that of the preceding but hulls rough. Growth inclined to be less upright.

Bell, Carroll, Fleming, Gallatin, Leslie, Lyon, Russell, Spencer, Rockcastle.

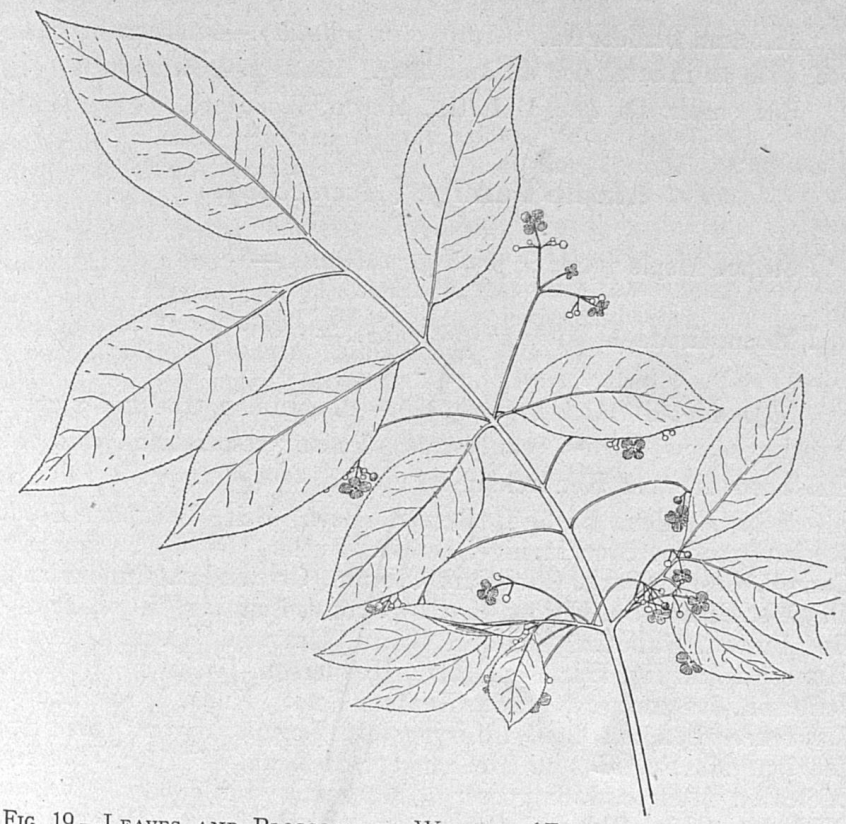


FIG. 19.—LEAVES AND BLOSSOMS OF WAAHOO (*Evonymus atropurpureus*). REDUCED.

**Evonymus obovatus.**—Kentucky (Gray's Manual).

**Bittersweet** (*Celastrus scandens*).—An attractive vine common everywhere in tangles of vegetation, over which it clambers. Noticeable in the fall from its bright orange fruit.

Adair, Allen, Bath, Bourbon, Boyd, Campbell, Carroll, Cumberland, Elliott, Estill, Fayette, Floyd, Franklin, Fulton, Gallatin, Garrard, Grant, Hardin, Harrison, Jefferson, Jessamine, Knott, Larue, Laurel, Leslie, Letcher, Lincoln, Monroe, Morgan, Nicholas, Oldham, Owsley, Perry, Powell, Robertson, Rowan, Scott, Shelby, Taylor, Warren, Webster.

## Bladder Nut Family (*Staphyleaceae*).

**American Bladder Nut** (*Staphylea trifolia*).—A shrub or small tree, with an inflated pod an inch long. Leaflets, 3 commonly.

Edmonson, Fayette, Gallatin, Mason, Woodford.

## Maple Family (*Aceraceae*).

**? Striped Maple** (*Acer pennsylvanicum*).—

**? Mountain Maple** (*Acer spicatum*).—

**Sugar Maple** (*Acer saccharum*).—A common tree and a great favorite because of its beauty and pleasant associations with the childhood of most Kentuckians.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Clark, Christian, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fayette, Fleming, Floyd, Franklin, Fulton, Gallatin, Garrard, Grant, Grayson, Green, Greenup, Hancock, Hardin, Harrison, Hart, Henderson, Hickman, Hopkins, Jefferson, Jessamine, Johnson, Kenton, Knott, Knox, Larue, Laurel, Lawrence, Letcher, Lewis, Livingston, Logan, Lyon, Madison, Marion, Martin, Mason, McCracken, McLean, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Muhlenberg, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rockcastle, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Washington, Wayne, Webster, Whitley, Woodford.

**Black Maple** (*Acer nigrum*).—A fine tree, sometimes seen in woodland pastures. The leaves are green on both sides, tho paler beneath. Those of the common species are decidedly paler beneath. Not commonly regarded as distinct from the preceding, and considered a variety by some botanists. Those I have seen are at once recognizable by the large stipules of the leaves.

Fayette and adjoining counties. Boyle and Mercer (Linney). Warren (Miss Price).

**Soft or White Maple, Water Maple** (*Acer saccharinum*).—A common tree along streams and often used for shade, for which purpose it is generally chosen because of its rapid growth. Its soft wood renders it subject to frequent injury by summer storms and winter sleet.

Adair, Allen, Ballard Barren, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fayette, Fleming, Floyd, Franklin, Fulton, Gallatin, Garrard, Grant, Graves, Green, Hancock, Hardin, Harrison, Hart, Henderson, Hickman, Jessamine, Johnson, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lincoln, Livingston, Logan, Lyon, Madison, Mason, McCracken, McLean, Menifee, Mercer, Monroe, Montgomery, Morgan, Muhlenberg, Nelson, Nicholas, Ohio, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Rockcastle, Rowan, Russell, Scott, Simpson, Spencer, Todd, Trigg, Union, Warren, Washington, Wayne, Webster, Whitley, Wolfe, Woodford.

**Red Maple** (*Acer rubrum*).—An attractive tree of medium or small size, widely distributed in the State, and common locally.

Ballard, Barren, Bath, Bell, Boyd, Breathitt, Carroll, Casey, Clinton, Crittenden, Cumberland, Daviess, Fayette, Fleming, Floyd, Fulton, Gallatin, Garrard, Graves, Grayson, Hancock, Hardin, Hart, Hickman, Hopkins, Lawrence, Leslie, Letcher, Lincoln, Livingston, Lyon, Madison, McLean, Monroe, Morgan, Muhlenberg, Nelson (abundant), Ohio, Oldham, Perry, Rowan, Shelby, Spencer, Todd.

**Box Elder** (*Acer negundo*).—Common along streams.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Bracken, Butler, Caldwell, Campbell, Carroll, Casey, Christian, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fleming, Floyd, Franklin, Fulton, Gallatin, Garrard, Grant, Graves, Green, Jessamine, Hancock, Hardin, Harrison, Hart, Henderson, Hickman, Laurel, Lawrence, Leslie, Lincoln, Livingston, Logan, Lyon, Madison, Mason, McCracken, McLean, Mercer, Monroe, Montgomery, Morgan, Muhlenberg, Nelson, Nicholas, Ohio, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Union, Warren, Washington, Wayne, Webster, Woodford.

## Soapberry Family (*Sapindaceae*).

**Ohio Buckeye** (*Aesculus glabra*).—A common tree, with fine foliage, and splendid big mahogany-colored seeds, well known to every schoolboy. Hulls prickly. Admirably adapted for park and lawn.

Ballard, Barren, Boyle, Butler, Breathitt, Caldwell, Campbell, Carroll, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fayette, Floyd, Franklin, Gallatin, Garrard, Grant, Greenup, Hart, Henderson, Larue, Lawrence, Leslie, Lewis, Logan, Mason, McLean, Mercer, Metcalfe, Monroe, Nelson, Owsley, Perry, Powell, Rockcastle, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Trigg, Woodford.

**Sweet Buckeye** (*Aesculus octandra*).—An attractive tree, to be distinguished from the preceding by the smooth hulls of the seeds. Not so generally scattered in the State, but the common species in the mountains.

Bell, Breckinridge, Bullitt, Crittenden, Cumberland, Daviess, Gallatin, Garrard, Green, Hancock, Hart, Johnson, Kenton, Knott, Larue, Letcher, Lincoln, Madison, Martin, Mason (common), Monroe, Morgan, Oldham, Owsley, Pike, Powell, Pulaski, Robertson, Scott, Simpson, Spencer, Taylor.

**Red Buckeye** (*Aesculus pavia*).—Seen by me only in Western Kentucky—about Columbus. A handsome, compact shrub, with red blossoms. I have had it reported from other localities, but do not feel satisfied that it grows spontaneously away from the Mississippi River. Correspondents will confer a favor by sending me specimens from other localities than that mentioned.

Floyd, Monroe, Scott.

## Buckthorn Family (*Rhamnaceae*).

**Supple Jack** (*Berchemia scandens*).—
Hickman, Fulton County, 1892.

**Narrow-leaved Buckthorn** (*Rhamnus lanceolata*).—Shrub; not common.

Franklin, Woodford.

**Common Buckthorn** (*Rhamnus caroliniana*).—Shrub with black berries. Common locally.

Bell, Edmonson, Logan, Meade, Nelson, Todd, Warren, Woodford.

**New Jersey Tea** (*Ceanothus americanus*).—A small shrub of frequent occurrence in mountain counties and westward.

Bell, Lincoln, Warren.

## Vine Family (*Vitaceae*).

**Virginia Creeper** (*Psedera quinquefolia*).—One of our most attractive American vines. A vigorous, hardy plant. Common everywhere.

Bell, Christian, Edmonson, Fayette, Franklin, Fulton, Harlan, Hardin, Lincoln, Nelson, Powell, Rockcastle, Warren, Whitley.

**Cissus ampelopsis.**—A vine. Not common.

Bell, Franklin, Harlan, Larue, Warren.

**Pepper Vine** (*Cissus arborea*).—

Lexington (Collected by Miss Mary Didlake of the Division).

**Northern Fox Grape** (*Vitis labrusca*).—

Bell County.

**? Summer Grape** (*Vitis aestivalis*).—

Warren (Miss Price).

**Frost Grape** (*Vitis cordifolia*).—Our commonest species.

Lexington, Frankfort, Olympia and Pineville. Logan and Whitley counties.

**River-bank Grape** (*Vitis vulpina*).—

Aden Springs.

**Red Grape** (*Vitis palmata*).—

Hickman.

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**Muscadine Grape** (*Vitis rotundifolia*).—Common in southern counties along streams.

Glasgow Junction, Cumberland Falls, Corbin. Fulton County, Whitley County (common).

## Linden Family (*Tiliaceae*).

**Basswood, Linn** (*Tilia americana*).—An attractive tree. The blossoms furnish good bee forage.

Boyd, Boyle, Breckinridge, Cumberland, Daviess, Gallatin, Hart, Hickman, Larue, Laurel, Letcher, Oldham, Pendleton, Perry, Rockcastle, Rowan.

**Downy-leaved Basswood** (*Tilia michauxii*).—
Breathitt, Powell, Woodford.

**White Basswood** (*Tilia heterophylla*).—A beautiful tree. Common along streams.

Boyle, Fayette, Gallatin, Hart, Hickman, Jessamine, Letcher, Lincoln, Madison, Perry, Rockcastle, Rowan, Spencer, Warren, Wolfe.

## Camellia Family (*Ternstroemiaceae*).

**Stewartia pentagyna.**—A beautiful shrub, sometimes reaching a height of nine feet, the flowers three inches across. Pineville—common locally. The second species of the genus (*S. malachodendron*), has been credited to Kentucky, but I am disposed to question the accuracy of the reference.

Bell, Letcher, Powell, Rowan.

## St. John's-wort Family (*Hypericaceae*).

**Shrubby St. John's-wort** (*Hypericum prolificum*).—
Rockcastle, Wayne.

**St. Andrew's Cross** (*Ascyrum hypericoides*).—
Madison, Ohio, Fulton.

## Leatherwood Family (*Thymeleaceae*).

**Leatherwood** (*Dirca palustris*).—A rather common shrub in the mountains. Local elsewhere.

Adair, Allen, Bath, Boyd, Casey, Clinton, Cumberland, Edmonson (frequent in shaded places along Nolin River, 4 feet in height), Elliott, Estill, Floyd, Grant, Green, Hardin, Hart, Jessamine, Johnson, Knott, Larue, Lawrence, Leslie, Lewis, Martin, Metcalfe, Monroe, Morgan, Owsley, Perry, Pike, Powell, Pulaski, Rowan, Russell, Spencer, Wayne, Whitley.

## Ginseng Family (*Araliaceae*).

**Hercules' Club** (*Aralia spinosa*).—A shrub or small tree with prickly stem and showy spreading panicle of flowers and fruit.

Bell, Christian, Crittenden, Edmonson, Jefferson, Lincoln, Todd, Warren, Wayne.

**Bristly Sarsaparilla** (*Aralia hispida*).—
Kentucky (Miss Price).

## Dogwood Family (*Cornaceae*).

**Flowering Dogwood** (*Cornus florida*).—A small tree, common in most woodland. The large white involucres of the blossoms expand in spring before the leaves of the forest trees and render the dogwood conspicuous for a time.

Adair, Allen, Ballard Barren, Bath, Bell, Bourbon, Boyd, Boyle, Breckinridge, Bullittt, Butler, Campbell, Carroll, Casey, Christian, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Estill, Fayette, Floyd, Franklin, Fulton, Gallatin, Garrard, Grant, Graves, Grayson, Green, Hancock, Hardin, Harrison, Hart, Henderson, Hickman, Hopkins, Jefferson, Jessamine, Johnson, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, McCracken, McLean, Menifee, Mercer, Metcalfe, Montgomery, Morgan, Muhlenberg, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rockcastle, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Wayne, Webster, Whitley, Woodford.

**Round-leaved Dogwood** (*Cornus circinata*).—Linney.

**Silky Cornel** (*Cornus stolonifera*).—Short and Peter; Miss Price.

Campbell, Crittenden, Franklin, Gallatin, Garrard, Hancock, Laurel, Madison, Perry, Powell, Rockcastle, Spencer.

**Stiff Cornel** (*Cornus stricta*).—
Rockcastle County.

**Cornus paniculata.**—
Kentucky (Short and Peter).

**Cornus alternifolia.**—
Kentucky (Short and Peter); Linney; Rockcastle (Williamson).

**Black Gum** (*Nyssa sylvatica*).—A common and attractive tree with the outer bark checked both lengthwise and crosswise, producing squarish areas. Foliage often purple in autumn.

Adair, Allen, Ballard, Barren, Bath, Bell, Boyd, Boyle, Bracken, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Casey, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fleming, Floyd, Fulton, Gallatin, Garrard, Grant, Graves, Grayson, Green, Hancock, Hardin, Hart, Henderson, Hickman, Jessamine, Johnson, Knott, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Martin, McCracken, McLean, Metcalfe, Monroe, Montgomery, Morgan, Muhlenberg, Nelson, Nicholas, Ohio, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rockcastle, Rowan, Russell, Scott, Simpson, Spencer, Taylor, Todd, Trigg, Union, Wayne, Webster, Whitley, Wolfe.

**Swamp Black Gum** (*Nyssa aquatica*).—Not as common or well known as the preceding.

Todd, Warren.

## Heath Family (*Ericaceae*).

**Sweet Pepper Bush** (*Clethra alnifolia*).—
Western Kentucky (DeFriese).

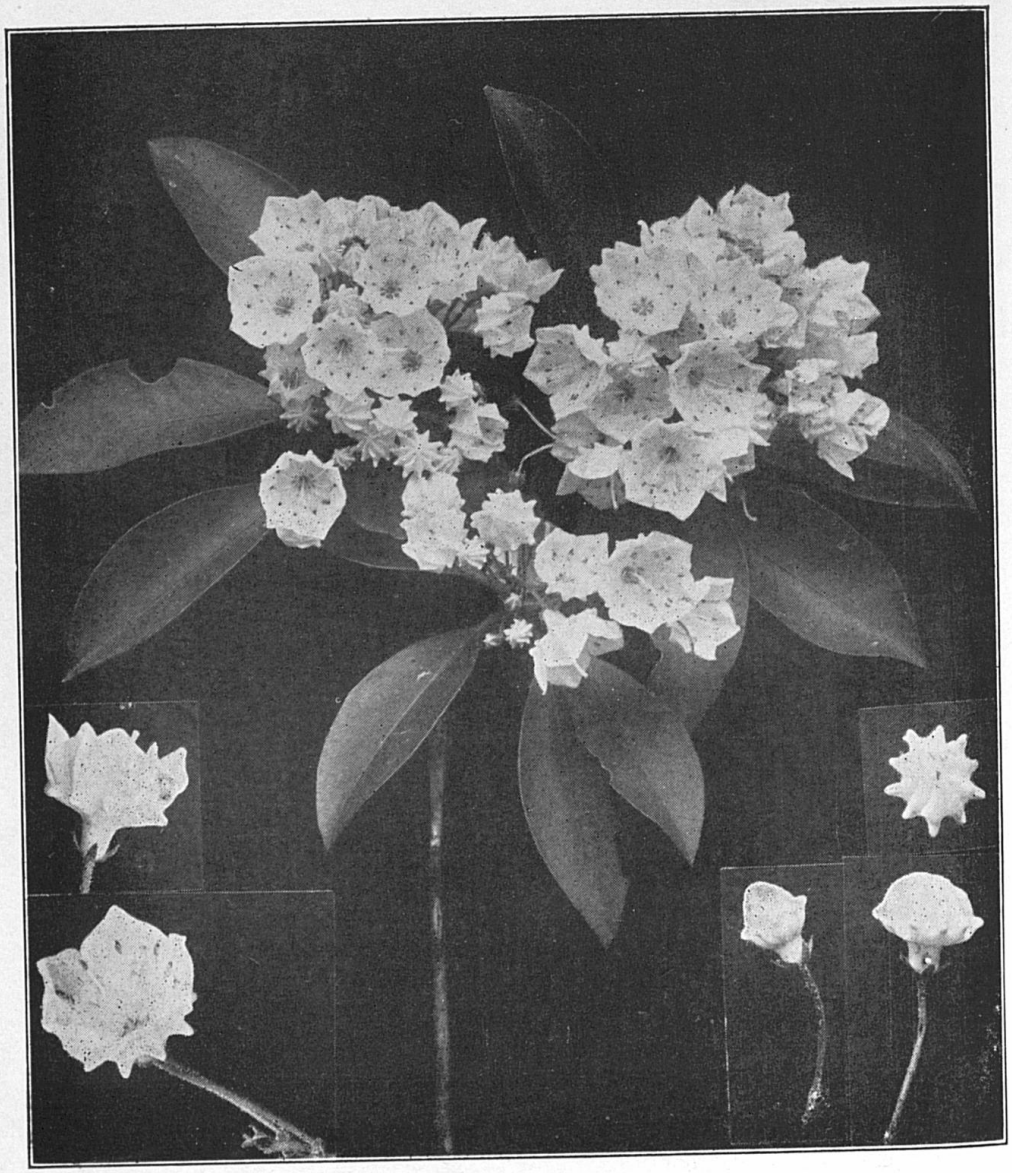


FIG. 20.—MOUNTAIN LAUREL (*Kalmia latifolia*). LOWER FIGURES, NATURAL SIZE.
Photographed by H. GARMAN.

**White Alder** (*Clethra acuminata*).—
Cumberland Mountains (Kearney); Wolfe.

**Spotted or Bitter Wintergreen** (*Chimaphila maculata*).

**Smooth Azalea** (*Rhododendron viscosum*).—
Kentucky (DeFriese); Rockcastle (Williamson).

**Pinxter Flower** (*Rhododendron nudiflorum*).—
Rockcastle.

**Pinxter Flower** (*Rhododendron canescens*).—Greenup County.

**Flame-colored Azalea** (*Rhododendron calendulaceum*).—
Adair, Bath, Breathitt, Knott, Leslie, Morgan, Perry, Powell, and other mountain counties. Common. In bloom in early spring.

**Great Laurel** (*Rhododendron maximum*).—A fine shrub or small tree with glossy leaves and clusters of rose-colored flowers. Common in shaded ravines in the mountains.

Bath, Bell, Estill, Floyd, Johnson, Knott, Laurel, Menifee, Perry, Powell, Pulaski, Rockcastle, Taylor, Whitley, Wolfe.

**Mountain Laurel** (*Kalmia latifolia*).—A common and beautiful shrub in the mountains, but extending westward into Edmonson, Grayson and western Hardin counties. M'Murtrie credits also *K. angustifolia* to Kentucky, but no recent collector has observed it here.

Adair, Bath, Bell, Boyd, Cumberland, Edmonson, Elliott, Estill, Fleming, Floyd, Harlan, Hart, Knott, Knox, Larue, Laurel, Lawrence, Leslie, Letcher, Lewis, Menifee, Monroe, Montgomery, Morgan, Owsley, Perry, Pike, Powell, Pulaski, Rockcastle, Rowan, Taylor, Trigg, Wolfe.

**Male Berry** (*Lyonia ligustrina*).—
Cumberland Mountains (Kearney); Rockcastle County.

**Sorrel Tree, Sourwood** (*Oxydendrum arboreum*).—A common tree in the mountains of Kentucky, but occurring in small numbers elsewhere in the State.

Bell, Boyd, Campbell, Edmonson, Estill, Letcher, Lincoln, Madison, Ohio, Perry, Rockcastle, Whitley.

**Trailing Arbutus** (*Epigaea repens*).—Common in the mountains.

Carter, Garrard, Hart, Knott, Knox, Letcher, Perry, Powell, Rockcastle.

**Wintergreen, Teaberry** (*Gaultheria procumbens*).—A common plant in some of the mountain counties.

Jackson, Knox, Powell, Rockcastle.

**Gaylussacia brachycera.**—Kentucky (Linney).

**Dwarf Huckleberry** (*Gaylussacia dumosa*).—
Warren County (Miss Price).

**Blue Tangleberry** (*Gaylussacia frondosa*).—
Kentucky (Short and Peter); Linney; Warren County (Miss Price).

**Bear Huckleberry** (*Gaylussacia ursina*).—
Kentucky (Gray's Manual); Cumberland Mountains (Kearney).

**Black Huckleberry** (*Gaylussacia baccata*).—
Kentucky (M'Murtrie's list); Kentucky (Short and Peter).

**Farkleberry** (*Vaccineum arboreum*).—
Edmonson, Lincoln, Livingston, Logan, Warren, Whitley.

**Deerberry** (*Vaccineum stamineum*).—
Breathitt (common), Lincoln, Rockcastle, Oldham.

**Late Low Blueberry** (*Vaccineum vacillans*).—
Powell County.

**High Blueberry** (*Vaccineum corymbosum*).—
Bell, Powell.

## Sapodilla Family (*Sapotaceae*).

**Southern Buckthorn** (*Bumelia lycioidea*).—
Edmonson County, near Dickey's Mills. Warren County (Miss Price).

## Ebony Family (*Ebenaceae*).

**Persimmon** (*Diospyrus virginiana*).—One of our commonest and most generally distributed trees.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Bracken, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Clark, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fayette, Fleming, Floyd, Franklin, Fulton, Gallatin, Garrard, Grant, Graves, Green, Greenup, Hancock, Hardin, Harrison, Hart, Henderson, Hickman, Hopkins, Johnson, Knott, Knox, Larue, Laurel, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Marion, Martin, Mason, McCracken, McLean, Meade, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Rockcastle, Rowan, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Washington, Webster, Whitley, Wolfe, Woodford.

## Storax Family (*Styracaceae*).

**Opossum Wood** (*Halesia carolina*).—
Star Lime Works, Lyon County.

**Storax americana.**—
Kentucky (Linney).

## Olive Family (*Oleaceae*).

**White Ash** (*Fraxinus americana*).—A splendid tree, formerly not uncommon locally thruout the State. Merchantable trees now largely gone.

Adair, Allen, Ballard, Barren, Bath, Bourbon, Boyd, Boyle, Bracken, Breckinridge, Bullitt, Butler, Campbell, Carroll, Casey, Christian, Clark, Clinton, Crittenden, Cumberland, Daviess, Elliott, Estill, Fayette, Fleming, Floyd, Fulton, Gallatin, Garrard, Grant, Green, Hancock, Harrison, Hart, Henderson, Hickman, Jessamine, Johnson, Knott, Knox, Larue, Laurel, Leslie, Letcher, Lewis, Livingston, Logan, Lyon, Marion, Martin, McCracken, McLean, Menifee, Mercer, Monroe, Montgomery, Morgan, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Pendleton, Perry, Pike, Powell, Pulaski, Robertson, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Union, Washington, Wayne, Warren, Webster, Whitley, Woodford.

**Biltmore Ash** (*Fraxinus biltmoreana*).—I am including this on the basis of a small lot of seeds collected by me near Nicholasville, in Jessamine County, September 28, 1899. They are larger than those of the red ash, the seed plumper and better defined where it joins the wing. The tree resembles the white ash, but has pubescent twigs.

**Red Ash** (*Fraxinus pennsylvanica*).—

Adair, Ballard, Bath, Boyd, Campbell, Carroll, Clinton, Edmonson, Elliott, Estill, Fayette, Franklin, Fleming, Fulton, Gallatin, Garrard, Grayson, Green, Hart, Henderson, Laurel, Leslie, Livingston, Lyon, Martin, McLean, Menifee, Monroe, Muhlenberg, Owsley, Perry, Powel, Pulaski, Rockcastle (very common), Rowan. Scott, Simpson, Spencer, Warren, Whitley.

**Green Ash** (*Fraxinus lanceolata*).—Not as common as the white and red ashes.

Bourbon, Carroll, Fayette, Fleming, Fulton, Gallatin, Garrard, Hardin, Larue, Madison.

**Blue Ash** (*Fraxinus quadrangulata*).—A common tree locally.

Allen, Ballard, Barren, Bath, Bourbon, Boyd, Breckinridge, Bullitt, Campbell, Carroll, Clark, Clinton, Cumberland, Daviess, Elliott, Estill, Fayette, Fleming, Fulton, Franklin, Gallatin, Grant, Harrison, Hart, Henderson, Hickman, Jessamine, Kenton, Leslie, Livingston, Madison, Mason, McLean, Menifee, Mercer, Monroe, Morgan, Nicholas, Owen, Pendleton, Perry, Powell, Pulaski, Robertson, Russell, Scott, Shelby, Spencer, Trimble, Union, Warren, Wayne, Webster, Whitley, Woodford.

**Black Ash** (*Fraxinus nigra*).—Swamps.
Kentucky (DeFriese).

**Fringe Tree** (*Chionanthus virginica*).—An attractive shrub, with sweet-scented blossoms. Local and not common, taking the State as a whole.

Adair, Bath, Cumberland, Estill, Madison, Marion, Menifee, Morgan, Powell, Pulaski, Rowan, Rockcastle. Green River, July, 1895.

## Bignonia Family (*Bignoniaceae*).

**Trumpet Creeper** (*Tecoma radicans*).—An ornamental vine with fine trumpet-shaped orange-red flowers and graceful foliage. Sometimes complained of as a weed, but easily exterminated.

Adair, Ballard, Barren, Bell, Bourbon, Carroll, Cumberland, Daviess, Edmonson, Fayette, Franklin, Fulton, Gallatin, Greenup, Hancock, Hickman, Jessamine, Knott, Letcher, Livingston, Logan, Mason, McCracken, Menifee, Morgan, Mulhenberg, Ohio, Owen, Perry, Rockcastle, Scott, Simpson, Taylor, Todd, Warren, Woodford.

**Catalpa** (*Catalpa speciosa*).—A well known tree growing on bottom land. Of importance both because of its beauty for the lawn and for the durability of its wood. To be distinguished from the related southern *C. bignonioides* by its upright growth and deeply longitudinally grooved bark.

Boone, Muhlenberg, Trigg.

**Catalpa** (*Catalpa bignonioides*).—Common in cultivation.
Gallatin (J. F. Donaldson).

**Cross Vine** (*Bignonia capreolata*).—A common ornamental vine.

Allen, Ballard, Butler, Caldwell, Clinton, Crittenden, Edmonson, Fayette, Fulton, Gallatin, Hart, Hickman, Jessamine, Knott, Knox, Letcher, Lyon, Ohio, Owsley, Perry, Powell, Pulaski, Rockcastle, Russell, Spencer, Trigg, Wayne, Whitley, Wolfe.

## Madder Family (*Rubiaceae*).

**Partridge Berry** (*Mitchella repens*).—A small trailing vine common in the mountains. A pleasing ornamental plant.

Bell, Carter, Powell, Rockcastle, Wolfe (common).

**Buttonbush** (*Cephalanthus occidentalis*).—An attractive shrub, partial to wet ground along ditches and streams.

Bell, Daviess, Edmonson, Fayette, Franklin, Gallatin, Graves, Hickman, Hopkins, Livingston, Nelson, Oldham, Simpson, Warren.

## Honeysuckle Family (*Caprifoliaceae*).

**Trumpet Honeysuckle** (*Lonicera sempervirens*).—
Bullitt.

**? Lonicera sullivantii.**

**Lonicera dioica.—**
Kentucky (Linney).

**Yellow Honeysuckle** (*Lonicera flava*).—
Warren County (Miss Price). Kentucky (Linney).

**Buckberry, Coralberry** (*Symphoricarpos orbiculatus*).—A very common shrub along roadsides and in thickets.

Christian, Edmonson, Fayette, Franklin, Grayson, Hart, Jessamine, Logan, McCracken, Nelson, Todd, Woodford.

**Dockmackie** (*Viburnum acerifolium*).—A common shrub in mountain counties of Eastern Kentucky.

Bell, Breathitt, Edmonson, Rockcastle.

**? Downy Arrowwood** (*Viburnum pubescens*).—
Kentucky (Short and Peter).

**Viburnum molle.**—
Kentucky (Gray's Manual).

**Arrowwood** (*Viburnum dentatum*).—Fayette, Rockcastle.

**Withe Rod** (*Viburnum cassinoides*).—Fayette, Rockcastle.

**Viburnum nudum.**—Kentucky (Hussey).

**Sheepberry** (*Viburnum lentago*).—Bath, Bell, Fayette.

**Black Haw** (*Viburnum prunifolium*).—Frequent thruout the State.

Adair, Allen, Ballard, Barren, Bath, Bourbon, Boyd, Boyle, Bracken, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Clark, Clinton, Crittenden, Cumberland, Edmonson, Elliott, Estill, Fayette, Fleming, Floyd, Fulton, Gallatin, Garrard, Grayson, Grant, Green, Hancock, Hardin, Harrison, Hart, Henderson, Hickman, Jessamine, Johnson, Kenton, Knott, Larue, Laurel, Lawrence, Leslie, Letcher, Logan, Lyon, Madison, Mason, McCracken, McLean, Menifee, Mercer, Metcalfe, Monroe, Montgomery, Morgan, Nelson, Nicholas, Powell, Pulaski, Robertson, Rockcastle, Russell, Scott, Shelby, Simpson, Spencer, Taylor, Trigg, Trimble, Wayne, Webster, Whitley, Woodford.

**Viburnum rufidulum.**—Bullitt, Powell, Warren, Woodford.

**Common Elder** (*Sambucus canadensis*).—A common shrub everywhere, with showy cymes of white flowers, producing large numbers of small black berries.

Adair, Allen, Ballard, Barren, Bath, Bell, Bourbon, Boyd, Boyle, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Carroll, Casey, Clark, Clinton, Crittenden, Cumberland, Daviess, Edmonson, Elliott, Estill, Fayette, Fleming, Floyd, Franklin, Fulton, Gallatin, Garrard, Grant, Graves, Green, Hancock, Hardin, Harrison, Hart, Henderson, Hickman, Jessamine, Johnson, Kenton, Knott, Knox, Laurel, Lawrence, Leslie, Letcher, Lewis, Lincoln, Livingston, Logan, Lyon, Madison, Marion, Mason, McCracken, McLean, Menifee, Monroe, Montgomery, Morgan, Nelson, Nicholas, Ohio, Oldham, Owen, Owsley, Perry, Powell, Pulaski, Robertson,

Russell, Scott, Shelby, Simpson, Spencer, Taylor, Todd, Trigg, Trimble, Union, Warren, Washington, Wayne, Webster, Whitley, Woodford.

**Red Elder** (*Sambucus racemosa*).—I am familiar with this plant as it grows in Northern Michigan, but have not seen it in Kentucky. It has been reported to me from the following counties:

Allen, Boyd, Campbell, Carroll, Fleming, Hart, Knox, Marion, Menifee, Powell, Rowan, Simpson. Kentucky (Linney).

It is not recorded in either M'Murtrie's or Short and Peter's list. Gattinger appears not to have observed it in Tennessee.

KENTUCKY

# Agricultural Experiment Station

OF THE

## STATE UNIVERSITY

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BULLETIN No. 170

# Concentrated Commercial Feeding Stuffs

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LEXINGTON, KENTUCKY

JANUARY, 1913

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The Bulletins of the Station will be mailed free to any citizen of Kentucky who sends his name and address to the Station for that purpose.

Correspondents will please notify the Director of changes in their postoffice address, or any failure to receive Bulletins.

Address:
KENTUCKY AGRICULTURAL EXPERIMENT STATION,
Lexington, Kentucky.

# BULLETIN No. 170

## Commercial Feeding Stuffs

By J. D. Turner and H. D. Spears.

The quality of feeding stuffs has been under governmental control in the European countries for a good many years, but not until recently, or comparatively so, has it been necessary for this country to enact laws regulating the manufacture and sale of these commodities. Practically every state in the union now has a Commercial Feeding Stuffs Law, all varying considerably in their requirements, due largely to conditions peculiar to each particular state. The trade has grown to such proportions and inter-state shipments are so general that the complications caused by the varying requirements of the different laws are beginning to place a heavy burden on the manufacturers who do an inter-state business. In order to relieve this hardship on the manufacturers, importers, jobbers and sellers as far as possible, the Association of Feed Control Officials of the United States, assisted by a large number of manufacturers individually and through their organizations, has adopted a uniform law and definitions and recommends them to the several states for adoption for the government of the manufacture and sale of commercial feeding stuffs.

The Uniform law differs from the Kentucky law only in minor points, but the basic principles are practically the same. The Uniform law is now being urged to be substituted in all states for such laws now in operation, and for adoption in those states where the subject of feeding stuffs laws is now being considered.

While the Uniform law is of great importance to both the officials and manufacturers, the subject of uniform definitions is of equal or greater importance, and a full list so far adopted by the Association of Feed Control Officials appears on another page.

The purpose of this bulletin, which is No. 170 in the Station series, and which is the fourth issue on the subject of feeding stuffs under the operation of the feed control law, is to set forth in detail, as far as possible, the results of the inspection during the year 1912.

The Kentucky law has not been changed since it went into effect in June, 1906. The law is now so generally understood and recognized in the trade, both in the manufacture and sale, that practically all the feeds sold or offered for sale in the state come up to every requirement, and the fact that these requirements are so generally complied with shows a very evident desire on the part of the manufacturers and dealers to conform with the law. And it is very noteworthy, too, that the consumer is now buying his feeding materials on their feeding value and feeding them in a more intelligent and economical manner.

The principal points of the law affecting the manufacture and sale of feeding stuffs and of most interest both to the manufacturer and consumer, follow:

*The Brand*—Every distinctive brand of commercial feeding stuff shall bear a label giving the name and address of the manufacturer or importer or dealer, the name or trade mark under which it is sold, the number of net pounds contained in the package, the minimum amounts of protein and fat and maximum amount of fiber, and the names of the different ingredients from which it is compounded. If an adulterant or a material of little or no feeding value is used, the name and percentage of same must be stated.

*What Materials Are Included Under the Law*—The law so defines the term "Concentrated Commercial Feeding Stuffs" that it covers practically all materials used as feeding stuffs except whole hays, straws, cotton seed hulls, corn stover and whole seeds and grains when unmixed with other materials.

*Adulteration of Feeding Stuffs*—If any material of little or no feeding value and not classified as a concentrate, is added to any commercial feeding stuff, the true mixture must be so registered with the Experiment Station and must be plainly printed on the official label, giving the percentage.

*Duties of the Director*—The Director shall furnish labels to the manufacturers and dealers upon application, when the feeding stuffs are properly registered. He shall in person or by deputy take samples of feeding stuffs, the sale of which is regulated by law, for analysis, and publish the results with such additional information as the case demands. He shall adopt such rules and regulations as may be necessary for the enforcement of the law. He shall refuse to register any feed under a name that is misleading as to the materials of which it is compounded, or containing a substance injurious to the health of animals, or if the percentage of crude protein and fat is below, or the percentage of the fiber is above the standard adopted for feeding stuffs.

*Penalties*—The sale or offering for sale of a feeding stuff not properly registered and labeled, or of a quality inferior to that guaranteed, or of an adulterated feeding stuff, or the using of a label the second time, or counterfeiting a label, or changing a label, is punishable by a fine not exceeding $100.00. Also, a penalty of not more than $50.00 is provided for any person who may hinder or prevent in any manner any authorized agent or person in performance of his duty under this act.

*Fees*—The inspection fee is based on the ton and is at the rate of twenty cents. However, this fee is considerably reduced when one takes into account that sufficient state official tags are furnished to be attached to the packages, thus refunding to the manufacturer or dealer, in the way of printed labels, a portion of this fee.

## SYSTEM OF TAGGING.

In addition to printing the guaranty on the official tag, the department issues tags in three colors, namely: black, red and yellow. This is done in order to classify the feeds relative

to their general make-up and assist the trade as far as possible to recognize at a glance at the tag the general character of the feed. This, in connection with the guaranty printed on the tag, will put the purchaser on guard and give him reasonable warning and an opportunity to make whatever investigation he desires before making the purchase.

The color design is: First, a manila tag printed in black ink represents a straight feeding stuff, or a feeding stuff made from the products and by-products of one kind of grain or plant only, such as wheat, or corn, or cotton seed, etc. Second, a manila tag printed in red ink indicates that the feeding stuff is made of the products or by-products of two or more grains or plants, such as corn and wheat, or corn, wheat and oats, etc. Third, a yellow tag printed in black ink represents a feeding stuff as containing a material of little or no feeding value, or a material not classed as a concentrate, such as oat hulls, cob meal, flax refuse, cotton seed hulls, etc.

## MATERIALS COMING UNDER THE LAW.

The Kentucky law so defines the term "Concentrated Commercial Feeding Stuffs" that it practically covers all materials used for feeding live stock and poultry except whole hays, straws, cotton seed hulls, corn stover and whole seeds and grains when unmixed with other materials.

It is particularly to be noted that no mill by-products or unmixed meals are exempt under the law and that all such mill by-products and meals must be registered and tagged with a state official tag. The term includes cracked or crushed corn, corn chop, corn feed meal, corn bran, and hominy meal as well as the by-products and meals from other cereals and grains.

## NEW MATERIALS OFFERED AS FEEDING STUFFS.

Two new materials, Peat (or humus as it is sometimes called) and Bastol Meal, have been offered to the trade in Kentucky and have been refused for registration for the

reason that the department feels that they are not of sufficient value as feeding stuffs to merit recognition, and should not, therefore, be classified as feeding stuffs.

Peat is an accumulation of more or less spongy, decaying vegetable matter, intermediate in character and properties between recent vegetable material and coal, produced under various conditions of climate and topography, and found either in swampy locations or in damp foggy regions. It is used for fuel, and is manufactured into blankets, carpets, rugs, wadding, paper, cardboard, etc., and peat gas for power purposes.

It is claimed that peat is being used extensively in the European countries as a feeding stuff, but from a nutritive standpoint it appears to have no merit. It is also claimed that it is a good absorbent and drier and possesses many corrective properties of bad effects caused by the use of other materials in feeding stuffs.

A sample of this material was obtained for the purpose of analysis, and resulted as follows: Protein, 17.50%; Fat, 0.82%; Ash, 27.74%; Water, 9.05%. It is the opinion of the department, after making as thorough investigation as is possible at this time that this material is inert, or practically so, and has no place in the list of commercial feeding stuffs.

Bastol Meal consists of finely ground wood which has been subjected to the action of sulphurous acid and steam under pressure. It is claimed by the manufacturers that, by this process, about 30% of the wood is converted into sugar, principally glucose and other soluble substances. Molasses is then mixed with this material and it is sold on the market as Bastol Meal. This department has made no analysis of this material, but from a report made by the State Chemist of Indiana the product contains 2.2% crude protein, 0.4% crude fat, 31.6% crude fiber, and 52.6% nitrogen-free extract. This analysis closely resembles that of corn cobs and shows that the material has only a low feeding value.

The consumers of this state are cautioned to consider carefully the value of these materials before purchasing them as feeding stuffs.

## SOURCES OF MATERIALS USED IN FEEDING STUFFS.

The greatest sources of materials used in commercial feeding stuffs are the by-products of the grain elevators, flouring mills, sugar, glucose and oil factories, breweries, distilleries, slaughter houses, etc. These materials are usually of high grade and form the bulk of legitimate trade in feeding stuffs. The next source is the light and immature grains of wheat, barley, oats and other grains and cereals, certain weed seeds, oat by-products such as oat shorts, oat middlings, oat hulls, clipped oat refuse, flax plant refuse, etc., which range from very low to fair in feeding value, and should not be wasted. Finally, there is another source of materials which is exploited on the trade usually under false cover, such as the trash of elevators and mills, corn cobs, peanut hulls, certain weed seeds, cocoa waste and similar materials ranging from worthless to dangerous.

## REGISTRATION.

Before any brand of feeding stuff can be registered, an application must be filed with the Experiment Station giving the name; brand or trade mark under which the feeding stuff is sold; the name and principal address of the manufacturer or person responsible for placing the feed on the market; the net weight of the contents of the package; the minimum percentages of protein and fat and the maximum percentage of fiber; and the specific name of each ingredient used in its manufacture.

No registration of any feeding stuff will be accepted under a name or brand that is misleading, and if the name is descriptive of the ingredients, the ingredients must correspond thereto.

The net weight must be given and proper allowance should be given feeds stored in damp places and for atmospheric influences.

The minimum percentages of protein and fat and maximum percentage of fiber are required in the guaranty under

the law and no appreciable deficiency will be accepted. The law makes no provision whereby an excess in one of the essential ingredients may make up for a deficiency in another.

In giving the list of ingredients from which a feeding stuff is made, the specific name of each ingredient must be stated, and a collective name will not be accepted to cover a combination of materials. Also, if screenings are used the kind and percentage must be stated, and if a material of little or no feeding value is used the percentage must be given.

## DEFINITIONS.

The following definitions have been adopted by the Association of Feed Control Officials of the United States and supersede all other definitions heretofore published. These definitions, therefore, will govern in the feeding stuffs trade in Kentucky, and the manufacturers and dealers should familiarize themselves with them and co-operate with the State Officials wherever possible in order to bring about uniformity in the feeding stuffs trade generally.

### From Alfalfa.

*Alfalfa Meal* is the entire alfalfa hay ground, and does not contain an admixture of ground alfalfa straw or other foreign materials.

### Animal Products.

*Blood Meal* is ground dried blood.

*Cracklings* are the residue after partially extracting the fats and oils from the animal tissue. If they bear a name descriptive of their kind, composition or origin, they must correspond thereto.

*Digester Tankage* is the residue from animal tissue exclusive of hoof and horn, specially prepared for feeding purposes by tanking under live steam, drying under high heat, and suitable grinding. If it contains any considerable amount of bone, it must be designated *Digester Meat* and *Bone Tankage.*

*Meat Scrap* and *Meat Meal* are the ground residues from animal tissue exclusive of hoof and bone. If they contain

any considerable amount of bone, they must be designated *Meat* and *Bone Scrap,* or *Meat* and *Bone Meal.* If they bear a name descriptive of their kind, composition or origin, they must correspond thereto.

FROM BARLEY.

*Malt Sprouts* are the sprouts of the barley grain. If the sprouts are derived from any other malted cereal, the source must be designated.

FROM BUCKWHEAT.

*Buckwheat Shorts or Buckwheat Middlings* are that portion of the buckwheat grain immediately inside the hull after separation from the flour.

FROM CORN.

*Corn Bran* is the outer coating of the corn kernel.

*Corn Feed Meal* is the sifting obtained in the manufacture of (sifted) cracked corn and table meal made from the whole grain.

*Corn Germ Meal* is a product in the manufacture of starch, glucose and other corn products, and is the germ layer from which a part of the corn oil has been extracted.

*Corn Starch By-Product* with *Corn Bran* is that part of commercial shelled corn that remains after the separation of the larger part of the starch and the germ by the processes employed in the manufacture of corn starch and glucose. It may or may not contain corn solubles.

*Corn Starch By-Product* without *Corn Bran* is that part of commercial shelled corn that remains after the separation of the larger part of the starch, the germ and the bran by the processes employed in the manufacture of corn starch and glucose. It may or may not contain corn solubles.

*Grits* are the hard flinty portions of Indian corn without hulls and germ.

*Hominy Meal, Hominy Feed or Hominy Chop* is a mixture of the bran coating, the germ and a part of the starchy

portion of the corn kernel obtained in the manufacture of hominy grits for human consumption.

FROM COTTON SEED.

*Cotton Seed Meal* is a product of the cotton seed only, composed principally of the kernel, with such portion of the hull as is necessary in the manufacture of oil, provided that nothing shall be recognized as cotton seed meal that does not conform to the foregoing definition, and that does not contain at least thirty-six (36) per cent. of protein.

*Choice Cotton Seed Meal* must be finely ground, not necessarily bolted, perfectly sound and sweet in odor, yellow, free from excess of lint and must contain at least forty-one (41) per cent. of protein.

*Prime Cotton Seed Meal* must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, yellow, not brown or reddish, free from excess of lint, and must contain at least thirty-eight and six-tenths (38.6) per cent. of protein.

*Good Cotton Seed Meal* must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color and must contain at least thirty-six (36) per cent. of protein.

*Cotton Seed Feed* is a mixture of cotton seed meal and cotton seed hulls containing less than thirty-six (36) per cent. of protein.

FROM FLAX SEED.

*Flax Plant By-Product* is that portion of the flax plant remaining after the separation of the seed, the baste fiber and a portion of the shives, and consists of flax shives, flax pods, broken and immature flax seeds and the corticle tissue of the stem.

*Linseed Meal* is the ground residue after extraction of part of the oil from ground flax seed.

FROM OATS.

*Oat Groats* are the kernels of the oat berry with the hulls removed.

*Oat Hulls* are the outer chaffy coverings of the oat grain.

*Oat Middlings* are the floury portion of the groat obtained in the milling of rolled oats.

*Clipped Oats Refuse* is the resultant by-product obtained in the manufacture of clipped oats. It may contain light chaffy material broken from the end of the hulls, empty hulls, light immature oats and dust. It must not contain an excessive amount of oat hulls.

*Oat Shorts* are the covering of the oat grain lying immediately inside the hull, being a fuzzy material carrying with it considerable portions of the fine floury part of the groat obtained in the milling of rolled oats.

FROM RICE.

*Rice Bran* is the cuticle beneath the hull.

*Rice Polish* is the finely powdered material obtained in polishing the kernel.

*Rice Hulls* are the outer chaffy coverings of the rice grain.

FROM WHEAT.

*Wheat Bran* is the coarse outer coatings of the wheat berry.

*Wheat White Middlings* or *White Middlings* are that part of the offal of wheat intermediate between shorts or standard middlings and red dog.

*Shipstuff* or *Wheat Mixed Feed* is a mixture of the products other than the flour obtained from the milling of the wheat berry.

*Shorts or Standard Middlings* are the fine particles of the outer and inner bran separated from bran and white middlings.

*Red Dog* is a low grade wheat flour containing the finer particles of bran.

MISCELLANEOUS.

*Meal* is the clean, sound, ground product of the entire grain, cereal or seed which it purports to represent: Provided, That the following meals, qualified by their descriptive names,

are to be known as, viz: *Corn Germ Meal* is a product in the manufacture of starch, glucose and other corn products and is the germ layer from which a part of the corn oil has been extracted. *Linseed Meal* is the ground residue after extraction of part of the oil from ground flax seed.

*Brewers' Dried Grains* are the properly dried residue from cereals obtained in the manufacture of beer.

*Chop* is a ground or chop feed composed of one or more different cereals or by-products thereof. If it bears a name descriptive of the kind of cereals, it must be made exclusively of the entire grains of those cereals.

*Distillers' Dried Grains* are the dried residue from cereals obtained in the manufacture of alcohol and distilled liquors. The product shall bear the designation indicating the cereal predominating.

*Screenings* are the smaller imperfect grains, weed seeds and other foreign material having feeding value, separated in cleaning the grain.

## RULINGS.

The law empowers the Director to make and enforce such rules and regulations as he may deem necessary to carry into effect the full meaning and intent of the act. For the guidance of the manufacturer and dealer and in compliance with this provision, the following rules have been made:

1. *Name*—No feed will be accepted for registration under a name, brand, or trade mark that is misleading as to the materials it contains.

2. *Condimental or Medicated Stock and Poultry Foods or Feeds*—All materials sold under the name Stock and Poultry Foods or Feeds, or Condimental or Medicated Stock and Poultry Foods or Feeds, come under the requirements of the law and must be registered and properly labeled with the Kentucky official label.

3. *Adulterants*—The name and percentage of any ingredient of a feeding stuff of little or no feeding value, or a material not classified as a concentrate, must be stated. Corn

chop, corn feed meal, hominy feed, and all such feeds containing an excess of corn bran, unless plainly stated, will be considered adulterated.

4. *Damaged or Unsound Grain*—The use of damaged or unsound grain in making feeds, unless registered as such and plainly stated in the label, is prohibited.

5. *Screenings*—By-products of mills and like materials used for feeding purposes, containing screenings, must be registered under their true name, as "Wheat Bran and Wheat Screenings," "Shipstuff and Wheat Screenings," etc. In all cases the source of the screenings and whether "ground" or "unground" must be given. The general term "grain screenings" or "recleaned miscellaneous field seeds" will not be accepted.

6. *Seeds—Field Seeds*—In the list of ingredients, these terms will not be accepted to cover a mixture of seeds. The common name of each variety must be given.

7. *Guaranties*—Manufacturers and dealers must make their guaranties so that their products will equal or exceed them.

8. *Ingredients*—In naming the ingredients from which a feed is made, the name of each particular ingredient used must be stated.

9. *Local Sales*—All goods sold locally or otherwise must be labeled. Also, feeds exchanged for wheat, corn, or other products, must be labeled.

10. *Short Weights*—The law requires net weight in all packages, that is, a sack of feed purporting to be 100 pounds must weigh enough more to make up for the weight of the sack. Reasonable allowances should be made for atmospheric influences and damp storage places.

11. *Labels*—Labels must be attached to the feed when it is sold or exposed for sale, or delivered within the State for sale. Often, we find feeds delivered to dealers and consumers without having the official labels attached, in most instances the tags having been sent by express, by mail, or by driver, which results in their not being attached. We have instructed

our inspectors to report such feeds "not labeled," and such violations will be prosecuted under the head of not tagging.

12. *Clubs, Associations, Etc.*—When a number of persons form a club or association and purchase feeding stuffs, either within or without the State, such feeds must be properly registered and labeled when delivered to the individual consumer. The person or persons ordering the goods will be responsible as agents for noncompliance with the law.

13. *Corn Cockle*—Corn Cockle, on account of its poisonous effect on live stock, will be considered an adulterant when found in feeding stuffs in appreciable amounts.

14. *Oat Feed*—The term "Oat Feed" in Kentucky is generally known and applied to whole or ground oats. A mixture of the by-products such as oat shorts, oat middlings and oat hulls obtained in the manufacture of oat meal will not be accepted under this term and the name of each of these materials will be required.

15. *Corn* and *Oats Feed*—This term, and similar ones, will be accepted only to cover a material composed entirely of the corn and oat grains.

16. *Grits*—This term when used as an ingredient of a feeding stuff shall mean the hard, flinty portions of Indian corn. If derived from any other cereal, the same must be stated.

17. *Grit*—This term when applied to an ingredient of a feeding stuff shall mean the rough, hard particles of siliceous sandstone, granite, mica, quartz, limestone, etc., used in poultry feeds.

18. *Redemption of Tags*—All tags or labels are good until used if attached to the feed they represent, but no tags can be redeemed unless there has been an error in printing them.

## THE USE OF FEEDING STUFFS.

Commercial feeding stuffs are usually purchased for the purpose of supplementing the feeding materials raised on the farm and especially is this true where corn and timothy hay are the only crops. One of the most important questions,

then, that concerns the consumer is how to buy feeding stuffs. Users of purchased feeds in large quantities are generally experienced and buy only high class materials at close prices. It frequently happens that the small consumer, too often feeling the pinch of poverty, seeks a cheap grade of feed that sells for less than high class materials, and is easily caught by the low grade trashy feeds bearing catchy names.

Cheap feeding stuffs, no matter what names they bear, are quite likely to result in hardship to the animals that are fed on them, and to the owners of such animals as well.

If alfalfa, cow peas, soy beans and other similar crops can be raised and used on the farms, little, if any, concentrates are needed as these materials are rich in protein and will supply sufficient nourishment. Farm products such as corn, oats, corn fodder, sheaf oats, timothy hay, and other hays grown so generally on Kentucky farms, contain relatively high percentages of carbohydrates and low percentages of fat and protein, and should not be considered in the purchase of concentrated materials. The amount, therefore, of digestible protein and fat should govern in the purchase of commercial feeding stuffs.

One fact of great importance which must not be lost sight of in economical feeding is that the amount, kind and character of the feed an animal requires depends entirely upon the use to which that animal is going to put the food. A team may be kept through an idle time on a kind of feed that would not be at all suited to the needs of a race horse during the training season, or a cow yielding a large quantity of milk during an official test. For instance, there is little use in paying high prices and establishing a good dairy herd unless careful attention is given to the amount and character of the feed, for however well bred and efficient the individuals, they can not give in their product what they do not receive in their food. This is just as true of work and growing animals.

## SCREENINGS.

The subject of screenings and weed seeds was treated extensively in Bulletin No. 156.

Most of the screenings and weed seeds coming into the State in compounded feeds are usually ground, thus rendering germination impossible. However, a large number of poultry feeds coming into the State often contain weed seeds in a perfectly viable condition. Quite a good deal of screenings are imported into the State for mixing purposes, but a major portion are brought in in compounded and poultry feeds. The most objectionable weed seeds found in the poultry feeds and feeds with unground screenings are wild buckwheat, plantain, corn cockle, pigeon grass, foxtail and Canada thistle. Others are also objectionable, but they are commonly scattered everywhere on land and are not difficult to suppress in cultivated ground.

In Kentucky, a number of fungi and weed seeds occur in feeds manufactured from crops grown within the State.

A sample of screenings such as are ordinarily used in compounded feeds and poultry feeds was obtained for examination. However, these screenings are usually recleaned, the better part being used for poultry feeds and the lighter and trashy material used in stock feeds. The analysis follows:

SAMPLE NO. 28745—"GRAIN SCREENINGS."

| | |
|---|---|
| Wheat | 11.08% |
| Corn | 0.14% |
| Wild Oats | 1.18% |
| Oats | 1.40% |
| Barley | 0.83% |
| Rye | 1.06% |
| Sunflower | 0.13% |
| Pigeon Grass | 1.66% |
| Buckwheat | 8.43% |
| Flax | 1.10% |
| Brassica Species | 3.86% |
| Lady's Thumb | 0.87% |

| | |
|---|---|
| Foxtail | 1.39% |
| Lamb's Quarters | 11.42% |
| Timothy | 0.71% |
| Hedge Mustard | 1.64% |
| Miscellaneous Seeds | 1.54% |
| Inert Matter (consisting of straw, chaff and dirt) | 51.56% |
| | 100.00% |

The miscellaneous seeds (1.54%) are estimated as follows per pound:

| | |
|---|---|
| Stick Seed | 2163 |
| Corn Cockle | 362 |
| Prickly poppy | 1271 |
| False Flax | 1633 |
| Hare's Ear | 3628 |
| Sage | 1452 |
| Curled Dock | 1180 |
| Catchfly | 1180 |
| Cress | 1633 |
| Paspalum | 181 |
| Canada Thistle | 453 |
| Gum plant | 1812 |
| Red Top | 6795 |
| Plantain | 906 |
| Crab Grass | 453 |
| Pepper Grass | 906 |
| Bluegrass | 453 |
| Witch grass | 906 |
| Cinquefoil | 9060 |
| Sour Dock | 90 |

Summary of the above may be given as follows:

| | |
|---|---|
| Grain | 26.06% |
| Weed Seeds | 22.38% |
| Inert Matter | 51.56% |
| | 100.00% |

A bag of feed of 100 pounds containing 20% of these screenings, or twenty pounds, is estimated to have in it 4½ pounds of weed seeds. Some of these weed seeds are highly nutritious and some of them are very poisonous. Another objection to the use of weed seeds in a viable form, and a very serious one, too, is that the land wherever these feeds are fed will become stocked with undesirable and noxious plants. It is therefore very important to avoid feeds containing whole weed seeds.

## TERMS USED IN TREATING OF FEEDING STUFFS.

*Concentrated Feeding Stuff*—A term usually applied to all feeding stuffs rich in one or more of the essential constituents of a highly nutritious character, such as the various grains, milling by-products, etc.

*Roughage*—A term applied to the coarser and less nutritious materials, such as hays, corn stover, straw, etc.

*Essential Constituents or Nutrients*—The parts of a feeding stuff termed protein, fat and carbohydrates, which are necessary in the support of animal life.

*Percentage Amount*—This is the amount in 100. For example, if shipstuff contains 16.5% of crude protein and 4% crude fat, then 100 pounds will contain 16.5 pounds of crude protein and 4 pounds of crude fat. A ton would contain twenty times these amounts, or 330 pounds of crude protein and 80 pounds of crude fat.

*Co-efficient of Digestibility*—A number which indicates what proportion or percentage of the nutrients in a feed is digested by an animal. For instance, if shipstuff contains 16.5% protein and has a digestibility co-efficient of .80, then the feed would contain .80 multiplied by 16.5 which equals 13.2 pounds of digestible protein in 100 pounds of feed.

*Ration*—The amount of feed which an animal should consume in twenty-four hours.

*Nutritive Ratio*—An expression giving the relation between the amount of digestible protein and the combined

amounts of digestible carbohydrates and fat in a feeding stuff.

## CHEMICAL ANALYSES OF FEEDS.

The chemical analysis of a feeding stuff consists in determining the following constituents: Moisture, Protein, Fat, Nitrogen-free extract, Fiber and Ash. The Nitrogen-free extract and the Fiber constitute the "Carbohydrates" which are sometimes reported in the various statements of analysis. There are a few constituents included in the Nitrogen-free extract, such as pentosans, dextrin, etc., which are occasionally determined, but they are of little importance and will not be mentioned further. The methods used herein are those adopted by the Association of Official Agricultural Chemists.

Moisture in a feeding stuff is the water it contains and it varies in amount from a few to as much as twenty per cent. or more, depending on the kind, age or state of greenness, and whether stored in a dry or damp place. Some feeding stuffs such as distillers' dried grains and brewers' dried grains have gone through a process of drying by artificial heat, thus greatly reducing their water content, and the amount they hold depends on the length of time they are allowed to remain in the dryer and the temperature of the same. When exposed to moist air, these artificially dried feeds will take up water again, the quantity absorbed depending upon atmospheric conditions and the extent of exposure.

Crude protein is the nitrogenous constituent of a feeding stuff, containing about 16% of the element nitrogen. The percentage of protein is obtained by simply multiplying the per cent. of nitrogen found in analysis by the factor 6.25. The amount of crude protein in feeding stuffs varies from a few to about 50% and even higher than this, the highly concentrated materials being meat scraps, blood meal, feeding tankage, cotton seed meal, etc.

Besides occurring in feeding stuffs, protein exists in nearly all natural foods, both animal and vegetable. Gluten of wheat, the albumen or white of eggs, the lean part of beef,

the curd of milk and the fibrin of the blood are well known forms of protein.

Crude fat is the name given to that portion of a feed which is extracted with ether or similar solvents. The terms "Ether Extract" or "Fat" are often used in reporting analyses instead of crude fat. This constituent consists chiefly of fats and oils, also containing other substances as wax, resins and chlorophyll or coloring matter, which are soluble in ether. The percentage of crude fat in feeding stuffs varies from about 1 to 15%.

Nitrogen-free extract is a general term given to those bodies contained in a feed other than water, protein, fat, fiber and ash. Its percentage is determined by subtracting the sum of the percentages of these constituents from 100. In most feeding stuffs, the nitrogen-free extract consists chiefly of starch. Sugars, gums and pentosans (an insoluble carbohydrate of little importance) are usually present in smaller amounts which vary according to the kind of feed. In grains, the nitrogen-free extract runs from 50 to 75%, and to almost wholly starch, while in the hulls and chaff of grain and roughages, the amount is considerably less.

Crude fiber is the woody part or structural material. It is composed largely of cellulose. It is insoluble in weak acid and alkali, and is therefore but slightly digested. It is lowest in amount in hulled corn, which contains about 1 or 2%, and the highest in the husk of grains or hulls, such as Cotton Seed Hulls, which contain about 45% and in Corn Cob which contains about 30%.

Ash is the mineral constituent and consists principally of phosphate and carbonate of lime and potash.

Carbohydrates are the nitrogen-free extract and fiber together, though the term is often wrongly used as synonymous with nitrogen-free extract.

## FUNCTIONS OF NUTRIENTS.

When coal is burned in an engine, heat and energy are produced. The same is true when food is consumed in the

body. It is oxydized or "burned" and produces heat and energy for the body to carry on its functions. Besides producing heat and energy for the animal body, food also furnishes the material necessary for its maintenance, growth, and repair for the natural waste. The principal constituents of food value in a feeding stuff are protein, fat, nitrogen-free extract, fiber and ash. They are called nutrients because they perform the function of building up and maintaining the animal body, each having certain duties to perform. They may be described as follows:

Water, though essential to life, is not mentioned as one of the nutrients in a feeding stuff because its commercial value is practically nothing. Accordingly, its presence affects the value of a feed negatively, by adding to the weight without adding any value, or by taking up the room of valuable constituents. Besides this, excessive amounts of water in a feed lower the keeping quality. The functions of the various organs of the animal body can not be maintained without water, and in the animal body acts as a solvent carrying the digested and assimilated food to the parts where needed.

Protein is the most important as well as the most costly nutrient in a feed and the value of a feed depends very largely on the amount of this constituent it contains. Protein supplies the nitrogenous material which is essential to the building up of the various tissues and secretions of the body. This constituent produces flesh, muscle, ligaments, glanular secretions, tissues, milk, blood, tendons, hair, hoofs, hide, and is found in all portions of the animal body which have strength, including the bones which contain about 25 or 30%. Under certain conditions, as in starvation, protein may serve as a source of heat and energy, and it may be used to form fat, thereby taking the place of the nutrients fat and carbohydrates. No other nutrient can be used to perform the proper office of protein, however, due to the fact that no others contain nitrogen.

Fat ranks next to protein in the valuation of the nutrients. It is used to produce heat and energy, and while carbohydrates are also used, fat is 2¼ times as valuable for the

same purpose. Fat also serves as a protection to the protein compounds of the body against destruction and as a protection for the other tissues.

Nitrogen-free extract is also of importance as a source of heat and energy. While it does not have as great a power in this respect as fat, it is present in such large quantities in feeding stuffs that it serves an important part. The members of this group, however, differ in nutritive value on account of the wide variance of their digestibility. The starches and sugars are readily soluble and almost completely digested, while pentosans and other less well known substances are digested with much more difficulty and far less completely. It is therefore desirable in selecting a feeding stuff that starches and sugars should constitute the principal part of the nitrogen-free extract, other things being equal. Nitrogen-free extract is converted into fats in the animal body and stored as such in the fatty tissues. Along with fats it is consumed by the body, thereby giving out heat, muscular and intellectual energy. The amount of fats and carbohydrates assimilated over and above that used immediately by the body for heat and energy is the amount stored up as fat in the tissues.

Fiber, the woody portion or structural material of plants, is not so valuable a nutrient as nitrogen-free extract. Like pentosans, it is not very soluble and is one of the slightly digestible carbohydrates. It is contained in large proportions in materials used as roughage and it is only for this purpose that it may be considered valuable. It is not well to use a too concentrated feed, and hence a feeding stuff containing a large per cent. of protein and fat is fed with fodder, hay, etc., which contain a large per cent. of crude fiber. When fed in this way, the animal derives a greater benefit from the nutrient. Fiber, though, is nearly inert and as a rule a feeding stuff containing a large per cent. of fiber is considered low grade.

Ash, or mineral matter, in a feed produces the bony structures and is found in the various tissues and secretions

of the body. Lime, potash and phosphoric acid are the valuable constituents.

## ANALYSES.

The analyses given in the following tables represent the various kinds of feeds found on the Kentucky market by our inspectors. For convenience, the analyses of feeds of the same class are grouped together.

The definitions of terms of different materials used as feeds and in compounding the various mixed feeds are given on another page of this bulletin.

### TABLE I.

In this table are classed all straight feeds, or feeds made from one grain or cereal only. The grains or cereals from which these feeds are made are given in alphabetical order and the names of the products of each grain or cereal are given in alphabetical order also.

Analyses were made of five samples of alfalfa meal, two of which fell below guaranty in both protein and fat; three samples of animal products, one falling below in protein; two samples of barley; five of dried beet pulp; one of buckwheat; four of corn bran, one of which fell below guaranty in both protein and fat; forty-four samples of corn chop were analyzed, six of which fell below in protein and eight in fat, two contained an excess of corn bran and two were misbranded; eleven samples of cracked corn were taken, four of which were below in fat; twenty of corn feed meal, two of which fell below in protein, seven in fat, two contained an excess of corn bran, and two were adulterated; of the twenty-two samples of cotton seed meal that were analyzed, fifteen fell below guaranty in protein. Only one sample of germ meal was taken; twenty-five hominy feed, four of which fell below in fat and one contained an excess of corn bran; ten samples of oil meal, two of which fell below in protein and one contained screenings; forty-four samples of wheat bran, five of which fell below in protein, eleven in fat, seven were adulterated and four were shipstuff; twenty-three samples of mid-

dlings, two of which fell below in protein, six in fat and three were adulterated. One hundred and twenty-two samples of shipstuff were analyzed, ten of which fell below guaranty in protein, twenty-four in fat, seven were adulterated with corn bran, seven adulterated with screenings, and ten contained corn cockle. Thirteen analyses were made of shorts, of which one fell below in protein, one in fat, three were adulterated with corn bran, two with screenings and two were misbranded.

It will be noted that practically all of the Cotton Seed Meals fell below guaranty in protein.

TABLE II.

Table II contains a class of mixed feeds composed of wheat products and corn products, corn bran being the principal ingredient from corn, and Distillers' and Brewers' dried grains. In this class of feeds, except the Distillers' and Brewers' dried grains, the feeds are composed almost wholly of wheat products and in some instances our examinations showed no corn products whatever. However, the percentage of corn product, usually corn bran, used in this class of feed ran from a mere trace to twenty or thirty per cent.

There were one hundred and seventy-five samples of this class of feeds analyzed, sixteen of which fell below in protein, twenty-nine in fat, eight contained screenings and three corn cockle. Six samples of Distillers' Dried Grains were taken, three of which fell below in protein and four in fat. Only one sample of Brewers' Grains was taken, and it fell below in protein.

The department desires to call attention to the fact that we have recently found grain screenings mixed with Distillers' Dried Grains, a practice which has not been observed heretofore.

TABLE III.

In this table are included all feeds termed "chicken feeds." Most of the chicken feeds came up to guaranty in protein and fat, but varied from guaranty a good deal in the

ingredients. A number contained screenings with a large per cent. of weed seeds present.

TABLE IV.

In this table are grouped the miscellaneous feeds. These feeds are made up of the various concentrates found on the market and a combination of grains.

Thirty-eight of these feeds were analyzed. This class of feeds generally equaled their guaranty. A number of them contained screenings and fibrous material of little value, but these materials were listed in their guaranty.

TABLE V.

In this table all feeds containing a material of little or no feeding value, or a material that is not classified as a concentrate, are grouped. These feeds vary in their guaranties and are mixtures of materials of very low grade to high class materials. A number of the feeds contained a large amount of fibrous material such as cob meal, oat hulls, screenings, cotton seed hulls, etc., and sufficient amount of some material high in protein to bring up the average to a certain percentage. A good many of these feeds are very expensive as a source of digestible protein. The percentage of digestible protein in high fiber feeds is usually much smaller than in the low fiber feeds, and for this reason, they furnish feed material at a much higher price than it can be bought in the ordinary standard grains and their by-products. The use of such feeds often results in hardship for the animals that are fed on them, and to the owners of such animals as well.

Forty-nine samples of this class of feed were analyzed and a number of them fell below guaranty in both protein and fat, and varied a good deal from their guaranties in the ingredients.

In the tables of analyses the manufacturers' guaranties are printed in bold face type.

To give a better idea of the relative food value of the common feeding stuffs the following table is added showing the average composition of the common materials.

AVERAGE COMPOSITION OF FEEDING STUFFS—PER CENT.

(Henry's, Jordan's and Lindsay's Compilations.)

| | Dry Matter | Water | Ash | Protein | Fat | Carbohydrates Fiber | Carbohydrates N-F Extract |
|---|---|---|---|---|---|---|---|
| Corn | 89.4 | 10.6 | 1.5 | 10.3 | 5.0 | 2.2 | 70.4 |
| Corn Meal | 85.0 | 15.0 | 1.4 | 9.2 | 3.8 | 1.9 | 68.7 |
| Corn Bran | 90.6 | 9.4 | 1.2 | 11.2 | 6.2 | 11.9 | 60.1 |
| Corn Chops | 87.2 | 12.3 | 1.5 | 9.8 | 4.4 | 2.0 | 69.5 |
| Hominy Meal | 90.4 | 9.6 | 2.7 | 10.5 | 8.0 | 4.9 | 64.3 |
| Gluten Feed | 90.8 | 9.2 | 2.0 | 25.0 | 3.5 | 6.8 | 53.5 |
| Corn & Cob Meal | 84.9 | 15.1 | 1.5 | 8.5 | 3.5 | 6.6 | 64.8 |
| Corn Cob | 89.3 | 10.7 | 1.4 | 2.4 | 0.5 | 30.1 | 54.9 |
| Oats | 89.6 | 10.4 | 3.2 | 11.4 | 4.8 | 10.8 | 59.4 |
| Oat Middlings | 91.2 | 8.8 | 4.5 | 16.2 | 6.9 | 7.1 | 56.5 |
| Oat Feed | 93.0 | 7.0 | 5.3 | 8.0 | 2.9 | 21.5 | 55.3 |
| Wheat | 89.5 | 10.5 | 1.8 | 11.9 | 2.1 | 1.8 | 71.9 |
| Wheat Bran | 88.1 | 11.9 | 5.8 | 15.4 | 4.0 | 9.0 | 53.9 |
| Wheat Middlings (shorts) | 88.8 | 11.2 | 4.4 | 16.9 | 5.1 | 6.2 | 56.2 |
| Flour Middlings | 90.0 | 10.0 | 3.2 | 19.2 | 4.8 | 3.2 | 59.6 |
| Shipstuff | 89.1 | 10.9 | 5.6 | 16.3 | 4.6 | 7.5 | 55.1 |
| Rye | 91.3 | 8.7 | 2.1 | 11.3 | 1.9 | 1.5 | 74.5 |
| Rye Feed (shorts & bran) | 87.8 | 12.4 | 3.2 | 15.7 | 3.1 | 4.1 | 61.5 |
| Barley | 89.2 | 10.8 | 2.5 | 12.0 | 1.8 | 4.2 | 68.7 |
| Buckwheat | 86.6 | 13.4 | 2.0 | 10.8 | 2.4 | 11.7 | 59.7 |
| Buckwheat Feed | 88.4 | 11.6 | 3.9 | 18.3 | 4.9 | 19.2 | 42.1 |
| Brewers Dried Grains | 91.3 | 8.7 | 3.7 | 25.0 | 6.7 | 13.6 | 42.3 |
| Distillers Dried Grains | 92.4 | 7.6 | 2.0 | 31.2 | 12.2 | 11.6 | 35.4 |
| Malt Sprouts | 90.5 | 9.5 | 6.1 | 26.3 | 1.6 | 11.6 | 44.9 |
| Flax Seed | 90.8 | 9.2 | 4.3 | 22.6 | 33.7 | 7.1 | 23.2 |
| Linseed Meal (O. process) | 90.2 | 9.8 | 5.5 | 33.9 | 7.8 | 7.3 | 35.7 |
| Linseed Meal (N. process) | 91.0 | 9.0 | 5.5 | 37.5 | 2.0 | 8.9 | 36.4 |
| Cotton Seed | 89.7 | 10.3 | 3.5 | 18.4 | 19.9 | 23.2 | 24.7 |
| Cotton Seed Meal | 93.0 | 7.0 | 6.6 | 45.3 | 10.2 | 6.3 | 24.6 |
| Rice | 87.6 | 12.4 | 0.4 | 7.4 | 0.4 | 0.2 | 79.2 |
| Rice Bran | 90.3 | 9.7 | 9.7 | 11.9 | 10.1 | 12.0 | 46.6 |
| Rice Meal | 89.8 | 10.2 | 8.1 | 12.0 | 13.1 | 5.4 | 51.2 |
| Rice Polish | 89.2 | 10.8 | 4.8 | 11.9 | 7.2 | 3.3 | 62.3 |
| Alfalfa Hay | 91.6 | 8.4 | 7.4 | 14.3 | 2.2 | 25.0 | 42.7 |
| Dried Beet Pulp | 91.6 | 8.4 | 4.5 | 8.1 | 0.7 | 17.5 | 60.8 |
| Meat Scraps | 89.3 | 10.7 | 4.1 | 71.2 | 13.7 | .... | 0.3 |
| Molasses Feed | 89.6 | 10.4 | 6.5 | 17.1 | 2.9 | 11.9 | 51.2 |
| Mixed Feed (shipstuff 80%, corn bran 20%) | 89.6 | 10.4 | 4.13 | 14.6 | 5.18 | 8.97 | 56.76 |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| | | **Alfalfa.** | | |
| 1101-11 | Alfalfa Meal | The Consolidated Alfalfa Milling Co., Newton, Kansas. | 16.53<br>14.00 | 2.40<br>1.20 |
| 14-11 | Alfalfa Meal | Albert Dickinson Co. Chicago, Ill. | 13.69<br>12.00 | 2.14<br>1.00 |
| 14-11 | Alfalfa Meal | Albert Dickinson Co. Chicago, Ill. | 13.19<br>12.00 | 1.32<br>1.00 |
| 413-12 | Double "S" Alfalfa Meal | A. Schneiders' Sons Louisville, Ky. | 14.74<br>15.50 | 1.50<br>2.06 |
| 976-12 | Wichita Alfalfa Meal | Wichita Alfalfa Stock Food Co. Wichita, Kansas. | 12.22<br>13.00 | 1.93<br>2.00 |
| | | **Animal Products.** | | |
| 784-12 | Meat Scraps | Darling & Co. Chicago, Ill. | 58.38<br>55.00 | 12.37<br>10.00 |
| 999-12 | Atlas Beef Scraps | Southern Seed Co. Louisville, Ky. | 57.97<br>55.00 | 10.58<br>5.00 |
| 399-11 | Digester Tankage | Swift & Co. Chicago, Ill. | 54.47<br>60.00 | 10.48<br>8.00 |
| | | **Barley.** | | |
| 1065-10 | Malt Sprouts (Light) | Frank Fehr Brewing Co. Louisville, Ky. | 20.06<br>18.88 | 2.19<br>1.12 |
| 1066-10 | Malt Sprouts (Heavy) | Frank Fehr Brewing Co. Louisville, Ky. | 22.50<br>20.75 | 2.21<br>1.33 |
| | | **Beet Pulp.** | | |
| 114-12 | Dried Beet Pulp | The Early & Daniel Co. Covington, Ky. | 8.66<br>8.00 | 0.47<br>0.50 |
| 514-11 | Dried Beet Pulp | Larrowe Milling Co. Detroit, Mich. | 9.31<br>8.00 | 1.05<br>0.50 |
| 514-11 | Dried Beet Pulp | Larrowe Milling Co. Detroit, Mich. | 8.50<br>8.00 | 0.69<br>0.50 |
| 514-11 | Dried Beet Pulp | Larrowe Milling Co. Detroit, Mich. | 8.78<br>8.00 | 0.63<br>0.50 |
| 1058-11 | Dried Beet Pulp | W. H. Small & Co. Evansville, Ind. | 7.88<br>8.00 | 0.93<br>0.50 |
| | | **Buckwheat.** | | |
| 367-11 | Buckwheat | Edinger & Co. Louisville, Ky. | 16.56<br>15.44 | 4.43<br>3.41 |
| | | **Corn Bran.** | | |
| 477-12 | Corn Bran | Bonnie Bros. Louisville, Ky. | 11.47<br>9.00 | 8.25<br>6.50 |

## ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 1101-11 | Humphrey Bros. ..... Wakefield, Ky. | Alfalfa Hay ..... | |
| 14-11 | W. T. Skillman & Co..... Owensboro, Ky. | Alfalfa Hay ..... | |
| 14-11 | I. F. Tabb ..... Mt. Sterling, Ky. | Alfalfa Hay ..... | |
| 413-12 | O. F. Schaftlein ..... Shively, Ky. | Alfalfa Hay ..... | Below in protein and fat. |
| 976-12 | D. A. McCormick ..... Owensboro, Ky. | Alfalfa Hay ..... | Below in protein and fat. |
| 784-12 | S. C. Jennings & Co..... Madisonville, Ky. | Meat Scraps ..... | |
| 999-12 | F. A. Yost Co..... Hopkinsville, Ky. | Meat Product ..... | |
| 399-11 | W. S. Overstreet ..... LaGrange, Ky. | Meat and Bone Residues. | Below in protein. |
| 1065-10 | A. Reichtmuth ..... Louisville, Ky. | Barley ..... | |
| 1066-10 | A. Reichtmuth ..... Louisville, Ky. | Barley ..... | |
| 114-12 | Albert Hartman ..... Covington, Ky. | Residue of Beets after extraction of Sugar. | |
| 514-11 | Joe Bisig ..... St. Mathews, Ky. | Residue of Beets after extraction of Sugar. | |
| 514-11 | A. Burkholder ..... Louisville, Ky. | Residue of Beets after extraction of Sugar. | |
| 514-11 | A. Schoenbauhler ..... Louisville, Ky. | Residue of Beets after extraction of Sugar. | |
| 1058-11 | Barnett Feed & Com. Co.. Henderson, Ky. | Residue of Beets after extraction of Sugar. | |
| 367-11 | Oehrle Bros. ..... Shively, Ky. | Buckwheat ..... | |
| 477-12 | M. Exley ..... Louisville, Ky. | Corn ..... | |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 543-7 | Corn Bran | Bradley Bros. | 9.06 | 7.10 |
| | | Paducah, Ky. | 10.69 | 7.80 |
| 1016-10 | Corn Bran | Ohio Valley Mills | 12.94 | 8.90 |
| | | Louisville, Ky. | 9.00 | 6.50 |
| 567-12 | Corn Bran | Orndorff & Russell | 10.85 | 9.58 |
| | | Adairville, Ky. | 6.94 | 4.85 |
| | Corn Chop. | | | |
| 719-9 | Corn Chop | A. J. Arnold | 8.03 | 4.15 |
| | | Slaughtersville, Ky. | 8.64 | 4.26 |
| 1226-11 | Corn Chop | Blackford Milling Co. | 8.41 | 4.48 |
| | | Blackford, Ky. | 8.40 | 4.00 |
| 544-7 | Corn Chop | Bradley Bros. | 9.91 | 4.96 |
| | | Paducah, Ky. | 8.34 | 4.36 |
| 182-11 | Corn Chop | Chas. Broeker & Co. | 10.19 | 8.53 |
| | | Owensboro, Ky. | 9.00 | 5.00 |
| 182-11 | Corn Chop | Chas. Broeker & Co. | 9.06 | 6.70 |
| | | Owensboro, Ky. | 9.00 | 5.00 |
| 149-11 | Corn Chop | Browder Milling Co. | 9.06 | 3.48 |
| | | Fulton, Ky. | 7.48 | 4.74 |
| 861-12 | Corn Chop and Corn Bran | D. J. Burchett | 9.72 | 3.98 |
| | | Louisa, Ky. | 9.33 | 5.22 |
| 1168-11 | Corn Chop | W. H. Carlin & Co. | 8.19 | 3.67 |
| | | Owensboro, Ky. | 8.75 | 4.00 |
| 511-12 | Corn Chop | Jas. Cate & Son Co. | 10.03 | 4.18 |
| | | Hopkinsville, Ky. | 8.18 | 4.11 |
| 493-8 | Famous Corn Chop | Corydon Milling Company | 8.35 | 4.45 |
| | | Corydon, Ky. | 9.40 | 4.80 |
| 160-12 | Corn Chop | Crown Roller Mills | 8.66 | 3.93 |
| | | Morganfield, Ky. | 8.50 | 4.50 |
| 762-11 | Corn Chop | Dawson Milling Co. | 8.94 | 4.76 |
| | | Dawson Springs, Ky. | 8.80 | 4.00 |
| 1163-11 | Corn Chop | J. W. Duncan | 8.38 | 4.19 |
| | | Owensboro, Ky. | 8.62 | 3.64 |
| 129-11 | Corn Chop | Ellis & Cline | 9.75 | 4.30 |
| | | Rumsey, Ky. | 8.65 | 4.25 |
| 731-9 | Corn Chop | T. M. Ellis & Co. | 10.13 | 4.57 |
| | | Russellville, Ky. | 8.65 | 4.12 |
| 635-12 | Pure Corn Chop | W. M. Farless | 9.19 | 4.58 |
| | | Henderson, Ky. | 9.00 | 4.00 |
| 729-9 | Corn Chop | Fordsville Milling Co. | 8.94 | 4.33 |
| | | Fordsville, Ky. | 8.00 | 4.00 |
| 733-11 | Corn Chop | Fuqua & Co. | 9.44 | 4.23 |
| | | Livermore, Ky. | 8.50 | 4.00 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 543-7 | Manufacturer's Warehouse | Corn ..... | Below in protein and fat. |
| 1016-10 | C. Moses ..... Shively, Ky. | Corn ..... | |
| 567-12 | Manufacturer's Warehouse | Corn ..... | |
| 717-9 | Manufacturer's Warehouse | Corn ..... | Below in protein. Excess corn bran. |
| 1226-11 | Manufacturer's Warehouse | Corn ..... | |
| 544-7 | Manufacturer's Warehouse | Corn ..... | |
| 182-11 | Central City Wholesale & Retail Feed & Sup Co... Central City, Ky. | Corn ..... | Hominy Chop. |
| 182-11 | J. H. Roberts ..... Fordsville, Ky. | Corn ..... | |
| 149-11 | Manufacturer's Warehouse | Corn ..... | Below in fat. |
| 861-12 | Manufacturer's Warehouse | Corn, Corn Bran..... | Below in fat. |
| 1168-11 | D. P. Ratican ..... Owensboro, Ky. | Corn ..... | Below in protein. |
| 511-12 | J. W. Overby ..... Hopkinsville, Ky. | Corn ..... | |
| 493-8 | Manufacturer's Warehouse | Corn ..... | |
| 160-12 | D. E. Alvey ..... Morganfield, Ky. | Shelled Corn ..... | Below in fat. |
| 762-11 | Manufacturer's Warehouse | Corn ..... | |
| 1163-11 | D. P. Ratican ..... Owensboro, Ky. | Corn ..... | |
| 129-11 | Manufacturer's Warehouse | Corn ..... | Excess of Corn Bran. |
| 731-9 | Manufacturer's Warehouse | Corn ..... | |
| 635-12 | Henderson F. & Com. Co.. Henderson, Ky. | Corn ..... | |
| 729-9 | Manufacturer's Warehouse | Corn ..... | |
| 733-11 | Manufacturer's Warehouse | Corn ..... | |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 733-11 | Corn Chop | Fuqua & Co. | 9.44 | 4.63 |
| | | Livermore, Ky. | 8.50 | 4.00 |
| 653-11 | Corn Chop | Gwinn Bros. & Co. | 10.31 | 4.84 |
| | | Huntington, W. Va. | 8.19 | 4.29 |
| ..... | Corn Chop | Hanson Roller Mills | 8.81 | 4.06 |
| | | Hanson, Ky. | 8.50 | 4.07 |
| 1181-11 | Corn Chop | Jenkins-Ryan Milling Co. | 10.03 | 4.82 |
| | | Adairville, Ky. | 8.59 | 3.75 |
| 718-12 | Corn Chop | Johns Bros. Milling Co. | 9.00 | 3.98 |
| | | Henshaw, Ky. | 8.50 | 4.00 |
| 443-11 | Corn Chop | R. U. Kevil & Sons | 8.50 | 3.75 |
| | | Mayfield, Ky. | 8.50 | 4.00 |
| 96-12 | Corn Chop | R. U. Kevil & Sons | 9.47 | 4.50 |
| | | Princeton, Ky. | 8.66 | 3.96 |
| 840-12 | Corn Chop | Lewisburg Milling Co. | 9.16 | 4.78 |
| | | Lewisburg, Ky. | 9.19 | 5.23 |
| 88-11 | Quail Chop | Madisonville Milling Co. | 8.19 | 3.80 |
| | | Madisonville, Ky. | 8.25 | 3.93 |
| 1029-11 | Pure Corn Chop | Marion Milling Co. | 9.00 | 4.93 |
| | | Marion, Ky. | 9.40 | 4.80 |
| 741-9 | Corn Chop | McDaniel & White | 8.56 | 4.33 |
| | | Olaton, Ky. | 8.50 | 4.00 |
| 837-6 | Corn Chop | A. J. Melton | 8.47 | 4.26 |
| | | Sebree, Ky. | 8.75 | 4.00 |
| 617-10 | Corn Chop | Morganfield Roller Mills | 8.97 | 3.75 |
| | | Morganfield, Ky. | 9.40 | 4.80 |
| 702-9 | Corn Chop | E. F. Ogden | 8.25 | 4.21 |
| | | Slaughtersville, Ky. | 8.00 | 4.50 |
| 496-11 | Corn Chop | Ohio Valley Mill & Supply Co. | 9.38 | 3.01 |
| | | Ashland, Ky. | 8.75 | 3.63 |
| 820-12 | Corn Chop | Parrish & Hankins | 8.78 | 4.34 |
| | | Providence, Ky. | 8.00 | 4.44 |
| 423-11 | Corn Chop | The Patton Milling Co. | 9.13 | 3.44 |
| | | Catlettsburg, Ky. | 8.50 | 3.50 |
| 596-11 | Corn Chop | R. C. Poage Milling Co. | 9.19 | 3.77 |
| | | Ashland, Ky. | 8.31 | 3.85 |
| 925-12 | Corn Chop | Red Cross Milling Co. | 8.25 | 3.77 |
| | | Clay, Ky. | 8.50 | 4.25 |
| 1059-11 | Corn Chop | W. M. Ringo | 9.38 | 3.98 |
| | | Clinton, Ky. | 8.75 | 4.00 |
| 1194-11 | Corn Chop | Rockport Milling Co. | 8.00 | 3.51 |
| | | Rockport, Ind. | 8.59 | 3.75 |
| 563-12 | Ohio River Chopped Corn | T. A. Sandefur | 8.91 | 4.93 |
| | | Henderson, Ky. | 9.40 | 4.80 |

## Analyses of Inspectors' Samples.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 733-11 | Manufacturer's Warehouse | Corn ..... | |
| 653-11 | J. A. Maddox & Son..... Olive Hill, Ky. | Corn ..... | |
| ..... | Manufacturer's Warehouse | Corn ..... | |
| 1181-11 | Manufacturer's Warehouse | Corn ..... | |
| 718-12 | Manufacturer's Warehouse | Shelled Corn ..... | |
| 443-11 | Manufacturer's Warehouse | Corn ..... | |
| 96-12 | Jas. N. Norris ..... Princeton, Ky. | Corn ..... | |
| 840-12 | Clarence Howard ..... Russellville, Ky. | Corn ..... | |
| 88-11 | W. E. Ellis ..... Hartford, Ky. | Corn ..... | |
| 1029-11 | Manufacturer's Warehouse | Corn ..... | |
| 741-9 | Manufacturer's Warehouse | Corn ..... | |
| 837-6 | C. M. Cox ..... Sebree, Ky. | Corn ..... | |
| 617-10 | Manufacturer's Warehouse | Corn ..... | Below in both protein and fat. |
| 702-9 | Manufacturer's Warehouse | Corn ..... | |
| 496-11 | F. P. Blair ..... Morehead, Ky. | Corn ..... | Below in fat. |
| 820-12 | W. N. Payne ..... Providence, Ky. | Corn ..... | |
| 423-11 | Catlettsburg F. & Sup. Co.. Catlettsburg, Ky. | Shelled Corn ..... | |
| 596-11 | Leffingwell & Co. ..... Ashland, Ky. | Corn ..... | |
| 925-12 | Manufacturer's Warehouse | Corn ..... | Below in both protein and fat. |
| 1059-11 | Manufacturer's Warehouse | Corn ..... | |
| 1194-11 | Owensboro F. & Seed Co.. Owensboro, Ky. | Corn ..... | Below in protein. |
| 563-12 | Barnett Feed & Com. Co.. Henderson, Ky. | Corn ..... | Below in protein. |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 1099-11 | Corn Chop | W. H. Small & Co. | 8.88 | 4.23 |
| | | Evansville, Ind. | 8.66 | 4.51 |
| 929-12 | Corn Chop | Sturgis Milling Co. | 8.72 | 3.55 |
| | | Sturgis, Ky. | 8.50 | 4.10 |
| 1130-11 | Sterling Chop | I. F. Tabb | 9.28 | 3.56 |
| | | Mt. Sterling, Ky. | 8.25 | 4.00 |
| 615-8 | Corn Chop | Thompson & Tweddell | 9.72 | 4.12 |
| | | Calhoun, Ky. | 8.50 | 4.25 |
| | **Cracked Corn.** | | | |
| 73-11 | Callahan's Cracked Corn | Callahan & Son | 9.13 | 3.33 |
| | | Louisville, Ky. | 8.62 | 4.00 |
| 81-11 | Cracked Corn | Early & Daniel Co. | 8.69 | 3.35 |
| | | Covington, Ky. | 8.60 | 4.00 |
| 673-11 | Cracked Corn | Early & Daniel Co. | 8.94 | 4.13 |
| | | Cincinnati, Ohio. | 8.60 | 4.00 |
| 3-12 | Cracked Corn | Farris Bros. | 8.44 | 4.48 |
| | | Cave City, Ky. | 8.25 | 4.00 |
| 800-9 | Crushed Corn | Harlan & Lowe Milling Co. | 9.56 | 4.20 |
| | | Bardwell, Ky. | 8.65 | 4.12 |
| 260-11 | Cracked Corn | Island Grove Mill Co. | 9.63 | 3.72 |
| | | Greenfield, Ohio. | 8.65 | 4.12 |
| 460-12 | Cracked Corn | Louisville Cereal Mill Co. | 8.63 | 3.16 |
| | | Louisville, Ky. | 7.75 | 2.55 |
| 672-12 | Cracked Corn | J. B. Ramsey | 9.69 | 4.75 |
| | | Sebree, Ky. | 8.60 | 3.75 |
| 231-12 | Smith's Pure Cracked Corn | H. C. Smith & Sons | 8.69 | 3.49 |
| | | Harrodsburg, Ky. | 9.40 | 4.80 |
| 702-11 | Atlas Cracked Corn | Southern Seed Co. | 8.56 | 3.02 |
| | | Louisville, Ky. | 8.75 | 4.00 |
| 702-11 | Atlas Cracked Corn | Southern Seed Co. | 8.25 | 2.88 |
| | | Louisville, Ky. | 8.75 | 4.00 |
| | **Feed Meal.** | | | |
| 1006-11 | Feed Meal | R. Brett | 8.31 | 2.95 |
| | | Mayfield, Ky. | 9.45 | 5.53 |
| 784-11 | Corn Feed Meal | The Cincinnati Grain Co. | 9.22 | 4.18 |
| | | Covington, Ky. | 8.50 | 4.25 |
| 215-12 | Corn Feed Meal | The Cincinnati Grain Co. | 8.22 | 3.45 |
| | | Covington, Ky. | 8.50 | 4.25 |
| 725-12 | Feed Meal | C P. Dodd & Co. | 10.00 | 2.94 |
| | | Louisville, Ky. | 8.50 | 4.20 |
| 606-11 | Dusing's Corn Meal | The Dorsel Co. | 8.69 | 3.79 |
| | | Newport, Ky. | 8.63 | 4.25 |
| 468-12 | Dorsel's Corn Meal | The Dorsel Co. | 7.75 | 3.16 |
| | | Newport, Ky. | 9.06 | 4.16 |

## Analyses of Inspectors' Samples.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 1099-11 | W. E. Ellis ..... Hartford, Ky. | Corn ..... | Sample is Corn Meal. |
| 929-11 | Manufacturer's Warehouse | Corn ..... | Below in fat. |
| 1130-11 | Manufacturer's Warehouse | Corn ..... | Below in fat. |
| 615-8 | Manufacturer's Warehouse | Corn ..... | |
| 73-11 | Edw. Zehnder ..... Louisville, Ky. | Corn ..... | Below in fat. |
| 81-11 | E. H. Riggs ..... Erlanger, Ky. | Corn ..... | |
| 673-11 | W. R. Henderson ..... Vanceburg, Ky. | Corn ..... | |
| 3-12 | Manufacturer's Warehouse | Corn ..... | |
| 800-9 | Manufacturer's Warehouse | Corn ..... | |
| 260-11 | N. D. Taboe ..... Olive Hill, Ky. | Corn ..... | |
| 460-12 | Floyd Day & Co. ..... Jackson, Ky. | Corn ..... | |
| 672-12 | Manufacturer's Warehouse | Corn ..... | |
| 231-12 | Manufacturer's Warehouse | Corn ..... | Below in fat. |
| 702-11 | J. H. Roberts ..... Fordsville, Ky. | Corn ..... | Below in fat. |
| 702-11 | W. E. Ellis ..... Hartford, Ky. | Corn ..... | Below in fat. |
| 1006-11 | Manufacturer's Warehouse | Corn ..... | Below in protein and fat. |
| 784-11 | C. Schulte ..... Latonia, Ky. | Corn ..... | |
| 215-12 | H. Trenkamp ..... Covington, Ky. | Corn ..... | Below in fat. |
| 725-12 | D. Zehnder ..... St. Mathews, Ky. | Corn ..... | Contains weed seeds, charcoal and particles of wheat. Below in fat. |
| 606-11 | H. Dusing ..... Covington, Ky. | Corn ..... | |
| 468-12 | H. Dusing ..... Covington, Ky. | Corn ..... | Below in both protein and fat. |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 104-11 | E. G. D. & Co.'s Feed Meal | E. G. Duckwall & Co. Louisville, Ky. | 9.10<br>8.00 | 4.06<br>3.58 |
| 104-11 | E. G. D. & Co.'s Feed Meal | E. G. Duckwall & Co. Louisville, Ky. | 8.88<br>8.00 | 3.74<br>3.58 |
| 83-11 | Yellow Corn Meal | Early & Daniel Co. Covington, Ky. | 8.94<br>8.43 | 4.20<br>4.29 |
| 83-11 | Yellow Corn Meal | Early & Daniel Co. Covington, Ky. | 9.25<br>8.43 | 4.92<br>4.29 |
| 112-12 | Yellow Corn Meal | Early & Daniel Co. Covington, Ky. | 8.63<br>8.43 | 3.93<br>4.29 |
| 483-12 | Feed Meal | Edinger & Co. Louisville, Ky. | 9.31<br>8.76 | 4.90<br>3.98 |
| 394-11 | Feed Meal | J. H. Fedders & Son Covington, Ky. | 9.16<br>8.56 | 3.88<br>4.40 |
| 646-12 | Feed Meal | J. H. Fedders & Son Covington, Ky. | 8.60<br>8.56 | 4.28<br>4.40 |
| 1119-11 | Corn Meal | Fogarty & Rutledge Covington, Ky. | 8.50<br>8.85 | 4.11<br>4.35 |
| 376-11 | Feed Meal | H. Fruechtenicht Louisville, Ky. | 8.63<br>9.50 | 3.42<br>3.69 |
| 473-12 | Feed Meal | H. Fruechtenicht Louisville, Ky. | 9.25<br>9.50 | 3.91<br>3.69 |
| 59-11 | Corn Meal | Geo. Keller Newport, Ky. | 8.19<br>8.55 | 4.35<br>4.27 |
| 59-11 | Corn Meal | Geo. Keller Newport, Ky. | 9.22<br>8.55 | 3.86<br>4.27 |
| 59-11 | Corn Meal | Geo. Keller Newport, Ky. | 8.56<br>8.55 | 4.62<br>4.27 |
| 254-11 | Corn Meal | Nordmeyer & Berding Covington, Ky. | 8.85<br>8.62 | 3.87<br>4.85 |
| 527-12 | Corn Meal | Nordmeyer & Berding Covington, Ky. | 8.41<br>8.62 | 3.78<br>4.85 |
| 32-11 | Feed Meal | F. Raidt Milling Co. Louisville, Ky. | 9.16<br>8.31 | 4.95<br>3.85 |
| 156-12 | Feed Meal | F. Raidt Milling Co. Louisville, Ky. | 9.88<br>8.31 | 6.60<br>3.85 |
| 997-12 | Atlas Corn Meal | Southern Seed Co. Louisville, Ky. | 10.19<br>8.50 | 3.85<br>4.00 |
| 234-11 | Corn Feed Meal | Standard Hay & Grain Co. Cincinnati, Ohio. | 8.97<br>8.56 | 3.98<br>4.10 |
| 32-12 | Pearl Feed Meal | J. W. Thompson Madisonville, Ky. | 9.53<br>8.75 | 4.12<br>3.89 |
| 133-11 | Corn Feed Meal | Amos Yaeger Louisville, Ky. | 8.78<br>8.43 | 4.25<br>4.48 |

## Analyses of Inspectors' Samples.

| Reg. No. | Sample Taken From | Ingredients Guaranteed. | Remarks—Variance from Guaranty. |
|---|---|---|---|
| 104-11 | F. Wittwer ..... Louisville, Ky. | Corn ..... | |
| 104-11 | Oehrle Bros. ..... Shively, Ky. | Corn ..... | |
| 83-11 | E. H. Riggs ..... Erlanger, Ky. | Corn ..... | Contains excess of Corn Bran. |
| 83-11 | H. Dieckman ..... Newport, Ky. | Corn ..... | |
| 112-12 | W. T. Reeves ..... Sanfordtown, Ky. | Corn ..... | |
| 483-12 | Oehrle Bros. ..... Shively, Ky. | Corn ..... | |
| 394-11 | B. Dueckle ..... Covington, Ky. | Corn ..... | Excess Corn Bran. Below in fat. |
| 646-12 | H. Techler ..... Covington, Ky. | Corn ..... | |
| 1119-11 | H. Kollmann ..... Latonia, Ky. | Yellow Corn ..... | |
| 376-11 | Joe Bisig ..... St. Mathews, Ky. | Corn ..... | Below in protein. |
| 473-12 | John Wittwer ..... Louisville, Ky. | Corn ..... | |
| 59-11 | Geo. Weyman ..... Newport, Ky. | Corn ..... | |
| 59-11 | Geo. Weyman ..... Newport, Ky. | Corn ..... | |
| 59-11 | Geo. B. Moock ..... Newport, Ky. | Corn ..... | |
| 254-11 | H. Steinken ..... Covington, Ky. | Corn ..... | Below in fat. |
| 527-12 | Henry Feldmann ..... Newport, Ky. | Corn ..... | Below in fat. |
| 32-11 | Joe Bisig ..... St. Mathews, Ky. | Corn ..... | |
| 156-12 | Ben Grieve ..... Louisville, Ky. | Corn ..... | |
| 997-12 | Ochsner Bros. ..... St. Mathews, Ky. | Corn ..... | Contains hulls of cow peas and the starch of leguminous grains, probably cow peas or ordinary peas. |
| 234-11 | C. E. Hamilton ..... Covington, Ky. | Corn ..... | Below in fat. |
| 32-12 | Manufacturer's Warehouse | Corn ..... | Cracked Corn. |
| 133-11 | Chas. Kaelin, Jr. ..... St. Mathews, Ky. | Corn ..... | |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 133-11 | Corn Feed Meal | Amos Yaeger | 8.88 | 5.71 |
| | | Louisville, Ky. | 8.43 | 4.48 |
| 749-8 | Germ Food | J. H. Fedders & Son | 11.72 | 7.94 |
| | | Covington, Ky. | 14.54 | 6.45 |
| | **Hominy Feed.** | | | |
| 183-11 | Hominy Feed | Chas. Broeker & Co. | 10.80 | 8.81 |
| | | Owensboro, Ky. | 10.00 | 10.00 |
| 183-11 | Hominy Feed | Chas. Broeker & Co. | 10.28 | 10.47 |
| | | Owensboro, Ky. | 10.00 | 10.00 |
| 187-11 | Hominy Feed Meal | The Cincinnati Grain Co. | 11.13 | 9.23 |
| | | Covington, Ky. | 10.19 | 8.00 |
| 607-11 | Hominy Meal | The Dorsel Co. | 10.69 | 8.48 |
| | | Newport, Ky. | 9.78 | 8.83 |
| 78-11 | Hominy Meal | Early & Daniel Co. | 10.69 | 9.41 |
| | | Covington, Ky. | 9.86 | 8.22 |
| 78-11 | Hominy Meal | Early & Daniel Co. | 11.19 | 9.30 |
| | | Covington, Ky. | 9.86 | 8.22 |
| 360-11 | Hominy Meal | Edinger & Co. | 10.66 | 7.57 |
| | | Louisville, Ky. | 10.19 | 8.25 |
| 66-12 | "We Kno" Hominy Meal | Oscar Farmer & Sons | 10.69 | 8.55 |
| | | Louisville, Ky. | 9.25 | 7.52 |
| 389-11 | "We Kno" Hominy Meal | Oscar Farmer & Sons | 10.47 | 8.11 |
| | | Louisville, Ky. | 9.25 | 7.52 |
| 389-11 | "We Kno" Hominy Meal | Oscar Farmer & Sons | 10.35 | 8.04 |
| | | Louisville, Ky. | 9.25 | 7.52 |
| 395-11 | Hominy Feed | J. H. Fedders & Son | 11.03 | 8.04 |
| | | Covington, Ky. | 10.25 | 7.75 |
| 395-11 | Hominy Feed | J. H. Fedders & Son | 10.00 | 8.57 |
| | | Covington, Ky. | 10.25 | 7.75 |
| 54-11 | Hominy Feed | Geo. Keller | 10.13 | 8.21 |
| | | Newport, Ky. | 9.37 | 7.51 |
| 54-11 | Hominy Feed | Geo. Keller | 10.00 | 6.98 |
| | | Newport, Ky. | 9.37 | 7.51 |
| 54-11 | Hominy Feed | Geo. Keller | 10.91 | 10.22 |
| | | Newport, Ky. | 9.37 | 7.51 |
| 90-11 | Hominy Feed | Louisville Cereal Mill Co. | 9.47 | 8.67 |
| | | Louisville, Ky. | 9.11 | 8.25 |
| 90-11 | Hominy Feed | Louisville Cereal Mill Co. | 10.97 | 10.30 |
| | | Louisville, Ky. | 9.11 | 8.25 |
| 910-11 | Hominy Feed | Perin Bros. | 10.72 | 9.36 |
| | | Cincinnati, Ohio. | 10.69 | 9.15 |
| 35-11 | Hominy Meal | F. Raidt Milling Co. | 9.94 | 8.08 |
| | | Louisville, Ky. | 9.06 | 7.87 |

## ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 133-11 | Chas. Kaelin, Jr. ..... St. Mathews, Ky. | Corn ..... | |
| 749-8 | Joe Kahmann ..... Sanfordtown, Ky. | Corn ..... | Below in protein. |
| 183-11 | Central City Wholesale & Retail Feed & Sup Co... Central City, Ky. | Corn ..... | Below in fat. |
| 183-11 | B. F. Wallace ..... Fordsville, Ky. | Corn ..... | |
| 787-11 | H. Haarmeyer ..... Latonia, Ky. | White Corn ..... | |
| 607-11 | Andy Young ..... Ft. Thomas, Ky. | Corn ..... | |
| 78-11 | H. Dieckman ..... John's Hill, Ky. | Corn ..... | |
| 78-11 | Frank Huntemann..... Newport, Ky. | Corn ..... | |
| 360-11 | A. Burkholder ..... Louisville, Ky. | Corn ..... | Below in fat. |
| 66-12 | G. M. Fenley ..... Valley Station, Ky. | Corn ..... | |
| 389-11 | S. B. Morris ..... Sulphur, Ky. | Corn ..... | |
| 389-11 | G. M. Fenley ..... Valley Station, Ky. | Corn ..... | |
| 395-11 | W. T. Reeves ..... Sanfordtown, Ky. | Corn ..... | |
| 395-11 | B. Duechle ..... Covington, Ky. | Corn ..... | |
| 54-11 | Frank Huntemann ..... Newport, Ky. | Corn ..... | |
| 54-11 | F. Schuerman ..... Newport, Ky. | Corn ..... | Below in fat. |
| 54-11 | F. Schuerman ..... Newport, Ky. | Corn ..... | |
| 90-11 | J. S. Kaelin ..... Louisville, Ky. | Corn ..... | |
| 90-11 | A. Kaelin ..... St. Mathews, Ky. | Corn ..... | |
| 910-11 | J. C. Everett & Co..... Maysville, Ky. | Corn ..... | |
| 35-11 | Andy Kaelin ..... St. Mathews, Ky. | Corn ..... | |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 35-11 | Hominy Meal | F. Raidt Milling Co. Louisville, Ky. | 11.25<br>9.06 | 9.25<br>7.87 |
| 155-12 | Hominy Meal | F. Raidt Milling Co. Louisville, Ky. | 10.81<br>9.06 | 7.32<br>7.87 |
| 811-11 | Scioto Hominy Feed | Scioto Hominy Co. Portsmouth, Ohio. | 9.75<br>10.00 | 7.45<br>6.00 |
| 1007-10 | Hominy Feed | W. J. Sutton Newport, Ky. | 10.56<br>10.70 | 9.46<br>7.80 |
| 1007-10 | Hominy Feed | W. J. Sutton Newport, Ky. | 10.25<br>10.70 | 8.08<br>7.80 |
| 313-12 | Hominy Feed | Amos Yaeger Louisville, Ky. | 10.35<br>9.50 | 9.83<br>8.13 |
| | **Cotton Seed Meal.** | | | |
| ..... | Cotton Seed Meal | H. E. Bridges & Co. Memphis, Tenn. | 39.88<br>41.00 | 8.05<br>.... |
| ..... | Cotton Seed Meal | F. W. Brode & Co. Memphis, Tenn. | 40.00<br>41.00 | 7.59<br>6.00 |
| 130-12 | Cotton Seed Meal | F. W. Brode & Co. Memphis, Tenn. | 39.31<br>41.00 | ....<br>6.00 |
| 51-11 | "Owl Brand" High Grade Cotton Seed Meal | F. W. Brode & Co. Memphis, Tenn. | 39.41<br>41.00 | 7.20<br>6.00 |
| 51-11 | "Owl Brand" High Grade Cotton Seed Meal | F. W. Brode & Co. Memphis, Tenn. | 41.50<br>41.00 | 8.84<br>6.00 |
| 51-11 | "Owl Brand" High Grade Cotton Seed Meal | F. W. Brode & Co. Memphis, Tenn. | 38.75<br>41.00 | 6.58<br>6.00 |
| 51-11 | "Owl Brand" High Grade Cotton Seed Meal | F. W. Brode & Co. Memphis, Tenn. | 38.47<br>41.00 | 7.71<br>6.00 |
| 51-11 | "Owl Brand" High Grade Cotton Seed Meal | F. W. Brode & Co. Memphis, Tenn. | 39.41<br>41.00 | 8.12<br>6.00 |
| 51-11 | "Owl Brand" High Grade Cotton Seed Meal | F. W. Brode & Co. Memphis, Tenn. | 37.94<br>41.00 | 7.80<br>6.00 |
| 51-11 | "Owl Brand" High Grade Cotton Seed Meal | F. W. Brode & Co. Memphis, Tenn. | 41.91<br>41.00 | 10.06<br>6.00 |
| 1144-11 | Cotton Seed Meal | Brownsville Cotton Oil & Ice Co. Brownsville, Tenn. | 42.13<br>41.00 | 10.43<br>6.00 |
| 1144-11 | Cotton Seed Meal | Brownsville Cotton Oil & Ice Co. Brownsville, Tenn. | 37.47<br>41.00 | 9.03<br>6.00 |
| 256-11 | Cotton Seed Meal | Wm. A. Burnett Louisville, Ky. | 44.50<br>41.00 | 8.83<br>6.00 |
| 163-12 | Burnett's Best Cotton Seed Meal | Wm. A. Burnett Louisville, Ky. | 40.69<br>41.00 | 8.93<br>6.00 |
| 85-11 | Cotton Seed Meal | The Early & Daniel Co. Covington, Ky. | 40.50<br>41.41 | 8.67<br>6.94 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | FROM GUARANTY. | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 35-11 | F. Schurch ..... Louisville, Ky. | Corn ..... | |
| 155-12 | G. F. Gauman ..... Louisville, Ky. | Corn ..... | Below in fat. |
| 811-11 | Central Coal & Feed Co... Middlesboro, Ky. | Corn Hearts, Corn Bran. | |
| 1007-10 | Herm Feldmann..... Newport, Ky. | Corn ..... | |
| 1007-10 | Henry Feldmann ..... Newport, Ky. | Corn ..... | |
| 313-12 | Chas. Kaelin, Jr..... St. Mathews, Ky. | Corn ..... | Excess Corn Bran. |
| ..... | Harry Walker ..... Glendale, Ky. | Cotton Seed ..... | Below in protein. |
| ..... | R. B. Hutchcraft ..... Paris, Ky. | Cotton Seed ..... | Below in protein. |
| 130-12 | Abell & Sherman ..... Samuels, Ky. | Cotton Seed ..... | Below in protein. |
| 51-11 | Samuel Bros. ..... Deatsville, Ky. | Decorticated Cotton Seed. | Below in protein. |
| 51-11 | G. M. Fenley ..... Valley Station, Ky. | Decorticated Cotton Seed. | |
| 51-11 | T. W. Oglesby ..... Shelbyville, Ky. | Decorticated Cotton Seed. | Below in protein. |
| 51-11 | W. C. Strader ..... Vine Grove, Ky. | Decorticated Cotton Seed. | Below in protein. |
| 51-11 | H. J. Hunt ..... Vine Grove, Ky. | Decorticated Cotton Seed. | Below in protein. |
| 51-11 | H. J. Hunt ..... Vine Grove, Ky. | Decorticated Cotton Seed. | Below in protein. |
| 51-11 | T. H. Harned ..... Tonieville, Ky. | Decorticated Cotton Seed. | |
| 1144-11 | Wilson Bros. ..... Cave City, Ky. | Cotton Seed ..... | |
| 1144-11 | R. N. Durrett ..... Bloomfield, Ky. | Cotton Seed ..... | Below in protein. |
| 256-11 | Magruder Bros. ..... Goshen, Ky. | Cotton Seed ..... | |
| 163-12 | C. Merhoff's Sons ..... Louisville, Ky. | Decorticated Cotton Seed. | |
| 85-11 | Hudson & Hughes ..... Lancaster, Ky. | Cotton Seed ..... | Below in protein. |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| ..... | Cotton Seed Meal ..... | Imperial Cotton Oil Co..... | 39.31 | 10.25 |
| | | Chicago, Ill. | 41.00 | .... |
| 518-11 | "Louisville Brand" Cotton Seed Meal ..... | Louisville Cottonseed Products.. Co., Louisville, Ky. | 39.38 | 7.10 |
| | | | 41.00 | 6.00 |
| 518-11 | "Louisville Brand" Cotton Seed Meal ..... | Louisville Cottonseed Products Co., Louisville, Ky. | 38.78 | 7.23 |
| | | | 41.00 | 6.00 |
| 859-12 | "Louisville Brand" Cotton Seed Meal ..... | Louisville Cottonseed Products Co., Louisville, Ky. | 39.31 | 6.95 |
| | | | 41.00 | 6.00 |
| | | Southern Seed Co..... | 43.81 | 8.63 |
| 704-11 | Atlas Cotton Seed Meal..... | Louisville, Ky. | 41.00 | 6.00 |
| | | Tennessee Cotton Oil Co..... | 37.31 | 7.76 |
| 843-11 | Prime Cotton Seed Meal..... | Memphis, Tenn. | 38.61 | 8.00 |
| | | H. E. Bridges & Co..... | 40.56 | 8.85 |
| ..... | Choice Cotton Seed Meal..... | Memphis, Tenn. | 41.00 | 9.00 |
| | **Oil Meal.** | | | |
| 794-11 | Old Process Oil Meal..... | The Cincinnati Grain Co..... | 27.31 | 7.71 |
| | | Covington, Ky. | 32.00 | 7.50 |
| 794-11 | Old Process Oil Meal..... | The Cincinnati Grain Co..... | 27.88 | 9.30 |
| | | Covington, Ky. | 32.00 | 7.50 |
| 608-11 | Oil Meal ..... | The Dorsel Co..... | 33.10 | 6.61 |
| | | Newport, Ky. | 32.00 | 6.39 |
| 1214-11 | Linseed Meal ..... | Hirst & Begley Linseed Co..... | 34.50 | 10.09 |
| | | Chicago, Ill. | 34.00 | 8.00 |
| 915-11 | Oil Meal ..... | Geo. Keller ..... | 33.13 | 6.60 |
| | | Newport, Ky. | 32.44 | 6.59 |
| 915-11 | Oil Meal ..... | Geo. Keller ..... | 32.88 | 7.49 |
| | | Newport, Ky. | 32.44 | 6.59 |
| 915-11 | Oil Meal ..... | Geo. Keller ..... | 34.00 | 6.28 |
| | | Newport, Ky. | 32.44 | 6.59 |
| 720-9 | Old Process Laxo Cake Meal..... | Laxo Cake Meal Co..... | 25.78 | 7.76 |
| | | Chicago, Ill. | 25.00 | 8.00 |
| 1022-11 | Old Process Laxo Cake Meal..... | Laxo Cake Meal Co..... | 28.63 | 8.08 |
| | | Chicago, Ill. | 25.00 | 8.00 |
| 774-8 | Old Process Oil Meal..... | Metzger Seed & Oil Co..... | 33.00 | 6.80 |
| | | Toledo, Ohio. | 30.00 | 5.00 |
| | **Wheat Bran.** | | | |
| 584-8 | Wheat Bran ..... | Adams Bros. ..... | 15.85 | 3.89 |
| | | Cadiz, Ky. | 15.72 | 4.62 |
| 113-11 | Winter Wheat Bran..... | Akin-Erskine Milling Co..... | 16.19 | 3.87 |
| | | Evansville, Ind. | 15.66 | 3.17 |
| 170-11 | Ballard's Bran ..... | Ballard & Ballard Co..... | 15.68 | 3.62 |
| | | Louisville, Ky. | 14.50 | 4.10 |

## ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| ..... | Benj. Woodford ..... Paris, Ky. | Cotton Seed ..... | Below in protein. |
| 518-11 | C. Kaelin ..... St. Mathews, Ky. | Decorticated Cotton Seed. | Below in protein. |
| 518-11 | McAfee & Schramme .... Shelbyville, Ky. | Decorticated Cotton Seed. | Below in protein. |
| 859-12 | O. F. Schaftlein ..... Shively, Ky. | Decorticated Cotton Seed. | Below in protein. |
| 704-11 | D. G. D. Sandefur ..... Beaver Dam, Ky. | Cotton Seed ..... | |
| 843-11 | Edgewood Farm Dairy.... Paducah, Ky. | Cotton Seed ..... | Below in protein. |
| ..... | M. Woosley & Son ..... Elizabethtown, Ky. | Cotton Seed ..... | |
| 794-11 | H. Kollman ..... Latonia, Ky. | Flax Seed ..... | Below in protein. |
| 794-11 | H. Kollman ..... Latonia, Ky. | Flax Seed ..... | Below in protein. |
| 608-11 | Frank Huntemann ..... Newport, Ky. | Flax Seed ..... | |
| 1214-11 | Henderson F. & Com. Co Henderson, Ky. | Flax Seed ..... | |
| 915-11 | A. Bickers ..... South Bellevue, Ky. | Flax Seed ..... | |
| 915-11 | Geo. Weyman ..... Newport, Ky. | Flax Seed ..... | |
| 915-11 | A. Bickers ..... South Bellevue, Ky. | Flax Seed ..... | |
| 720-9 | Andy Kaelin ..... St. Mathews, Ky. | Flax Seed ..... | Flax Screenings present. |
| 1022-11 | Edw. Zehnder ..... Louisville, Ky. | Flax Seed, Field and Weed Seeds 15%. | |
| 774-8 | J. S. Stevens & Co..... Ashland, Ky. | Flax Seed ..... | |
| 584-8 | Manufacturer's Warehouse | Wheat ..... | Below in fat. |
| 113-11 | W. A. Young ..... Greenville, Ky. | Wheat. Wheat screenings 1%. | |
| 170-11 | Allendale Farms ..... Shelbyville, Ky. | Wheat ..... | |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 191-11 | Bran | Bowling Green Milling Co. | 13.72 | 4.33 |
| | | Bowling Green, Ky. | 15.00 | 4.25 |
| 1008-9 | Wheat Bran | V. A. Brock | 16.06 | 4.13 |
| | | Sparta, Ky. | 15.14 | 4.29 |
| 1008-9 | Wheat Bran | V. A. Brock | 15.88 | 3.45 |
| | | Sparta, Ky. | 15.14 | 4.29 |
| 1150-11 | Wheat Bran | Cayce Milling Co. | 16.44 | 4.20 |
| | | Cayce, Ky. | 15.20 | 4.07 |
| 209-12 | Wheat Bran | Cincinnati Grain Co. | 18.28 | 5.20 |
| | | Covington, Ky. | 15.00 | 4.00 |
| 404-10 | Wheat Bran | Cincinnati Grain Co. | 16.03 | 3.65 |
| | | Cincinnati, Ohio. | 15.18 | 4.35 |
| 64-8 | Wheat Bran | Coe & Wells | 17.16 | 3.43 |
| | | Martinsburg, Ky. | 16.81 | 3.64 |
| 751-12 | Wheat Bran | College Mill Co. | 14.85 | 3.71 |
| | | Franklin, Ky. | 15.56 | 4.68 |
| 422-9 | Wheat Bran | J. L. Collins | 16.50 | 3.93 |
| | | New Market, Ky. | 16.12 | 4.13 |
| 491-11 | Wheat Bran | The Early & Daniel Co. | 15.78 | 3.06 |
| | | Cincinnati, Ohio. | 14.53 | 4.00 |
| 676-11 | Wheat Bran | The Early & Daniel Co. | 15.56 | 3.92 |
| | | Cincinnati, Ohio | 14.53 | 4.00 |
| 485-12 | Bran | Edinger & Co. | 15.88 | 3.83 |
| | | Louisville, Ky. | 15.00 | 4.00 |
| 185-8 | Wheat Bran | Equity Mills | 15.94 | 4.19 |
| | | Salmon, Ky. | 15.00 | 4.00 |
| 1230-11 | Wheat Bran | Golconda Roller Mills | 17.06 | 4.23 |
| | | Golconda, Ill. | 15.63 | 4.86 |
| 55-11 | Bran | Geo. Keller | 16.91 | 4.41 |
| | | Newport, Ky. | 14.50 | 4.50 |
| 55-11 | Bran | Geo. Keller | 17.00 | 4.13 |
| | | Newport, Ky. | 14.50 | 4.50 |
| 55-11 | Bran | Geo. Keller | 16.50 | 4.61 |
| | | Newport, Ky. | 14.50 | 4.50 |
| 510-11 | Snowflake Bran | Lawrenceburg Roller Mills Co. | 15.60 | 3.70 |
| | | Lawrenceburg, Ind. | 14.20 | 3.80 |
| 11-11 | Bran | Leitchfield Milling Co. | 16.56 | 4.85 |
| | | Leitchfield, Ky. | 15.00 | 4.23 |
| 11-11 | Bran | Leitchfield Milling Co. | 16.35 | 4.24 |
| | | Leitchfield, Ky. | 15.00 | 4.23 |
| 611-12 | Bran | Lycan Bros. | 15.53 | 4.00 |
| | | LaFayette, Ky. | 13.93 | 4.03 |
| 111-11 | Bran | Lynn Grove Milling Co. | 16.50 | 3.56 |
| | | Lynn Grove, Ky. | 16.50 | 4.50 |
| 1142-11 | Wheat Bran | J. H. Morgan | 15.75 | 3.26 |
| | | Gracey, Ky. | 16.25 | 4.33 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 191-11 | Martin & Ford..... Glasgow, Ky. | Wheat ..... | Below in protein. Contains Corn Bran and Screenings. |
| 1008-9 | Manufacturer's Warehouse | Wheat ..... | |
| 1008-9 | Manufacturer's Warehouse | Wheat ..... | |
| 1150-11 | Manufacturer's Warehouse | Wheat ..... | Contains small amount of Corn and Flax. |
| 209-12 | C. Dieckman ..... Covington, Ky. | Wheat ..... | Contains Screenings, Wild Buckwheat. |
| 404-10 | Summe & Raterman .... Covington, Ky. | Wheat ..... | Below in fat. |
| 64-8 | Geo. P. Taylor Co..... Burnside, Ky. | Wheat ..... | Contains Corn Cockle. |
| 751-12 | Manufacturer's Warehouse | Wheat ..... | Below in both protein and fat. |
| 422-9 | Manufacturer's Warehouse | Wheat ..... | |
| 491-11 | Con. Coal & Mining Co.... Erlanger, Ky. | Wheat ..... | Contains Screenings. Below in fat. |
| 676-11 | W. R. Henderson ..... Vanceburg, Ky. | Wheat ..... | |
| 485-12 | A. Torstrick ..... Shively, Ky. | Wheat ..... | Contains Screenings. |
| 185-8 | S. F. Clark ..... Auburn, Ky. | Wheat ..... | |
| 1230-11 | Jas. Johnson ..... Paducah, Ky. | Winter Wheat ..... | Below in fat. |
| 55-11 | A. Deye ..... Cold Springs, Ky. | Wheat ..... | Sample is Shipstuff. |
| 55-11 | Frank Huntemann ..... Newport, Ky. | Wheat ..... | |
| 55-11 | Geo. B. Moock ..... Newport, Ky. | Wheat ..... | Contains small amount of screenings and corn cockle. |
| 510-11 | G. C. Shaw ..... Frankfort, Ky. | Wheat ..... | |
| 11-11 | W. W. Manzey ..... Leitchfield, Ky. | Wheat ..... | |
| 11-11 | W. F. Kennedy ..... Leitchfield, Ky. | Wheat ..... | |
| 611-12 | Forbes Manufacturing Co. Hopkinsville, Ky. | Wheat ..... | Sample is Shipstuff |
| 111-11 | W. M. West ..... Murray, Ky. | Wheat ..... | Below in both protein and fat. |
| 1142-11 | Chappall & Cowherd..... Cadiz, Ky. | Wheat ..... | Below in both protein and fat. |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 1147-11 | Pure Wheat Bran | National Feed Co. | 16.88 | 4.20 |
| | | St. Louis, Mo. | 14.00 | 4.00 |
| 999-9 | Wheat Bran | Chas. Noonon | 16.06 | 4.49 |
| | | Fulton, Ky. | 15.00 | 4.29 |
| 251-11 | Bran. | Nordmeyer & Berding | 16.25 | 3.45 |
| | | Covington, Ky. | 14.19 | 3.65 |
| 1210-11 | Bran | Norris Roller Mills | 16.47 | 3.38 |
| | | Morgantown, Ky. | 15.85 | 3.43 |
| 566-12 | Wheat Bran | Orndorff & Russell | 15.85 | 5.33 |
| | | Adairville, Ky. | 15.06 | 4.89 |
| 263-11 | Phoenix Wheat Bran | Phoenix Flour Mill | 16.00 | 4.03 |
| | | Evansville, Ind. | 16.24 | 4.42 |
| 593-11 | Bran | R. C. Poage Milling Co. | 15.94 | 3.08 |
| | | Ashland, Ky. | 15.37 | 3.31 |
| 840-11 | Bran | Rice & Allen | 17.19 | 4.36 |
| | | Elkhorn, Ky. | 16.00 | 4.50 |
| 805-8 | Wheat Bran | J. H. Roark | 14.22 | 4.34 |
| | | Price's Mill, Ky. | 15.00 | 4.00 |
| 805-8 | Wheat Bran | J. H. Roark | 15.22 | 3.69 |
| | | Price's Mill, Ky. | 15.00 | 4.00 |
| 1021-11 | Bran | Rochester Ice & Milling Co. | 17.25 | 3.59 |
| | | Rochester, Ky. | 15.14 | 4.29 |
| 758-10 | Bran | L. G. Shehan | 15.25 | 3.10 |
| | | Bardstown, Ky. | 16.31 | 4.74 |
| 765-11 | Wheat Bran and Screenings | D. E. Stahl & Sons | 15.94 | 4.60 |
| | | Barlow, Ky. | 12.35 | 4.03 |
| 239-11 | Wheat Bran | Standard Hay & Grain Co. | 16.03 | 3.49 |
| | | Cincinnati, Ohio. | 15.12 | 4.55 |
| ..... | Wheat Bran | W. J. Sutton | 15.56 | 3.39 |
| | | Newport, Ky. | 15.06 | 3.25 |
| 831-11 | Wheat Bran | R. W. Thompson | 16.56 | 4.16 |
| | | Water Valley, Ky. | 15.88 | 4.72 |
| 223-11 | Wheat Bran | Washburn-Crosby Milling Co. | 15.88 | 3.85 |
| | | Louisville, Ky. | 14.50 | 4.00 |
| 799-8 | Wheat Bran | Chas. Watkins | 14.75 | 4.40 |
| | | Adairville, Ky. | 15.00 | 4.00 |
| | **Middlings.** | | | |
| 115-11 | Winter Wheat Middlings | Akin-Erskine Milling Co. | 16.94 | 4.75 |
| | | Evansville, Ind. | 16.36 | 4.50 |
| 115-11 | Winter Wheat Middlings | Akin-Erskine Milling Co. | 16.75 | 4.46 |
| | | Evansville, Ind. | 16.36 | 4.50 |
| 115-11 | Winter Wheat Middlings | Akin-Erskine Milling Co. | 17.63 | 4.65 |
| | | Evansville, Ind. | 16.36 | 4.50 |
| 913-11 | Middlings | The Ansted & Burk Co. | 17.88 | 4.71 |
| | | Springfield, Ohio. | 16.00 | 3.50 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 1174-11 | J. W. Webb & Son ..... Vanceburg, Ky. | Wheat ..... | |
| 999-9 | Manufacturer's Warehouse | Wheat ..... | |
| 251-11 | Henry Stallo ..... Covington, Ky. | Wheat ..... | |
| 1210-11 | Manufacturer's Warehouse | Wheat ..... | Sample is Shipstuff. |
| 566-12 | Manufacturer's Warehouse | Wheat ..... | Sample is Shipstuff. |
| 263-11 | W. E. Ellis ..... Hartford, Ky. | Wheat ..... | |
| 593-11 | Leffingwell & Co. ..... Ashland, Ky. | Wheat ..... | |
| 840-11 | Maufacturer's Warehouse | Wheat ..... | |
| 805-8 | J. R. Tully & Co. ..... Adairville, Ky. | Wheat ..... | Below in protein. |
| 805-8 | Manufacturer's Warehouse | Wheat ..... | Below in fat. |
| 1021-11 | M. A. Haden ..... Rockport, Ky. | Wheat ..... | Below in fat. |
| 758-10 | Manufacturer's Warehouse | Wheat ..... | Below in both protein and fat. |
| 765-11 | Manufacturer's Warehouse | Wheat bran and screenings 15%. | |
| 239-11 | C. E. Hamilton ..... Covington, Ky. | Wheat ..... | Below in fat. |
| ..... | Herm Feldmann ..... Newport, Ky. | Wheat ..... | |
| 831-11 | Manufacturer's Warehouse | Wheat ..... | |
| 223-11 | Cen. City Feed & Sup. Co. Central City, Ky. | Wheat ..... | |
| 799-8 | Manufacturer's Warehouse | Wheat ..... | |
| 115-11 | Central Coal & Iron Co.... Central City, Ky. | Wheat. Wheat screeenings 1%. | |
| 115-11 | Central Coal & Iron Co.... Central City, Ky. | Wheat. Wheat screeenings 1%. | |
| 115-11 | W. A. Young ..... Greenville, Ky. | Wheat, Wheat screeenings 1%. | |
| 913-11 | J. A. Maddox & Son ..... Olive Hill, Ky. | Wheat ..... | |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 85-7 | Middlings | Bergenroth Bros. | 15.35 | 3.93 |
| | | Troy, Ind. | 16.70 | 4.15 |
| 243-7 | Middlings | R. A. Carr | 11.85 | 2.04 |
| | | Maysville, Ky. | 15.50 | 3.50 |
| 405-10 | Middlings | Cincinnati Grain Co. | 16.19 | 3.72 |
| | | Cincinnati, Ohio. | 14.50 | 3.58 |
| 21-10 | Flour Middlings | The Dorsel Co. | 16.06 | 3.63 |
| | | Newport, Ky. | 14.63 | 1.72 |
| 21-10 | Flour Middlings | The Dorsel Co. | 16.47 | 3.90 |
| | | Newport, Ky. | 14.63 | 1.72 |
| 80-11 | Middlings | The Early & Daniel Co. | 17.13 | 4.30 |
| | | Covington, Ky. | 15.50 | 4.50 |
| 1115-11 | Pure Wheat Middlings | B. A. Eckhart Milling Co. | 18.53 | 4.61 |
| | | Chicago, Ill. | 15.00 | 4.00 |
| 650-11 | Middlings | Gwinn Bros. & Co. | 15.88 | 4.09 |
| | | Huntington, W. Va. | 13.91 | 3.61 |
| 532-9 | Middlings | Henderson & Strickell | 14.31 | 3.29 |
| | | Vanceburg, Ky. | 15.36 | 4.45 |
| 56-11 | Middlings | Geo. Keller | 15.97 | 3.70 |
| | | Newport, Ky. | 15.97 | 4.55 |
| 56-11 | Middlings | Geo. Keller | 15.94 | 3.92 |
| | | Newport, Ky. | 15.97 | 4.55 |
| 594-11 | Middlings | R. C. Poage Milling Co. | 16.41 | 3.81 |
| | | Ashland, Ky. | 16.75 | 4.41 |
| 562-12 | Leader Middlings | T. A. Sandefur | 17.66 | 4.60 |
| | | Henderson, Ky. | 15.60 | 4.75 |
| 746-11 | Steven's Middlings | J. S. Stevens & Co. | 16.06 | 5.86 |
| | | Ashland, Ky. | 16.06 | 5.86 |
| 341-11 | Middlings | Tell City Flouring Mills | 17.00 | 4.71 |
| | | Tell City, Ind. | 14.75 | 4.50 |
| 826-11 | "Noxall" Middlings and Wheat Screenings | Tranchant & Finnell | 17.22 | 4.94 |
| | | Osborn, Ohio. | 14.50 | 5.00 |
| 226-11 | Dandy Middlings | Washburn-Crosby Milling Co. | 17.03 | 3.90 |
| | | Louisville, Ky. | 15.00 | 4.00 |
| 418-7 | Middlings | J. W. Webb & Son | 16.25 | 4.73 |
| | | Vanceburg, Ky. | 16.50 | 4.75 |
| 482-11 | Middlings (William's Feed) | E. I. Williams & Co. | 14.41 | 2.66 |
| | | Sanders, Ky. | 14.56 | 3.82 |
| | **Shipstuff or Wheat Mixed Feed.** | | | |
| 122-11 | Acme Feed | Acme-Evans Milling Co. | 16.85 | 3.88 |
| | | Indianapolis, Ind. | 16.50 | 4.00 |
| 244-11 | Shipstuff | Adams & Langford | 16.13 | 4.23 |
| | | Harrodsburg, Ky. | 15.60 | 4.42 |

## ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 85-7 | G. N. Newman ..... Hawesville, Ky. | Wheat ..... | Below in protein and fat. |
| 243-7 | Manufacturer's Warehouse | Wheat ..... | Contains wheat bran and corn bran. |
| 405-10 | H. Haarmeyer ..... Latonia, Ky. | Wheat ..... | |
| 21-10 | Fred Schuerman ..... Newport, Ky. | Wheat ..... | |
| 21-10 | John Kruchten ..... Dayton, Ky. | Wheat ..... | Contains corn product. |
| 80-11 | Con. Coal & Mining Co.... Erlanger, Ky. | Wheat ..... | |
| 1115-11 | J. N. Caudill ..... Morehead, Ky. | Wheat ..... | |
| 650-11 | The J. Meek Co. ..... Catlettsburg, Ky. | Wheat ..... | |
| 532-9 | Manufacturer's Warehouse | Wheat ..... | Below in both protein and fat. |
| 56-11 | Geo. B. Moock ..... Newport, Ky. | Wheat ..... | Below in fat. |
| 56-11 | Geo. Weyman ..... Newport, Ky. | Wheat ..... | Below in fat. |
| 594-11 | Leffingwell & Co. ..... Ashland, Ky. | Wheat ..... | Below in fat. |
| 562-12 | Manufacturer's Warehouse | Wheat ..... | |
| 746-11 | Manufacturer's Warehouse | Wheat ..... | Below in fat. |
| 341-11 | W. C. Kelly ..... Hawesville, Ky. | Wheat ..... | Screenings. |
| 826-11 | Leffingwell & Co. ..... Ashland, Ky. | Wheat, Wheat screenings 6 %. | |
| 226-11 | Central Coal & Iron Co... Central City, Ky. | Wheat ..... | |
| 418-7 | Manufacturer's Warehouse | Wheat ..... | |
| 482-11 | J. J. Willenbrink ..... Bellevue, Ky. | Wheat ..... | Below in fat. Mostly flour. |
| 122-11 | W. R. Skillman & Co. Owensboro, Ky. | Wheat bran, Middlings, Ground Wheat screenings 1%. | |
| 244-11 | W. W. Finch ..... Somerset, Ky. | Wheat bran, Shorts ... | Below in fat. |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 18-12 | Shipstuff | Adams & Langford, Harrodsburg, Ky. | 17.69 | 3.31 |
| | | | 15.60 | 4.42 |
| 912-11 | Mixed Wheat Feed | The Ansted & Burk Co., Springfield, Ohio. | 17.50 | 4.35 |
| | | | 15.00 | 4.00 |
| 169-11 | Ballard's Shipstuff | Ballard & Ballard Co., Louisville, Ky. | 17.00 | 5.18 |
| | | | 15.69 | 4.26 |
| 169-11 | Ballard's Shipstuff | Ballard & Ballard Co., Louisville, Ky. | 17.13 | 4.53 |
| | | | 15.69 | 4.26 |
| 83-12 | Ballard's Mixed Wheat Feed | Ballard & Ballard Co., Louisville, Ky. | 16.44 | 3.65 |
| | | | 15.09 | 4.17 |
| 1010-11 | Wheat Bran, Shipstuff & Screenings | Beaver Dam Milling Co., Beaver Dam, Ky. | 16.16 | 3.60 |
| | | | 15.62 | 3.50 |
| 1035-11 | Pure Wheat Mill Feed & Screenings | Bloomfield Mill Co., Bloomfield, Ky. | 15.75 | 4.48 |
| | | | 16.13 | 4.33 |
| 403-12 | Shipstuff | Blue Grass Milling Co., Campbellsburg, Ky. | 14.31 | 3.31 |
| | | | 15.75 | 4.46 |
| 1009-9 | Shipstuff | V. A. Brock, Sparta, Ky. | 14.78 | 3.26 |
| | | | 15.75 | 4.46 |
| 1009-9 | Shipstuff | V. A. Brock, Sparta, Ky. | 15.38 | 3.35 |
| | | | 15.75 | 4.46 |
| 1100-11 | Mixed Wheat Feed | Ashton Bryant, Calhoun, Ky. | 15.31 | 3.95 |
| | | | 15.50 | 4.00 |
| 194-11 | Shipstuff | A. R. Burks Mill Co., Loretto, Ky. | 16.91 | 3.95 |
| | | | 15.62 | 3.83 |
| 428-9 | Blue Ribbon Feed | T. E. Butler, Shreve, Ky. | 15.91 | 4.48 |
| | | | 15.18 | 3.98 |
| 1093-11 | Shipstuff | Cameron & Co., Carrollton, Ky. | 17.63 | 4.63 |
| | | | 16.03 | 4.13 |
| 867-10 | Feed Stuff | Cane Valley Mill Co., Cane Valley, Ky. | 15.63 | 3.40 |
| | | | 15.15 | 3.31 |
| 278-11 | Shipstuff and Wheat Screenings | Cannelton Flour Mills, Cannelton, Ind. | 15.78 | 4.19 |
| | | | 16.25 | 4.18 |
| 278-11 | Shipstuff and Wheat Screenings | Cannelton Flour Mills, Cannelton, Ind. | 15.81 | 4.05 |
| | | | 16.25 | 4.18 |
| 505-11 | Shipstuff | Carlisle Milling Co., Carlisle, Ky. | 16.22 | 4.29 |
| | | | 14.41 | 4.34 |
| 505-11 | Shipstuff | Carlisle Milling Co., Carlisle, Ky. | 16.47 | 4.21 |
| | | | 14.41 | 4.34 |
| 1049-11 | Shipstuff | Cassidy & Dewey, Dycusburg, Ky. | 15.81 | 3.22 |
| | | | 15.28 | 3.51 |
| 73-10 | Shipstuff | Cedar Bluff Roller Mills, Sulphur Wells, Ky. | 17.69 | 4.67 |
| | | | 15.00 | 4.00 |
| 209-11 | Shipstuff | Cedar Field Mills, Franklin, Ky. | 16.35 | 4.81 |
| | | | 15.50 | 4.00 |
| 421-9 | Shipstuff | J. L. Collins, New Market, Ky. | 12.56 | 1.70 |
| | | | 16.00 | 4.50 |

## ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 18-12 | Manufacturer's Warehouse | Wheat bran, Shorts.... | |
| 912-11 | J. A. Maddox & Son..... Olive Hill, Ky. | Wheat bran, Middlings. | |
| 169-11 | Chas. Oechsle ..... Shively, Ky. | Wheat bran, Shorts.... | |
| 169-11 | Sparks & Brown ..... London, Ky. | Wheat bran, Shorts.... | |
| 83-12 | Ben Grieve ..... Louisville, Ky. | Wheat bran, Shorts ... | |
| 1010-11 | J. H. Tucker ..... Beaver Dam, Ky. | Wheat bran, Shipstuff, Wht. screenings 9½% | |
| 1035-11 | Manufacturer's Warehouse | Wheat bran, Middlings, Wheat screenings 5%. | |
| 403-12 | John Popp ..... Farmer's Station, Ky. | Wheat bran, Shorts .. | Below in both protein and fat. |
| 1009-9 | Manufacturer's Warehouse | Bran, Middlings, Wht. germ. | Below in protein and fat. Mostly middlings. |
| 1009-9 | Manufacturer's Warehouse | Bran, Middlings, Wht. germ. | Below in fat. |
| 1100-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | |
| 194-11 | Bricken & Merkley ..... Lebanon, Ky. | Wheat bran, Shorts .. | |
| 428-9 | W. E. Ellis ..... Hartford, Ky. | Wheat bran, Middlings | |
| 1093-11 | Manufacturer's Warehouse | Wheat bran, Middlings. | |
| 867-10 | Manufacturer's Warehouse | Wheat bran, Middlings | |
| 278-11 | J. W. Quisenbury ..... Hawesville, Ky. | Wheat bran, Middlings Wheat screenings 5% | |
| 278-11 | A. D. Ashcraft ..... Irvington, Ky. | Wheat bran, Middlings. Wheat screenings 5% | Below in protein. |
| 505-11 | Joe Kahmann ..... Sandfordtown, Ky. | Wheat bran, Shorts.... | |
| 505-11 | Manufacturer's Warehouse | Wheat bran, Shorts.... | |
| 1049-11 | Bradley Bros. ..... Paducah, Ky. | Wheat bran, Shorts, Middlings. | Contains large amount of Screenings. |
| 73-10 | Ben Shirley ..... Edmonton, Ky. | Wheat ..... | |
| 209-11 | Manufacturer's Warehouse | Wheat ..... | |
| 421-9 | Manufacturer's Warehouse | Wheat ..... | Flour middlings. Below in both protein and fat. |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 270-12 | Shipstuff and Screenings | R. L. Collins & Son. Crittenden, Ky. | 16.35<br>14.00 | 3.98<br>4.66 |
| 749-11 | Shipstuff | Crescent Roller Mills Taylorsville, Ky. | 15.44<br>15.62 | 6.83<br>3.50 |
| 144-11 | Mixed Wheat Feed | Doe Run & Brandenburg Mill Co., Brandenburg, Ky. | 15.69<br>16.00 | 3.45<br>4.50 |
| 998-11 | Shipstuff | W. J. Dossey & Sons. Fountain Run, Ky. | 18.31<br>15.75 | 4.11<br>4.46 |
| 1198-11 | Shipstuff | Drakesboro Milling Co. Drakesboro, Ky. | 15.97<br>15.03 | 3.62<br>4.13 |
| 91-6 | Shipstuff | Eagle Milling Co. Elizabethtown, Ky. | 14.41<br>16.00 | 3.68<br>4.50 |
| 371-12 | Shipstuff and Screenings | Eagle Roller Mills Lawrenceburg, Ky. | 15.97<br>15.50 | 3.85<br>4.20 |
| 84-11 | Mixed Wheat Feed | The Early & Daniel Co. Covington, Ky. | 17.72<br>15.36 | 4.93<br>4.41 |
| 84-11 | Mixed Wheat Feed | The Early & Daniel Co. Covington, Ky. | 17.13<br>15.36 | 4.29<br>4.41 |
| 494-12 | Mixed Wheat Feed | The Early & Daniel Co. Cincinnati, Ohio. | 17.44<br>15.36 | 4.15<br>4.41 |
| 346-11 | Mixed Wheat Feed | Eberts & Bro. Jeffersonville, Ind. | 15.60<br>15.16 | 4.94<br>4.50 |
| 346-11 | Mixed Wheat Feed | Eberts & Bro. Jeffersonville, Ind. | 15.30<br>15.16 | 3.95<br>4.50 |
| 1018-11 | Shipstuff | C. V. Edwards Center, Ky. | 16.94<br>14.50 | 4.31<br>3.62 |
| 1193-11 | Bran and Shorts | Evans & Hagan Co. Tompkinsville, Ky. | 18.00<br>16.75 | 4.31<br>4.34 |
| 385-11 | Mixed Wheat Feed | Farmers' & Merchants' Milling Co., Brooksville, Ky. | 16.03<br>15.75 | 4.29<br>4.25 |
| 129-12 | Mixed Wheat Feed | Farmers' & Merchants' Milling Co., Brooksville, Ky. | 16.53<br>15.75 | 4.18<br>4.25 |
| 37-11 | Shipstuff | Farris Bros. Cave City, Ky. | 16.47<br>16.18 | 4.25<br>3.90 |
| 393-11 | Mixed Wheat Feed | J. H. Fedders & Son Covington, Ky. | 16.28<br>15.12 | 4.37<br>4.27 |
| 644-12 | Mixed Wheat Feed | J. H. Fedders & Son Covington, Ky. | 16.97<br>15.12 | 4.24<br>4.27 |
| 1064-11 | Shipstuff | Fordsville Milling Co. Fordsville, Ky. | 16.35<br>16.03 | 4.12<br>4.13 |
| 864-11 | Shipstuff | Germantown Milling Co. Germantown, Ky. | 15.66<br>15.75 | 3.71<br>4.25 |
| 485-11 | Mixed Wheat Feed | Ghent Milling Co. Ghent, Ky. | 16.60<br>16.00 | 4.43<br>3.90 |
| 1010-12 | Mixed Wheat Feed | Ghent Milling Co. Ghent, Ky. | 16.10<br>16.00 | 3.48<br>3.90 |

## Analyses of Inspectors' Samples.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 270-12 | Manufacturer's Warehouse | Wheat bran, Shorts, Wheat screenings 2%. | |
| 749-11 | Humphrey Bros. ..... Wakefield, Ky. | Wheat bran, Middlings | |
| 144-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Below in fat. |
| 998-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Contains corn cockle. |
| 1198-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Below in fat. |
| 91-6 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Below in both protein and fat. |
| 871-12 | W. B. Morgan ..... Lawrenceburg, Ky. | Wheat bran, Middlings, Shorts, Scre'nings 5% | |
| 84-11 | H. Dieckman ..... John's Hill, Ky. | Wheat bran, Middlings | Contains corn bran. |
| 84-11 | H. Dieckman ..... John's Hill, Ky. | Wheat bran, Middlings | |
| 494-12 | G. M. Taylor ..... Georgetown, Ky. | Wheat bran, Middlings | Screenings, flax, wild buckwheat, hare's ear, lamb's quarters and mustard present. |
| 346-11 | F. Wittwer ..... Louisville, Ky. | Wheat bran, Shipstuff.. | |
| 346-11 | Sparks & Brown ..... London, Ky. | Wheat bran, Shipstuff.. | Below in fat. |
| 1081-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | |
| 1193-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Contains corn cockle. |
| 385-11 | Manufacturer's Warehouse | Wheat bran, Shipstuff.. | |
| 129-12 | John I. Claybrooke ..... Maysville, Ky. | Wheat bran, Middlings | |
| 37-11 | Dickinson Bros. ..... Glasgow, Ky. | Wheat bran, Shorts .. | |
| 393-11 | W. T. Reeves ..... Sanfordtown, Ky. | Wheat bran, Shorts .. | |
| 644-12 | Albert Hartman ..... Covington, Ky. | Wheat bran, Shorts .. | |
| 1064-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | |
| 864-11 | Manufacturer's Warehouse | Wheat bran, Shorts, Middlings. | Below in fat. |
| 485-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | |
| 1010-12 | J. W. Lancaster ..... Ghent, Ky. | Wheat bran, Middlings | |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 1225-11 | Shipstuff | D. W. Gish | 17.00 | 4.08 |
| | | Sacramento, Ky. | 15.81 | 4.83 |
| 1110-11 | Shipstuff | Goodpaster & Scott | 16.94 | 4.23 |
| | | Sherburne, Ky. | 15.50 | 4.20 |
| 835-11 | Mixed Wheat Feed | Greenup Milling Co. | 15.50 | 3.58 |
| | | Greenup, Ky. | 15.50 | 4.20 |
| 651-11 | Mixed Wheat Feed | Gwinn Bros. & Co. | 15.16 | 4.14 |
| | | Huntington, W. Va. | 13.78 | 3.96 |
| 675-12 | Mixed Wheat Feed | Gwinn Bros. & Co. | 14.88 | 5.00 |
| | | Huntington, W. Va. | 13.78 | 3.96 |
| 1063-10 | Shipstuff | Hancock Bros. | 18.00 | 4.39 |
| | | Albany, Ky. | 14.75 | 4.62 |
| 651-7 | Shipstuff | Hardin Milling Co. | 17.38 | 3.25 |
| | | Hardin, Ky. | 15.31 | 3.28 |
| 945-11 | Bran and Shipstuff | Hartford Mill Co. | 15.63 | 3.94 |
| | | Hartford, Ky. | 14.68 | 3.20 |
| 40-10 | Shipstuff | Hartford Water Mills | 13.81 | 2.80 |
| | | Hartford, Ky. | 16.00 | 4.50 |
| 808-11 | Mixed Wheat Feed | H. P. Hawkins | 16.44 | 3.78 |
| | | Paducah, Ky. | 14.69 | 4.18 |
| 1098-11 | Shipstuff | Holmes & Boyd | 15.56 | 3.55 |
| | | Sedalia, Ky. | 14.93 | 3.96 |
| 48-11 | Winter Wheat Middlings and Screenings | Igleheart Bros. | 17.81 | 5.21 |
| | | Evansville, Ind. | 16.36 | 4.50 |
| 48-11 | Winter Wheat Middlings and Screenings | Igleheart Bros. | 17.41 | 5.28 |
| | | Evansville, Ind. | 16.36 | 4.50 |
| 560-10 | Shipstuff | Jefferson & Grimes | 14.97 | 4.04 |
| | | Millersburg, Ky. | 15.75 | 4.46 |
| 930-9 | Shipstuff | Jefferson & Grimes | 14.38 | 3.16 |
| | | Millersburg, Ky. | 15.75 | 4.46 |
| 934-11 | Bran and Shorts | J. M. Johnson | 16.19 | 4.03 |
| | | Benton, Ky. | 16.13 | 4.30 |
| 1139-11 | Shipstuff | Newton Johnson | 16 22 | 4.29 |
| | | Grange City, Ky. | 15.36 | 4.41 |
| 373-8 | Shipstuff | W. R. Jones | 15.72 | 3.79 |
| | | Zula, Ky. | 14.72 | 4.59 |
| | | Kearns & Reese | 17.75 | 4.30 |
| 439-11 | Shipstuff | Jamestown, Ky. | 15.63 | 4.38 |
| 959-11 | Wheat Bran and Shipstuff | Kevil Milling Co. | 16.28 | 4.84 |
| | | Kevil, Ky. | 15.75 | 4.46 |
| 40-11 | Shipstuff | Lane Lumber & Milling Co. | 15.28 | 4.09 |
| | | Rio, Ky. | 16.00 | 4.68 |
| 1103-11 | "Peerless" | L. N. Iawson | 15.06 | 3.79 |
| | | Mayfield, Ky. | 15.18 | 4.08 |
| 958-11 | Thoroughbred Feed | Lexington Roller Mills Co. | 16.41 | 3.85 |
| | | Lexington, Ky. | 16.38 | 4.15 |

## Analyses of Inspectors' Samples.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 1225-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Below in fat. |
| 1110-11 | Manufacturer's Warehouse | Wheat bran, Middlings. | |
| 835-11 | J. W. Webb & Son ..... Vanceburg, Ky. | Wheat bran, Shorts .. | Below in fat. |
| 651-11 | Catlettsburg F. & Sup. Co.. Catlettsburg, Ky. | Wheat bran, Shorts .. | Contains corn product. |
| 675-12 | H. H. Fitzpatrick ..... Prestonsburg, Ky. | Wheat bran, Shorts .. | |
| 1063-10 | Manufacturer's Warehouse | Wheat bran, Shorts, Middlings. | |
| 651-7 | Manufacturer's Warehouse | Wheat bran, Shorts .. | |
| 945-11 | Manufacturer's Warehouse | Wheat bran, Shipstuff. | |
| 40-10 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Below in both protein and fat. |
| 808-11 | Haynes & Dismukes ..... Paducah, Ky. | Wheat, Wheat screenings 8%. | |
| 1098-11 | Manufacturer's Warehouse | Wheat bran, Middlings | Adulterated with corn bran and screenings. |
| 48-11 | E. P. Barnes & Bros. ..... Beaver Dam, Ky | Wheat, Wheat screenings 7%. | |
| 48-11 | E. P. Barnes & Bros. ..... Beaver Dam, Ky | Wheat, Wheat screenings 7%. | |
| 560-10 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Below in both protein and fat. |
| 930-9 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Below in both protein and fat. |
| 934-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | |
| 1139-11 | Manufacturer's Warehouse | Wheat bran, Middlings | |
| 373-8 | Manufacturer's Warehouse | Wheat bran, Shorts.... Middlings. | Below in fat. |
| 439-11 | Manufacturer's Warehouse | Wheat bran, Shorts, Middlings. | Contains screenings and large per cent corn cockle. |
| 959-11 | H. P. Hawkins ..... Paducah, Ky. | Wheat bran, Middlings | |
| 40-11 | W. A. Blakely ..... Camner, Ky. | Wheat bran, Shorts .. | Below in both protein and fat. |
| 1103-11 | A. J. Wheeler ..... Mayfield, Ky. | Wheat bran, Shorts .. | |
| 958-11 | J. W. Creech..... E. Burnstadt, Ky. | Wheat bran, Middlings, Wheat screenings 1% | |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 547-9 | Mixed Wheat Feed | Marfield Milling Co. | 15.81 | 3.63 |
| | | Chillicothe, Ohio. | 14.50 | 4.00 |
| 896-12 | Bran and Screenings | Marion Milling Co. | 17.10 | 5.03 |
| | | Marion, Ky. | 15.30 | 4.20 |
| 335-8 | Feedstuff | Ott Maxsey | 17.56 | 3.92 |
| | | Flippin, Ky. | 15.38 | 4.79 |
| 798-11 | Mixed Wheat Feed | R. H. Menefee & Co. | 16.72 | 4.04 |
| | | Louisville, Ky. | 15.80 | 4.70 |
| 877-9 | Shipstuff | Milford Milling Co. | 16.19 | 3.87 |
| | | Milford, Ky. | 15.50 | 4.20 |
| 524-11 | Wheat Bran and Shipstuff | Murray Milling Co. | 15.16 | 3.96 |
| | | Murray, Ky. | 15.00 | 4.00 |
| 336-11 | Shipstuff | New Edmonton Mills | 17.47 | 3.83 |
| | | Edmonton, Ky. | 15.50 | 4.25 |
| 556-11 | Shipstuff | Nolin Milling Co. | 15.16 | 4.38 |
| | | Nolin, Ky. | 15.00 | 4.50 |
| 881-12 | Shipstuff | Nolin Milling Co. | 15.41 | 4.08 |
| | | Nolin, Ky. | 15.00 | 4.50 |
| 30-6 | Shipstuff | Owenton Roller Mills | 15.97 | 4.02 |
| | | Owenton, Ky. | 16.00 | 4.50 |
| 1207-11 | Ideal Wheat Feed | T. L. Penn | 16.47 | 3.94 |
| | | Kevil, Ky. | 15.66 | 4.57 |
| 775-12 | Shipstuff | E. E. Perry | 12.06 | 5.15 |
| | | Elizabethtown, Ky. | 15.75 | 4.46 |
| 601-11 | Shipstuff | Philpott & Carden | 17.69 | 4.76 |
| | | Hardyville, Ky. | 16.68 | 4.53 |
| 599-11 | Shipstuff | Philpott & Lile | 16.28 | 4.31 |
| | | Rocky Hill Station, Ky. | 15.03 | 4.56 |
| 918-12 | Shipstuff | Philpott & Lile | 17.75 | 4.98 |
| | | Rocky Hill Station, Ky. | 15.03 | 4.56 |
| 257-11 | Quante's Mixed Feed | Quante & Sielbeck | 16.88 | 4.10 |
| | | Metropolis, Ill. | 15.19 | 4.23 |
| 89-9 | Shipstuff | J. R. Rankin & Co. | 15.81 | 4.03 |
| | | Monticello, Ky. | 13.03 | 3.04 |
| 640-11 | Bran and Shipstuff | Renfro & Dean | 16.06 | 4.13 |
| | | Dundee, Ky. | 15.75 | 4.14 |
| 885-12 | Shipstuff | J. M. Riley | 15.85 | 3.83 |
| | | Williamstown, Ky. | 15.31 | 3.82 |
| 367-12 | Shipstuff | W. O. Rouse | 16.25 | 3.42 |
| | | Walton, Ky. | 15.12 | 3.77 |
| 273-9 | Shipstuff | Sardis Milling Co. | 17.13 | 4.63 |
| | | Sardis, Ky. | 15.00 | 4.00 |
| 698-11 | Bostain's Shipstuff and Screenings | Sharpsburg Roller Mills | 17.53 | 4.03 |
| | | Sharpsburg, Ky. | 14.63 | 3.91 |
| 243-11 | Shipstuff | J. A. Shaver | 16.81 | 3.62 |
| | | Greenville, Ky. | 15.75 | 4.46 |

## Analyses of Inspectors' Samples.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 547-9 | Catlettsburg F. & Sup. Co. Catlettsburg, Ky. | Wheat bran, Middlings | Contains screenings and corn cockle. |
| 896-12 | Manufacturer's Warehouse | Wheat, Wheat screenings 2%. | Sample is shipstuff. |
| 335-8 | Manufacturer's Warehouse | Wheat, Wheat screenings 5%. | Contains corn cockle. |
| 798-11 | Oehrle Bros. ..... Shively, Ky. | Wheat bran, Middlings | Below in fat. |
| 877-9 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Below in fat. |
| 524-11 | Manufacturer's Warehouse | Wheat bran, Shipstuff. | |
| 336-11 | Mrs. Fannie Previette.... Edmonton, Ky. | Wheat bran, Middlings | Below in fat. |
| 556-11 | Sparks & Brown ..... London, Ky. | Wheat bran, Shorts .. | |
| 881-12 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Below in fat. |
| 30-6 | J. L. Grugin ..... Tacketts' Mill, Ky. | Wheat bran, Shorts .. | Contains corn bran and small amount of screenings. |
| 1207-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Below in fat. |
| 775-12 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Below in protein. |
| 601-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | |
| 599-11 | W. T. Kidd ..... Glasgow, Ky. | Wheat bran, Shorts .. | |
| 918-12 | Mel McKinney ..... Glasgow Junction, Ky. | Wheat bran, Shorts .. | |
| 257-11 | F. A. Arant ..... Paducah, Ky. | Wheat, Wheat screenings, 9%. | |
| 89-9 | Manufacturer's Warehouse | Wheat bran, Shorts .. | |
| 640-11 | W. E. Ellis..... Hartford, Ky. | Wheat bran, Shipstuff. | |
| 885-12 | Manufacturer's Warehouse | Wheat bran, Shorts .. | |
| 367-12 | C. S. Chambers ..... Walton, Ky. | Wheat bran, Shorts .. | |
| 273-9 | Manufacturer's Warehouse | Wheat bran, Shorts .. | |
| 698-11 | I. F. Tabb ..... Mt. Sterling, Ky. | Wheat bran, Wheat screenings 10%. | |
| 243-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Below in fat. |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 700-11 | Shipstuff | Shrewsbury Roller Mills | 16.38 | 3.71 |
| | | Shrewsbury, Ky. | 15.75 | 4.46 |
| 644-11 | Bran and Shipstuff | Smith & Stevenson | 17.06 | 4.23 |
| | | Columbia, Ky. | 16.81 | 4.74 |
| 1195-11 | Shipstuff | J. E. Snow | 16.22 | 3.99 |
| | | Russell Springs, Ky. | 15.36 | 4.41 |
| 1064-10 | Shipstuff | Snow Milling Co. | 17.56 | 4.58 |
| | | Snow, Ky. | 14.75 | 4.62 |
| 150-8 | Sifter Siftings | Spring Creek Roller Mills Co. | 17.69 | 4.59 |
| | | Huntersville, Ky. | 15.00 | 4.72 |
| 236-11 | Mixed Wheat Feed | Standard Hay & Grain Co. | 15.85 | 4.41 |
| | | Cincinnati, Ohio. | 15.31 | 4.23 |
| 927-12 | Shipstuff | Sturgis Milling Co. | 15.16 | 4.58 |
| | | Sturgis, Ky. | 16.00 | 4.25 |
| 37-7 | Mixed Wheat Feed | W. J. Sutton | 16.47 | 4.78 |
| | | Newport, Ky. | 15.43 | 3.95 |
| 621-11 | Bran and Shipstuff | Temple Bros. | 16.78 | 4.78 |
| | | Maxon Mills, Ky. | 15.69 | 4.37 |
| 1096-11 | Shipstuff (Mill Feed) | George S. Thompson | 16.72 | 4.27 |
| | | Warsaw, Ky. | 15.69 | 3.38 |
| 954-12 | Shipstuff (Mill Feed) | George S. Thompson | 16.13 | 3.63 |
| | | Warsaw, Ky. | 15.69 | 3.38 |
| 823-12 | Shipstuff | Trenton Milling Co. | 17.03 | 4.98 |
| | | Trenton, Ky. | 15.41 | 4.32 |
| 952-12 | Shipstuff | Trimble Milling Co. | 16.00 | 4.43 |
| | | Milton, Ky. | 15.20 | 4.72 |
| 774-11 | Trow's Shipstuff and Screenings | A. Trow Co. | 17.13 | 5.21 |
| | | Madison, Ind. | 16.00 | 4.50 |
| 337-11 | Bran and Shipstuff | J. W. Turner | 14.75 | 3.23 |
| | | Rumsey, Ky. | 15.14 | 4.29 |
| 397-12 | Bran, Shipstuff and Screenings | A. Waller & Co. | 15.00 | 4.09 |
| | | Corydon, Ky. | 14.50 | 4.00 |
| 224-11 | Mixed Wheat Feed | Washburn-Crosby Milling Co. | 16.94 | 4.24 |
| | | Louisville, Ky. | 14.50 | 4.00 |
| 224-11 | Mixed Wheat Feed | Washburn-Crosby Milling Co. | 15.53 | 4.81 |
| | | Louisville, Ky. | 14.50 | 4.00 |
| 224-11 | Mixed Wheat Feed | Washburn-Crosby Milling Co. | 16.31 | 4.58 |
| | | Louisville, Ky. | 14.50 | 4.00 |
| 219-12 | Mixed Wheat Feed | Washburn-Crosby Milling Co. | 15.81 | 4.30 |
| | | Louisville, Ky. | 14.50 | 4.00 |
| 921-11 | Shipstuff | M. C. Wells & Co. | 18.03 | 4.05 |
| | | Mt. Olivet, Ky. | 16.00 | 3.70 |
| 1011-10 | Bran and Shipstuff | West Louisville Mill & Elevator Co., W. Louisville, Ky. | 15.06 | 4.08 |
| | | | 15.75 | 4.46 |
| 265-9 | Mixed Wheat Feed | Wilhite & Bryant | 14.91 | 3.98 |
| | | Livermore, Ky. | 15.50 | 4.00 |

## Analyses of Inspectors' Samples.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 700-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Below in fat. |
| 644-11 | Manufacturer's Warehouse | Wheat bran, Shipstuff. | Contains screenings and good deal of corn cockle. |
| 1195-11 | Manufacturer's Warehouse | Wheat bran, Shorts .. | Largely bran. Contains a good deal of corn cockle. |
| 1064-10 | Manufacturer's Warehouse | Wheat bran, Shorts, Middlings. | Contains corn cockle. |
| 150-8 | Manufacturer's Warehouse | Wheat ..... | Contains corn cockle. |
| 236-11 | Joe Kahmann ..... Sandfordtown, Ky. | Wheat bran, Middlings | Contains corn bran. |
| 927-12 | Claude E. Bradburn ..... Sturgis, Ky. | Low Grade Flour, Wht. bran, Wht. screenings | Below in protein. Contains corn bran. |
| 37-7 | Henry Feldman ..... Newport, Ky. | Wheat bran, Middlings | Contains corn bran. |
| 621-11 | Edgewood Farm Dairy... Paducah, Ky. | Wheat bran, Shipstuff. | |
| 1096-11 | Manufacturer's Warehouse | Wheat bran, Middlings | |
| 954-12 | J. W. Abbott ..... Warsaw, Ky. | Wheat bran, Middlings | |
| 823-12 | Manufacturer's Warehouse | Wheat bran, Middlings | |
| 952-12 | C. S. Griffith ..... Carrollton, Ky. | Wheat bran, Middlings. | Sample is middlings. |
| 774-11 | Cameron & Co. ..... Carrollton, Ky. | Wheat bran, Middlings. | |
| 337-11 | Manufacturer's Warehouse | Wheat bran, Middlings. | Below in fat. |
| 397-12 | Manufacturer's Warehouse | Wheat bran, Shipstuff, Wheat screenings 4% | |
| 224-11 | D. Zehnder ..... St. Mathews, Ky. | Wheat bran, Middlings | |
| 224-11 | J. S. Kaelin ..... Louisville, Ky. | Wheat bran, Middlings | |
| 224-11 | Ed Zehnder ..... Louisville, Ky. | Wheat bran, Middlings | |
| 219-12 | G. F. Gauman ..... Louisville, Ky. | Wheat bran, Middlings | |
| 921-11 | Manufacturer's Warehouse | Wheat bran, Shorts... | |
| 1011-10 | Rapier Grain & Seed Co.. Owensboro, Ky. | Wheat bran, Shorts... | Below in protein. |
| 265-9 | W. A. Peay ..... Livermore, Ky. | Wheat bran, Shorts. | |

TABLE I.—STRAIGHT FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| ..... | Mixed Wheat Feed ..... | J. J. Willinbrink ..... | 15.35 | 3.68 |
| | | Bellevue, Ky. | 14.50 | 3.87 |
| 30-12 | Woolcott's Mixed Wheat Feed..... | Woolcott Bros. Flour Mills..... | 16.91 | 4.19 |
| | | Lexington, Ky. | 15.90 | 3.73 |
| 1097-11 | Shipstuff ..... | Woolridge & Perkins ..... | 16.94 | 4.34 |
| | | Sewellton, Ky. | 14.81 | 4.45 |
| 914-11 | Shipstuff ..... | Amos Yaeger ..... | 17.19 | 4.60 |
| | | Louisville, Ky. | 15.69 | 4.26 |
| 308-12 | Mixed Wheat Feed ..... | Amos Yaeger ..... | 16.50 | 4.18 |
| | | Louisville, Ky. | 14.75 | 3.75 |
| | **Shorts.** | | | |
| 73-12 | Shorts ..... | Auburn Mills ..... | 17.69 | 5.12 |
| | | Auburn, Ky. | 16.03 | 3.98 |
| 188-11 | Shorts ..... | Bowling Green Milling Co. ..... | 17.28 | 5.43 |
| | | Bowling Green, Ky. | 17.30 | 4.47 |
| 117-12 | Shorts ..... | Bowling Green Milling Co. ..... | 17.06 | 5.15 |
| | | Bowling Green, Ky. | 17.30 | 4.47 |
| 101-11 | E. G. D. & Co.'s Shorts ..... | E. G. Duckwall & Co..... | 14.72 | 4.74 |
| | | Louisville, Ky. | 15.62 | 4.10 |
| 101-11 | E. G. D. & Co.'s Shorts ..... | E. G. Duckwall & Co..... | 15.94 | 4.60 |
| | | Louisville, Ky. | 15.62 | 4.10 |
| 326-12 | E. G. D. & Co.'s Shorts ..... | E. G. Duckwall & Co..... | 16.44 | 4.33 |
| | | Louisville, Ky. | 15.62 | 4.10 |
| 596-12 | Shorts ..... | Elizabethtown Milling Co. ..... | 15.28 | 4.25 |
| | | Elizabethtown, Ky. | 14.97 | 4.47 |
| 994-10 | Shorts ..... | Chas. Noonon ..... | 14.63 | 2.93 |
| | | Fulton, Ky. | 15.97 | 4.52 |
| 1126-11 | Shorts ..... | Paducah Milling Co. ..... | 15.94 | 3.53 |
| | | Paducah, Ky. | 16.12 | 3.86 |
| 641-11 | Shorts ..... | Reidling & Bro. ..... | 16.69 | 4.56 |
| | | Louisville, Ky. | 14.50 | 4.00 |
| 225-11 | Shorts ..... | Washburn-Crosby Milling Co.... | 16.81 | 4.70 |
| | | Louisville, Ky. | 15.00 | 4.00 |
| 225-11 | Shorts ..... | Washburn-Crosby Milling Co.... | 17.31 | 4.73 |
| | | Louisville, Ky. | 15.00 | 4.00 |
| 218-12 | Shorts ..... | Washburn-Crosby Milling Co.... | 16.25 | 4.32 |
| | | Louisville, Ky. | 15.00 | 4.00 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| ..... | Manufacturer's Warehouse | Wheat bran, Shorts... | Contains corn bran. |
| 30-12 | C. Shimfessel ..... Clay City, Ky. | Wheat bran, Middlings. | |
| 1097-11 | Manufacturer's Warehouse | Wheat bran, Shorts... | Contains corn cockle. |
| 914-11 | Chas. Kaelin ..... St. Mathews, Ky. | Wheat bran, Middlings | Sample is middlings. |
| 308-12 | Chas. Kaelin ..... St. Mathews, Ky. | Wheat bran, Shorts... | |
| 73-12 | Manufacturer's Warehouse | Wheat ..... | |
| 188-11 | W. A. Cassidy ..... Bowling Green, Ky. | Wheat ..... | |
| 117-12 | R. L. Robinson ..... Bowling Green, Ky. | Wheat ..... | |
| 101-11 | Joseph Ehrler ..... Louisville, Ky. | Wheat ..... | Wheat, bran, shorts, corn bran, screenings. |
| 101-11 | Oehrle Bros. ..... Shively, Ky. | Wheat ..... | Contains corn bran. |
| 326-12 | Ben Reichmuth ..... Louisville, Ky. | Wheat ..... | Sample is shipstuff, containing small per cent. corn bran and screenings. |
| 596-12 | Manufacturer's Warehouse | Wheat ..... | |
| 994-10 | Manufacturer's Warehouse | Wheat ..... | Below in both protein and fat. |
| 1126-11 | Manufacturer's Warehouse | Wheat ..... | |
| 641-11 | Manufacturer's Warehouse | Wheat ..... | Sample is shipstuff. |
| 225-11 | John B. Floyd ..... Crestwood, Ky. | Wheat ..... | |
| 225-11 | Central City F. & Sup. Co. Central City, Ky. | Wheat ..... | |
| 218-12 | John Wittwer ..... Louisville, Ky. | Wheat ..... | |

TABLE II.—MIXED FEEDS, COMPOSED OF WHEAT AND CORN PRODUCTS, AND DISTILLERS' AND BREWERS' GRAINS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 19-12 | Mixed Feed | Adams & Langford | 16.00 | 4.85 |
| | | Harrodsburg, Ky. | 12.65 | 5.20 |
| 150-9 | Anderson & Spilman Feed | Anderson & Spilman | 16.00 | 3.99 |
| | | Danville, Ky. | 12.60 | 5.10 |
| 416-12 | Mill Run | Ashland Milling Co. | 13.75 | 3.78 |
| | | Ashland, Ky. | 13.00 | 4.00 |
| 4-12 | Mill Run | C. H. Aubrey | 15.78 | 5.23 |
| | | Stithton, Ky. | 14.63 | 5.26 |
| 167-11 | Mill Run | Auburn Mills | 13.94 | 3.91 |
| | | Auburn, Ky. | 14.22 | 4.98 |
| 74-12 | Mill Run | Auburn Mills | 16.72 | 4.83 |
| | | Auburn, Ky. | 15.75 | 4.50 |
| 75-12 | Auburn Mills Mixed Feed | Auburn Mills | 17.16 | 4.33 |
| | | Auburn, Ky. | 15.53 | 4.39 |
| 177-11 | Mixed Mill Feed | J. H. Baughman & Co. | 14.10 | 3.74 |
| | | Stanford, Ky. | 14.43 | 4.73 |
| 5-11 | Mixed Feed | Berea Roller Mills | 14.85 | 4.74 |
| | | Berea, Ky. | 14.00 | 4.50 |
| 721-11 | Mixed Brans & Screenings | Bergenroth Bros. | 15.47 | 4.00 |
| | | Troy, Ind. | 13.00 | 3.00 |
| 720-11 | Mixed Feed | Bergenroth Bros. | 15.10 | 4.09 |
| | | Troy, Ind. | 14.00 | 4.00 |
| 504-11 | Mixed Feed | C. H. Beshers | 16.44 | 5.30 |
| | | Columbus, Ky. | 15.69 | 4.86 |
| 999-11 | Mill Run | Big Sandy Milling Co. | 17.75 | 4.68 |
| | | Louisa, Ky. | 13.59 | 4.50 |
| 120-12 | Eclipse Feed | Binns Milling Co. | 16.28 | 4.63 |
| | | Hopkinsville, Ky. | 13.80 | 4.60 |
| 1165-11 | Mixed Feed | Blackford Milling Co. | 13.56 | 3.15 |
| | | Blackford, Ky. | 15.00 | 4.00 |
| 190-11 | Mill Run Brans | Bowling Green Milling Co. | 15.19 | 4.35 |
| | | Bowling Green, Ky. | 14.00 | 4.50 |
| 116-12 | Mill Run Brans | Bowling Green Milling Co. | 16.94 | 4.44 |
| | | Bowling Green, Ky. | 14.00 | 4.50 |
| 154-11 | Mixed Feed | Bransford Mills | 16.35 | 3.83 |
| | | Owensboro, Ky. | 15.00 | 4.00 |
| 154-11 | Mixed Feed | Bransford Mills | 15.72 | 3.97 |
| | | Owensboro, Ky. | 15.00 | 4.00 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 19-12 | Manufacturer's Warehouse | Wheat bran, Shorts, Corn bran, Corn Hearts. | |
| 150-9 | Manufacturer's Warehouse | Shipstuff, Corn bran, Screenings, 2%. | Below in fat. |
| 416-12 | W. L. Horn ..... Anglin, Ky. | Corn bran, Wheat bran, Middlings. | |
| 4-12 | J. M. Rihn ..... Elizabethtown, Ky. | Wheat bran, Corn bran | |
| 167-11 | F. W. Alvis ..... Bowling Green, Ky. | Wheat bran, Corn bran | Below in fat. |
| 74-12 | Manufacturer's Warehouse | Wheat, Corn offal..... | Contains screenings. |
| 75-12 | Manufacturer's Warehouse | Wheat, Corn offal..... | |
| 177-11 | W. H. Paynter ..... Mt. Vernon, Ky. | Wheat bran, Shorts, Corn bran, Wheat screenings 5%. | Below in fat. Contains cob. |
| 5-11 | R. J. Engle ..... Berea, Ky. | Shipstuff, Corn bran... | |
| 721-11 | G. N. Newman ..... Hawesville, Ky. | Wheat bran, Corn bran, Wheat screenings 5% | Contains corn cockle. |
| 720-11 | G. N. Newman ..... Hawesville, Ky. | Wheat bran, Corn bran, Mid'lings, Wht. scr'enings 3%. | |
| 504-11 | Manufacturer's Warehouse | Wheat bran, Corn bran. Shipstuff, Wheat screenings 4%. | |
| 999-11 | Manufacturer's Warehouse | Shipstuff, Corn bran, Corn Meal. | |
| 120-12 | G. E. Mayberry & Co..... Hopkinsville, Ky. | Wheat, Corn bran .... | |
| 1165-11 | Manufacturer's Warehouse | Wheat bran, Middlings Corn bran, screenings 3%. | |
| 190-11 | Geo. T. Massey ..... Bowling Green, Ky. | Wheat bran, Corn bran | Sample is shipstuff. |
| 116-12 | E. W. Alvis ..... Bowling Green, Ky. | Wheat bran, Corn bran | Sample is shipstuff. |
| 154-11 | Owensboro Feed & Seed Store, Owensboro, Ky. | Wheat bran, Shorts. Corn bran, Wheat screenings 2%. | |
| 154-11 | D. A. McCormick ..... Owensboro, Ky. | Wheat bran, Shorts Corn bran, Wheat screenings 2%. | No corn bran. |

TABLE II.—MIXED FEEDS, COMPOSED OF WHEAT AND CORN PRODUCTS, AND DISTILLERS' AND BREWERS' GRAINS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 1005-11 | Brano | R. Brett | 16.13 | 4.03 |
| | | Mayfield, Ky. | 14.00 | 4.60 |
| 180-11 | XX Mixed Feed | Chas. Broeker & Co. | 12.09 | 7.00 |
| | | Owensboro, Ky. | 13.00 | 4.00 |
| 180-11 | XX Mixed Feed | Chas. Broeker & Co. | 13.53 | 7.37 |
| | | Owensboro, Ky. | 13.00 | 4.00 |
| 170-12 | XX Mixed Feed | Chas. Broeker & Co. | 12.85 | 7.22 |
| | | Owensboro, Ky. | 13.00 | 4.00 |
| 148-11 | Mixed Feed | Browder Milling Co. | 15.75 | 4.78 |
| | | Fulton, Ky. | 16.28 | 4.68 |
| 134-12 | Rich Feed | Burkholder Bros. | 16.47 | 4.19 |
| | | Crofton, Ky. | 14.63 | 5.48 |
| 1092-11 | Cameron's Feed Stuff | Cameron & Co. | 14.94 | 4.98 |
| | | Carrollton, Ky. | 14.25 | 3.60 |
| 401-10 | Mixed Feed | Cannelton Flour Mills | 15.56 | 4.16 |
| | | Cannelton, Ind. | 13.70 | 4.10 |
| 280-11 | Mixed Feed | Cannelton Flour Mills | 15.78 | 3.90 |
| | | Cannelton, Ind. | 13.70 | 4.10 |
| 402-10 | Mixed Brans | Cannelton Flour Mills | 14.41 | 4.96 |
| | | Cannelton, Ind. | 14.43 | 3.45 |
| 268-12 | Mixed Feed | Cannelton Flour Mills | 14.60 | 4.80 |
| | | Cannelton, Ind. | 13.70 | 4.10 |
| 65-12 | Mixed Feed | Jas. Cate & Son Co. | 13.56 | 6.56 |
| | | Hopkinsville, Ky. | 12.87 | 4.62 |
| 229-12 | Mixed Feed | Cave Milling Co. | 14.41 | 4.78 |
| | | Bowling Green, Ky. | 13.63 | 3.50 |
| 729-11 | Mixed Feed | Cecilian Milling Co. | 16.03 | 4.49 |
| | | Cecilian, Ky. | 14.37 | 4.15 |
| 399-12 | Mixed Feed | Clark & Clark | 15.60 | 5.31 |
| | | Franklin, Ky. | 15.62 | 4.94 |
| 517-11 | Blue Grass Dairy Feed | Climax Roller Mills | 14.72 | 3.80 |
| | | Shelbyville, Ky. | 15.00 | 4.25 |
| 199-12 | Crescent | Crescent Milling Co. | 16.19 | 4.19 |
| | | Cynthiana, Ky. | 15.64 | 4.18 |
| 283-12 | Mixed Feed | Crider Roller Mills | 13.72 | 5.40 |
| | | Crider, Ky. | 13.56 | 3.76 |
| 213-11 | Mixed Feed | Crown Jewel Milling Co. | 16.66 | 4.68 |
| | | Cynthiana, Ky. | 16.06 | 4.52 |
| 198-12 | Mixed Feed | Crown Jewel Milling Co. | 15.75 | 3.93 |
| | | Cynthiana, Ky. | 16.06 | 4.52 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 1005-11 | Manufacturer's Warehouse | Wheat bran, Corn bran | Below in fat. |
| 180-11 | Central Coal & Iron Co.... Central City, Ky. | Shipstuff, Wheat bran, Hominy Feed, screenings 1%. | Below in protein. |
| 180-11 | Skillman Feed Co. ..... Owensboro, Ky. | Shipstuff, Wheat bran, Hominy Feed, screenings 1%. | |
| 170-12 | J. F. Allen ..... Olaton, Ky. | Shipstuff, Wheat bran, Hominy Feed, screenings 1%. | |
| 148-11 | Manufacturer's Warehouse | Wheat, Corn, Wheat Mid'lings, Wht. scr'enings, 7½%. | Below in protein. |
| 134-12 | Manufacturer's Warehouse | Wheat bran, Middlings, Corn bran, Wheat screenings 5%. | Sample is bran. |
| 1092-11 | Manufacturer's Warehouse | Wheat bran, Corn bran. | |
| 401-10 | J. W. Quisenbury..... Hawesville, Ky. | Wheat bran, Corn bran, Wheat screenings 5% | Sample is wheat bran. |
| 280-11 | A. D. Ashcraft..... Irvington, Ky. | Wheat bran, Corn bran. Wheat screenings 5% | Sample is shipstuff. |
| 402-10 | J. W. Fontaine..... Brandenburg, Ky. | Wheat bran, Corn bran. Wheat screenings 5% | |
| 268-12 | J. W. Quisenbury..... Hawesville, Ky. | Wheat bran, Corn bran. Wheat screenings 5% | |
| 65-12 | W. J. Kirk..... Madisonville, Ky. | Wheat bran, Corn bran, Shorts. | |
| 229-12 | L. G. Bright..... Bowling Green, Ky. | Wheat bran, Corn bran, Wheat screenings 10% | |
| 729-11 | Salsbury & Vaught..... Central City, Ky. | Wheat bran, Shipstuff, Corn bran 5%, Corn. | |
| 399-12 | Manufacturer's Warehouse | Wheat bran, Middlings, Corn bran. | |
| 517-11 | Manufacturer's Warehouse | Wheat bran, Corn bran. | |
| 199-12 | T. D. Whittaker..... Cynthiana, Ky. | Wheat bran, Corn bran. | |
| 283-12 | Manufacturer's Warehouse | Corn bran, Wheat husk | |
| 213-11 | T. A. Porter..... London, Ky. | Wheat bran, Corn bran. | Mostly shorts. |
| 198-12 | Whaley & McGibben..... Cynthiana, Ky. | Middlings, Wheat bran, Corn bran. | Below in fat. |

TABLE II.—MIXED FEEDS, COMPOSED OF WHEAT AND CORN PRODUCTS, AND DISTILLERS' AND BREWERS' GRAINS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 162-12 | Mixed Feed | Crown Roller Mills | 13.22 | 4.65 |
| | | Morganfield, Ky. | 12.50 | 4.50 |
| 345-12 | Damon's Brans | C. D. Damon | 16.00 | 4.47 |
| | | Elkton, Ky. | 13.00 | 3.00 |
| 667-8 | Mixed Feed | J. W. Davis & Co. | 13.10 | 6.98 |
| | | Elkton, Ky. | 15.78 | 4.83 |
| 340-12 | Mixed Feed | Dixon Milling Co. | 14.56 | 3.98 |
| | | Dixon, Ky. | 14.43 | 3.82 |
| 467-12 | Dorsel's Mixed Brans | The Dorsel Co. | 15.72 | 3.59 |
| | | Newport, Ky. | 13.91 | 4.00 |
| 1040-10 | Mixed Feed | The Dorsel Co. | 14.38 | 3.48 |
| | | Newport, Ky. | 16.13 | 3.99 |
| 467-12 | Dorsel's Mixed Brans | The Dorsel Co. | 15.41 | 3.99 |
| | | Newport, Ky. | 14.97 | 4.59 |
| 1040-10 | Mixed Feed | The Dorsel Co. | 15.53 | 4.38 |
| | | Newport, Ky. | 16.13 | 3.99 |
| 349-12 | Mixed Feed | Eagle Mills | 16.75 | 4.73 |
| | | Franklin, Ky. | 15.18 | 5.10 |
| 347-11 | Eberts' Mixed Feed | Eberts & Bro. | 15.88 | 4.19 |
| | | Jeffersonville, Ind. | 16.00 | 4.30 |
| 364-11 | Creamo Mixed Feed | Edinger & Co. | 16.13 | 4.21 |
| | | Louisville, Ky. | 15.50 | 4.25 |
| 364-11 | Creamo Mixed Feed | Edinger & Co. | 17.31 | 4.00 |
| | | Louisville, Ky. | 15.50 | 4.25 |
| 484-12 | Creamo Mixed Feed | Edinger & Co. | 12.25 | 4.10 |
| | | Louisville, Ky. | 15.50 | 4.25 |
| 595-12 | Mixed Feed | Elizabethtown Milling Co. | 15.00 | 4.63 |
| | | Elizabethtown, Ky. | 14.80 | 4.48 |
| 371-11 | Mixed Feed | T. M. Ellis & Co. | 16.41 | 4.40 |
| | | Russellville, Ky. | 15.00 | 4.60 |
| 350-12 | Mixed Feed | T. M. Ellis & Co. | 15.72 | 4.78 |
| | | Russellville, Ky. | 15.00 | 4.60 |
| 372-11 | Leader Mixed Feed | Eminence Milling Co. | 14.97 | 3.93 |
| | | Eminence, Ky. | 14.50 | 4.25 |
| 373-12 | Leader Mixed Feed | Eminence Milling Co. | 15.06 | 4.64 |
| | | Eminence, Ky. | 14.50 | 4.25 |
| 29-11 | Mixed Feed | W. M. Farless | 15.66 | 4.40 |
| | | Henderson, Ky. | 15.00 | 4.00 |
| 634-12 | Mixed Feed | W. M. Farless | 16.16 | 4.73 |
| | | Henderson, Ky. | 15.00 | 4.00 |

## ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 162-12 | D E. Alvey..... Morganfield, Ky. | Wheat bran, Corn bran, Wheat screenings 5%. | |
| 345-12 | Manufacturer's Warehouse | Corn bran, Wheat bran | Shipstuff. |
| 667-8 | Manufacturer's Warehouse | Wheat, Corn..... | Below in protein. |
| 340-12 | Manufacturer's Warehouse | Shipstuff, Corn bran... | |
| 605-11 | F. Schuerman..... Newport, Ky. | Wheat bran, Corn bran. | No corn bran present. |
| 1040-10 | Andy Young..... Ft. Thomas, Ky. | Wheat Middlings, Corn bran. | |
| 467-12 | Herm Feldmann..... Newport, Ky. | Wheat bran, Corn bran. | Below in fat. |
| 1040-10 | F. Schuerman..... Newport, Ky. | Wheat Middlings, Corn Bran. | |
| 349-12 | Park City Feed Store..... Bowling Green, Ky. | Wheat bran, Corn bran. | Sample is shipstuff with trace of corn bran. |
| 347-11 | Sparks & Brown..... London, Ky. | Wheat bran, Shipstuff, Corn bran, Wheat screenings 3%. | |
| 364-11 | Oehrle Bros..... Shively, Ky. | Wheat, Corn bran, Wht. screenings 2%. | |
| 364-11 | A. Burkholder..... Louisville, Ky. | Wheat, Corn bran, Wht. screenings 2%. | Contains no corn bran. |
| 484-12 | Oehrle Bros..... Shively, Ky. | Wheat, Corn bran, Wht. screenings 2%. | Below in protein. |
| 595-12 | Manufacturer's Warehouse | Wheat bran, Corn bran. | |
| 371-11 | Central City Wholesale & Retail Feed & Sup. Co. Central City, Ky. | Wheat bran, Corn bran, Screenings 2%. | No corn bran present. |
| 350-12 | Clarence Howard..... Russellville, Ky. | Wheat bran, Corn bran, Screenings 2%. | |
| 372-11 | W. R. Gibson & Co..... Barbourville, Ky. | Bran, Shipstuff, Corn bran 5%, Screenings 5%. | |
| 373-12 | Duncan & Co..... LaGrange, Ky. | Bran, Shipstuff, Corn bran 5%, Screenings 5%. | |
| 29-11 | E. A. & L. Cohen..... Greenville, Ky. | Wheat bran, Shipstuff, Corn bran 5%, Wheat screenings 2%. | No corn bran present. |
| 634-12 | Henderson Feed & Com. Co Henderson, Ky. | Wheat bran, Shipstuff, Corn bran 5%, Wheat screenings 2%. | |

TABLE II.—MIXED FEEDS, COMPOSED OF WHEAT AND CORN PRODUCTS, AND DISTILLERS' AND BREWERS' GRAINS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 392-11 | "We Kno" Mixed Feed | Oscar Farmer & Son<br>Louisville, Ky. | 15.47<br>14.00 | 4.63<br>4.10 |
| 392-11 | "We Kno" Mixed Feed | Oscar Farmer & Son<br>Louisville, Ky. | 18.31<br>14.00 | 4.50<br>4.10 |
| 72-12 | "We Kno" Mixed Feed | Oscar Farmer & Son<br>Louisville, Ky. | 16.19<br>14.00 | 4.62<br>4.10 |
| 1032-11 | Mixed Feed | Farmers Mill, John Hirth, Prop.<br>Louisville, Ky. | 14.35<br>13.00 | 4.02<br>3.80 |
| 1-12 | Mixed Feed | Farris Bros.<br>Cave City, Ky. | 16.85<br>15.47 | 3.98<br>5.06 |
| 629-11 | Mixed Brans | Flegle Bros.<br>Arlington, Ky. | 20.69<br>14.22 | 7.26<br>4.43 |
| 629-11 | Mixed Brans | Flegle Bros.<br>Arlington, Ky. | 16.16<br>14.22 | 4.66<br>4.43 |
| 1166-11 | Mixed Feed | John W. Fry<br>Melber, Ky. | 14.72<br>14.44 | 5.01<br>4.61 |
| 1201-11 | Mixed Feed | H. Fruechtenicht<br>Louisville, Ky. | 15.44<br>15.16 | 4.09<br>4.74 |
| 738-11 | Mixed Feed | Garrard Milling Co.<br>Lancaster, Ky. | 15.25<br>14.50 | 4.86<br>4.38 |
| 1070-11 | Mixed Feed | Gilliam & Tulley<br>Burgin, Ky. | 14.31<br>13.88 | 3.41<br>5.30 |
| 645-11 | Mixed Feed | Glasgow Milling Co.<br>Glasgow, Ky. | 15.91<br>15.50 | 4.47<br>4.25 |
| 625-12 | Mixed Feed | Goldcamp Mill Co.<br>Ironton, Ohio. | 13.94<br>13.63 | 6.21<br>7.31 |
| 623-12 | Daisy Feed | Goldcamp Mill Co.<br>Ironton, Ohio. | 15.16<br>15.35 | 5.73<br>5.34 |
| 45-12 | Mixed Feed | Gordonsville Milling Co.<br>Gordonsville, Ky. | 15.75<br>16.10 | 3.63<br>4.68 |
| 146-11 | Mixed Feed | Green Bros.<br>Falls-of-Rough, Ky. | 16.72<br>15.36 | 4.56<br>4.41 |
| 534-11 | Mixed Feed | Guthrie Milling Co.<br>Guthrie, Ky. | 15.38<br>13.81 | 5.16<br>4.08 |
| 534-11 | Mixed Feed | Guthrie Milling Co.<br>Guthrie, Ky. | 15.56<br>13.81 | 4.89<br>4.08 |
| 533-12 | H. R. M. Feed | Hanson Roller Mills<br>Hanson, Ky. | 16.41<br>14.75 | 3.43<br>4.31 |

## Analyses of Inspectors' Samples.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 392-11 | G. M. Fenley..... Valley Station, Ky. | Wheat, wheat screenings 2%, Corn bran 1%. | |
| 392-11 | Joe Bisig..... St. Mathews, Ky. | Wheat, wheat screenings 2%, Corn bran 1%. | No corn bran present. |
| 72-12 | D. Zehnder..... St. Mathews, Ky. | Wheat, wheat screenings 2%, Corn bran 1%. | |
| 1032-11 | Oehrle Bros..... Shively, Ky. | Wheat Product, Corn bran. | |
| 1-12 | Manufacturer's Warehouse | Wheat bran, Wheat screenings 3%, Corn screenings 2%. | Below in fat. |
| 629-11 | Manufacturer's Warehouse | Wheat bran, Corn bran | |
| 629-11 | Manufacturer's Warehouse | Wheat bran, Corn bran. | |
| 1166-11 | T. J. Wood..... Paducah, Ky. | Wheat bran, Shipstuff Corn bran, Wheat screenings 3%. | |
| 1201-11 | B. P. Walker..... Barbourville, Ky. | Wheat bran, Corn bran, Middlings, Wheat screenings 5%. | |
| 738-11 | Banks Hudson..... Lancaster, Ky. | Wheat bran, Shorts, Corn bran, Ground Wheat Screenings 3% | |
| 1070-11 | H. T. Ison..... Burgin, Ky. | Shipstuff, Corn bran... | Below in fat. |
| 645-11 | W. T. Kidd..... Glasgow, Ky. | Wheat bran, Shorts, Corn bran. | |
| 625-12 | John Jeems..... Louisa, Ky. | Middlings, Wheat bran, Corn bran. | Below in fat. |
| 623-12 | Shade Combs & Co..... Allen, Ky. | Wheat Middlings, Corn bran. | |
| 45-12 | L. Brame..... Russellville, Ky. | Wheat bran, Corn bran. | Below in both protein and fat. |
| 146-11 | A. D. Ashcraft..... Irvington, Ky. | Wheat, Wheat screenings 1%, Corn bran. | |
| 534-11 | C. Howard..... Russellville, Ky. | Wheat, Corn bran, Wheat screenings 2% | |
| 534-11 | Manufacturer's Warehouse | Wheat, Corn bran. Wheat screenings 2% | |
| 533-12 | Sisk & O'Bryant..... Madisonville, Ky. | Wheat bran, Corn bran. Ground screenings 4% | |

TABLE II.—MIXED FEEDS, COMPOSED OF WHEAT AND CORN PRODUCTS, AND DISTILLERS' AND BREWERS' GRAINS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 99-11 | Mixed Feed | Harlan & Lowe Milling Co. | 16.50 | 4.58 |
| | | Bardwell, Ky. | 14.22 | 4.43 |
| 725-11 | Milburn Feed | O. T. Helfer | 16.44 | 4.20 |
| | | Milburn, Ky. | 12.81 | 4.03 |
| 579-11 | Mixed Feed | T. J. Hook | 15.10 | 4.75 |
| | | Hardinsburg, Ky. | 14.38 | 4.61 |
| 961-11 | Jersey Mixed Feed | Hope Mills Co. | 17.31 | 4.10 |
| | | White Plains, Ky. | 16.31 | 4.68 |
| 43-12 | Star & Crescent | Hopkinsville Milling Co. | 15.25 | 4.91 |
| | | Hopkinsville, Ky. | 13.25 | 4.68 |
| 10-11 | Mixed Feed | Horse Cave Mills | 15.85 | 4.85 |
| | | Horse Cave, Ky | 14.87 | 3.78 |
| 10-11 | Mixed Feed | Horse Cave Mills | 16.60 | 4.54 |
| | | Horse Cave, Ky. | 14.87 | 3.78 |
| 159-12 | Mixed Feed | Horse Cave Mills | 16.75 | 4.45 |
| | | Horse Cave, Ky. | 14.87 | 3.78 |
| 124-11 | Mill Feed | Hustonville Milling Co. | 15.25 | 4.79 |
| | | Hustonville, Ky. | 16.00 | 3.55 |
| 124-11 | Mill Feed | Hustonville Milling Co. | 14.44 | 4.24 |
| | | Hustonville, Ky. | 16.00 | 3.55 |
| 436-11 | Mixed Feed | Irvington Mill & Elevator Co. | 16.19 | 3.80 |
| | | Irvington, Ky. | 12.19 | 4.35 |
| 436-11 | Mixed Feed | Irvington Mill & Elevator Co. | 15.44 | 3.75 |
| | | Irvington, Ky. | 12.19 | 4.35 |
| 719-12 | Mixed Feed | John Bros. Milling Co. | 15.56 | 4.73 |
| | | Henshaw, Ky. | 12.56 | 4.15 |
| 1011-9 | Mixed Feed | Thos. H. Johnson | 15.31 | 3.87 |
| | | Benton, Ky. | 13.00 | 4.29 |
| 248-11 | "Lyon" | Keith Bros. | 16.28 | 4.84 |
| | | Buffalo, Ky. | 15.19 | 5.09 |
| 507-11 | Mixed Feed | R. U. Kevil & Sons | 16.38 | 4.39 |
| | | Princeton, Ky. | 15.00 | 4.00 |
| 442-11 | Mixed Feed | R. U. Kevil & Sons | 16.31 | 4.20 |
| | | Mayfield, Ky. | 14.50 | 4.95 |
| 97-12 | Mixed Feed | R. U. Kevil & Sons | 16.10 | 4.37 |
| | | Princeton, Ky. | 15.00 | 4.00 |
| 502-11 | Mixed Feed | Kuttawa Milling Co. | 16.78 | 4.82 |
| | | Kuttawa, Ky. | 13.90 | 3.52 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 99-11 | Ballard Mercantile Co..... Wickliffe, Ky. | Wheat bran, Shipstuff, Corn bran, Wheat screenings 5%. | |
| 725-11 | Manufacturer's Warehouse | Wheat bran, Corn bran, screenings 15%. | |
| 579-11 | J. H. Roberts..... Fordsville, Ky. | Wheat bran, Corn bran. Wheat Middlings, Ground Wheat Screenings 2%. | |
| 961-11 | H. C. Wilkinson..... Greenville, Ky. | Wheat bran, Corn bran, | Sample is shipstuff. |
| 43-12 | S. C. Jennings & Co..... Madisonville, Ky. | Wheat bran, Corn bran, Wheat screenings 10% | |
| 10-11 | Farmers Union.W.H.&S.Co. Mumfordsville, Ky. | Wheat bran, Shorts, Corn bran. | Contains screenings. |
| 10-11 | Sparks & Brown..... London, Ky. | Wheat bran, Shorts, Corn bran. | Contains screenings and cockle. |
| 159-12 | Manufacturer's Warehouse | Wheat bran, Shorts, Corn bran. | Contains screenings. |
| 124-11 | S. C. White..... Moreland, Ky. | Wheat bran, Corn bran. | Below in protein. |
| 124-11 | W. W. Finch..... Somerset, Ky. | Wheat bran, Corn bran. | Below in protein. |
| 436-11 | J. H. Roberts..... Fordsville, Ky. | Wheat bran, Corn bran, Shipstuff, Screenings 5%. | No corn bran present. |
| 436-11 | Manufacturer's Warehouse | Wheat bran, Corn bran, Shipstuff, Screenings 5%. | No corn bran present. |
| 719-12 | Manufacturer's Warehouse | Wheat bran, Wheat screenings 2%, Corn bran. | |
| 1011-9 | Manufacturer's Warehouse | Wheat bran, Corn bran, Screenings. | No corn bran present. Below in fat. |
| 248-11 | J. A. Bright..... Buffalo, Ky. | Wheat bran, Corn bran. | No corn bran present. |
| 507.11 | A. B. Kevil..... Rockport, Ky. | Wheat bran, Corn bran. | |
| 442-11 | Manufacturer's Warehouse | Wheat bran Shipstuff, Corn bran, Wheat screenings 2%. | Below in fat. |
| 97-12 | Smith Bros..... Princeton, Ky. | Wheat bran, Corn bran. | |
| 502-11 | D. F. Gresham..... Eddyville, Ky. | Shipstuff. Corn bran... | |

TABLE II.—MIXED FEEDS, COMPOSED OF WHEAT AND CORN PRODUCTS, AND DISTILLERS' AND BREWERS' GRAINS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 839-12 | Mixed Feed | Lewisport Mill Co. | 16.53 | 3.91 |
| | | Lewisburg, Ky. | 15.25 | 4.10 |
| 492-11 | Farmers' Choice | Lewisport Mill Co. | 15.19 | 3.86 |
| | | Lewisport, Ky. | 14.00 | 4.25 |
| 493-11 | Mixed Feed | Lewisport Mill Co. | 14.06 | 3.76 |
| | | Lewisport, Ky. | 13.70 | 3.85 |
| 89-11 | Nonesuch Feed | Louisville Cereal Mill Co. | 10.25 | 7.16 |
| | | Louisville, Ky. | 11.00 | 7.80 |
| 89-11 | Nonesuch Feed | Louisville Cereal Mill Co. | 11.97 | 7.54 |
| | | Louisville, Ky. | 11.00 | 7.80 |
| 89-11 | Nonesuch Feed | Louisville Creal Mill Co. | 11.22 | 7.36 |
| | | Louisville, Ky. | 11.00 | 7.80 |
| 459-12 | Nonesuch Feed | Louisville Cereal Mill Co. | 11.53 | 8.00 |
| | | Louisville, Ky. | 11.00 | 7.80 |
| 46-12 | Mill Feed | Madison Milling Co. | 15.38 | 5.02 |
| | | Richmond, Ky. | 14.00 | 4.25 |
| 87-11 | Bob White | Madisonville Milling Co. | 15.31 | 5.30 |
| | | Madisonville, Ky. | 12.98 | 3.77 |
| 1007-12 | Bob White | Madisonville Milling Co. | 15.53 | 5.79 |
| | | Madisonville, Ky. | 12.98 | 3.77 |
| 897-12 | Feeders' Favorite Mixed Feed | Marion Milling Co. | 14.60 | 4.18 |
| | | Marion, Ky. | 14.40 | 4.60 |
| 748-11 | Mixed Feed | Massey Milling Co. | 14.10 | 5.50 |
| | | Drake, Ky. | 13.68 | 5.02 |
| 181-12 | Mixed Feed | Massey Milling Co. | 15.03 | 3.75 |
| | | Drake, Ky. | 13.68 | 5.02 |
| 794-9 | Mixed Feed | McDaniel & White | 14.69 | 4.10 |
| | | Olaton, Ky. | 13.95 | 4.87 |
| 44-11 | Mixed Brans | McWhorter & Wells | 14.91 | 3.55 |
| | | Springfield, Ky. | 13.41 | 3.30 |
| 927-11 | Mill Feed | Middlesboro Flour Mills Co. | 16.38 | 4.42 |
| | | Middlesboro, Ky. | 15.81 | 4.60 |
| 927-11 | Mill Feed | Middlesboro Flour Mills Co. | 15.41 | 3.88 |
| | | Middlesboro, Ky. | 15.81 | 4.60 |
| 526-11 | Mixed Feed | Model Roller Mills | 13.81 | 3.52 |
| | | Smith's Grove, Ky. | 13.81 | 5.13 |
| 650-12 | Mixed Feed | Model Roller Mills | 15.41 | 4.40 |
| | | Smith's Grove, Ky. | 13.81 | 5.13 |
| 712-11 | White Rose Mixed Feed | Morganfield Roller Mills | 14.35 | 6.17 |
| | | Morganfield, Ky. | 12.50 | 4.50 |
| 532-11 | Mixed Brans | W. N. Neville | 16.06 | 4.51 |
| | | Arlington, Ky. | 15.43 | 3.90 |

## Analyses of Inspectors' Samples.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 839-12 | Manufacturer's Warehouse | Shipstuff, Corn bran, Wheat screenings 10% | |
| 492-11 | C. A. Coleman..... Brandenburg, Ky. | Shipstuff, Corn bran... | |
| 493-11 | C. A. Coleman..... Brandenburg, Ky. | Wheat bran, Corn bran, Wheat screenings 5% | |
| 89-11 | DeLancey & White..... Williamsburg, Ky. | Hominy Meal, Wheat bran. | Below in both protein and fat. |
| 89-11 | O. M. Smith & Co..... Frankfort, Ky. | Hominy Meal, Wheat bran. | |
| 89-11 | Sparks & Brown..... London, Ky. | Hominy Meal, Wheat bran. | |
| 459-12 | M. S. Crain & Co..... Jackson, Ky. | Hominy Meal, Wheat bran. | |
| 46-12 | Manufacturer's Warehouse | Wheat bran, Corn bran, Wheat screenings 3% | |
| 87-11 | W. E. Ellis..... Hartford, Ky. | Shipstuff, Corn bran, Wheat bran, Cheat 5%. | |
| 1007-12 | Manufacturer's Warehouse | Shipstuff, Corn bran. Wheat bran, Cheat 5%. | |
| 897-12 | Manufacturer's Warehouse | Bran, Shipstuff, Corn bran , Wheat screenings. | |
| 748-11 | W. A. Cassidy..... Bowling Green, Ky. | Wheat bran, Corn bran. | |
| 181-12 | R. L. Robinson..... Bowling Green, Ky. | Wheat bran, Corn bran. | Below in fat. |
| 794-9 | Manufacturer's Warehouse | Wheat bran, Corn bran, Shipstuff. | Below in fat. |
| 44-11 | Bricken & Merkley..... Lebanon, Ky. | Wheat bran, Corn bran | |
| 927-11 | Central Coal & Feed Co... Middlesboro, Ky. | Wheat bran, corn bran. Shorts. | No corn bran present. |
| 927-11 | Manufacturer's Warehouse | Wheat bran, corn bran. Shorts. | Sample is shipstuff. Below in protein and fat. |
| 526-11 | G. M. King..... Glasgow Junction, Ky. | Wheat bran, corn bran, Wheat screenings 3% | Below in fat. |
| 650-12 | England & Co..... Horse Cave, Ky. | Wheat bran, corn bran Wheat screenings 3% | Below in fat. |
| 712-11 | W. E. Ellis..... Hartford, Ky. | Wheat bran, Corn bran | |
| 532-11 | Manufacturer's Warehouse | Wheat bran, Corn bran. | Sample is wheat bran. |

## TABLE II.—MIXED FEEDS, COMPOSED OF WHEAT AND CORN PRODUCTS, AND DISTILLERS' AND BREWERS' GRAINS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 532-11 | Mixed Brans | W. N. Neville | 13.63 | 5.11 |
| | | Arlington, Ky. | 15.43 | 3.90 |
| 532-11 | Mixed Brans | W. N. Neville | 17.88 | 3.35 |
| | | Arlington, Ky. | 15.43 | 3.90 |
| 1053-11 | Mixed Feed | New Era Mills | 16.28 | 4.70 |
| | | Allensville, Ky. | 15.31 | 5.07 |
| 519-11 | Mixed Feed | New Haven Milling Co. | 15.94 | 5.30 |
| | | New Haven, Ky. | 16.31 | 4.35 |
| 882-12 | Mixed Feed | Nolin Milling Co. | 14.78 | 3.95 |
| | | Nolin, Ky. | 14.00 | 4.00 |
| 555-12 | Mixed Brans | Oakville Milling Co. | 17.10 | 4.86 |
| | | Oakville, Ky. | 12.87 | 5.01 |
| 1095-11 | Ideal Feed | E. F. Ogden | 16.00 | 4.50 |
| | | Slaughtersville, Ky. | 13.00 | 4.00 |
| 126-12 | Mill Feed | Ohio Valley Mill & Supply Co. | 14.38 | 5.63 |
| | | Ashland, Ky. | 14.75 | 6.00 |
| 600-11 | Mixed Feed | Paris Milling Co. | 16.47 | 4.15 |
| | | Paris, Ky. | 15.50 | 4.00 |
| 819-12 | Mixed Feed | Parrish & Hawkins | 16.28 | 4.48 |
| | | Providence, Ky. | 13.18 | 5.34 |
| 424-11 | Mill Run | The Patton Milling Co. | 15.31 | 4.26 |
| | | Catlettsburg, Ky. | 13.75 | 3.50 |
| 689-11 | Mixed Feed | Peerless Roller Mills | 15.16 | 3.74 |
| | | Beech Grove, Ky. | 14.81 | 3.40 |
| 633-8 | Mill Feed | Pembroke Roller Mills | 13.78 | 4.95 |
| | | Pembroke, Ky. | 13.44 | 5.13 |
| 595-11 | Ideal Mill Feed | R. C. Poage Milling Co. | 15.60 | 4.85 |
| | | Ashland, Ky. | 12.94 | 4.65 |
| 545-12 | Mixed Feed | Poole Manufacturing Co. | 15.44 | 4.00 |
| | | Poole, Ky. | 15.56 | 4.13 |
| 638-11 | Cream Patent Feed | J. B. Ramsey | 15.31 | 4.89 |
| | | Sebree, Ky. | 15.43 | 4.28 |
| 924-12 | Peerless | Red Cross Milling Co. | 14.63 | 3.81 |
| | | Clay, Ky. | 14.00 | 3.00 |
| 865-12 | Mixed Mill Feed | A. J. Rice | 16.25 | 3.69 |
| | | Lawrenceburg, Ky. | 14.00 | 4.28 |
| 741-11 | Mixed Feed | W. M. Ringo | 16.63 | 4.95 |
| | | Clinton, Ky. | 15.69 | 4.86 |
| 805-11 | Kopp's Mixed Feed | Rockport Milling Co. | 12.81 | 4.11 |
| | | Rockport, Ind. | 12.60 | 4.19 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 532-11 | Manufacturer's Warehouse | Wheat bran, Corn bran. | Below in protein. |
| 532-11 | Manufacturer's Warehouse | Wheat bran, Corn bran. | Sample is white middlings. Below in fat. |
| 1053-11 | Buck Small & Co..... Guthrie, Ky. | Wheat bran, Corn bran 2%. | Below in fat. |
| 519-11 | G. W. Roney..... Lebanon Junction, Ky. | Shorts, Wheat bran, Corn bran. | Below in protein. |
| 882-12 | Manufacturer's Warehouse | Shipstuff, Corn 10%... | |
| 555-12 | S. C. Young..... Oakville, Ky. | Wheat, Corn bran..... | |
| 1095-11 | Manufacturer's Warehouse | Wheat bran, Corn bran, Shipstuff, Screenings 2%. | |
| 126-12 | Prichard & Womack..... Anglin, Ky. | Middlings, Wheat bran, Corn bran. | Below in both protein and fat. |
| 600-11 | Pineville Feed & Grain Co. Pineville, Ky. | Wheat bran, Shorts, Middlings, Corn bran 5%, Wheat screenings 5%. | Sample is shipstuff. |
| 819-12 | W. M .Payne..... Providence, Ky. | Wheat bran, Corn bran, Wheat screenings 5% | Below in fat. |
| 424-11 | Leffingwell & Co..... Ashland, Ky. | Middlings, Wheat bran, Corn bran. | Contains screenings. |
| 689-11 | Manufacturer's Warehouse | Wheat and Corn bran, Shipstuff Wheat screenings 1%. | |
| 633-8 | Manufacturer's Warehouse | Wheat, Corn ..... | |
| 595-11 | R. L. Barnett..... Ashland, Ky | Middlings, Wheat and Corn bran. | |
| 545-12 | E. Tapp..... Henderson, Ky. | Wheat bran, Corn bran, Shipstuff. | |
| 638-11 | A. J. Arnold..... Slaughtersville, Ky. | Wheat bran, Corn bran, Wheat screenings 5% | Contains shipstuff. |
| 924-12 | Manufacturer's Warehouse | Wheat bran, Corn bran. | |
| 865-12 | G. D. Spencer..... Lawrenceburg, Ky. | Shipstuff 90%, Corn Bran 10%. | Below in fat. |
| 741-11 | Manufacturer's Warehouse | Shipstuff, Low Grade Flour, Corn bran. | |
| 805-11 | G. D. Gabbert..... Owensboro, Ky. | Wheat bran, Middlings, Feed Meal, Wheat screenings 3%. | |

## TABLE II.—MIXED FEEDS, COMPOSED OF WHEAT AND CORN PRODUCTS, AND DISTILLERS' AND BREWERS' GRAINS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 637-11 | Mixed Feed | Rockport Milling Co. | 15.63 | 4.38 |
| | | Rockport, Ind | 14.75 | 3.75 |
| 121-12 | Mixed Feed | J. A. Rust | 15.75 | 3.96 |
| | | Dunmor, Ky. | 14.97 | 4.97 |
| 561-12 | White Swan Mixed Feed | T. A. Sandefur | 15.22 | 4.20 |
| | | Henderson, Ky. | 15.25 | 3.89 |
| 354-11 | Cow Specialty | Sanders & Schooler | 15.53 | 4.68 |
| | | Richmond, Ky. | 14.00 | 4.25 |
| 1012-11 | Mixed Feed | Scottsville Milling Co. | 15.75 | 4.38 |
| | | Scottsville, Ky. | 15.00 | 4.00 |
| 550-12 | Mixed Feed | Sharp Milling Co. | 15.10 | 3.60 |
| | | Ncholasville, Ky. | 15.00 | 3.50 |
| 744-12 | Mixed Feed | Smithfield Milling Co. | 14.97 | 4.05 |
| | | Smithfield, Ky. | 15.00 | 4.50 |
| 230-12 | Smith's I. X. L. Feed | H. C. Smith & Sons | 17.66 | 4.00 |
| | | Harrodsburg, Ky. | 15.68 | 4.62 |
| 697-11 | Shipstuff and Corn Bran | Smith, Keen & Smith | 17.50 | 4.80 |
| | | Burksville, Ky. | 16.53 | 5.16 |
| 779-12 | Mixed Feed | Southern Star Roller Mills | 16.00 | 4.14 |
| | | Perryville, Ky. | 14.50 | 3.40 |
| 810-11 | Mixed Feed | E. F. Spears & Sons | 15.85 | 4.28 |
| | | Paris, Ky. | 14.50 | 4.50 |
| 810-11 | Mixed Feed | E. F. Spears & Sons | 15.47 | 4.60 |
| | | Paris, Ky. | 14.50 | 4.50 |
| 810-11 | Mixed Feed | E. F. Spears & Sons | 14.81 | 4.60 |
| | | Paris, Ky. | 14.50 | 4.50 |
| 1047-11 | Mixed Feed | Squires & Miller | 16.22 | 4.25 |
| | | Cloverport, Ky. | 15.06 | 5.18 |
| 539-11 | Jersey Feed | Standard Roller Mills | 14.75 | 4.00 |
| | | Cerulean, Ky. | 15.00 | 4.00 |
| 307-12 | Tip Top Feed | Star Milling Co. | 16.19 | 4.06 |
| | | Nicholasville, Ky. | 14.41 | 3.71 |
| 989-11 | Mixed Feed | Stephensport Roller Mills | 15.56 | 3.84 |
| | | Stephensport, Ky. | 14.85 | 4.19 |
| 1055-11 | Mixed Feed | Stokes Bros. | 16.94 | 4.02 |
| | | Monticello, Ky. | 14.89 | 4.19 |

## Analyses of Inspectors' Samples.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 637-11 | G. D. Gabbert..... Owensboro, Ky. | Wheat bran, Middlings, Corn bran, Wheat screenings 3%. | |
| 121-12 | Manufacturer's Warehouse | Wheat bran, Corn bran. | Below in fat. |
| 561-12 | Barnett Feed & Com. Co. Henderson, Ky. | Wheat bran, Corn bran, Wheat screenings 4%. | |
| 354-11 | Edwards & Sparks..... London, Ky. | Wheat bran, Corn bran, Wheat Screenings 5%. | |
| 1012-11 | Manufacturer's Warehouse | Wheat bran, Shorts, Corn bran. | |
| 550-12 | C. T. Witt..... Irvine, Ky. | Wheat bran, Corn bran, Wheat screenings 5% | |
| 744-12 | Alex Browning..... LaGrange, Ky. | Wheat bran, Corn bran, Wheat screenings 2% | |
| 230-12 | Manufacturer's Warehouse | Wheat bran, Corn bran, Shorts. | Does not contain corn bran. Below in fat. |
| 697-11 | Manufacturer's Warehouse | Wheat, Corn, Wheat screenings 2%. | |
| 779-12 | Lee & Helan..... Danville,, Ky. | Wheat bran, Shipstuff, Corn bran. | No corn bran present. |
| 810-11 | T. A. Porter..... London, Ky. | Wheat bran, Shorts, Middlings, Corn bran 5%, Wheat screenings 3%. | |
| 810-11 | J. C. Everett & Co..... Maysville, Ky. | Wheat bran, Shorts, Middlings, Corn bran 5%, Wheat screenings 3%. | |
| 810-11 | Magic City Coal & Feed Co. Middlesboro, Ky. | Wheat bran, Shorts, Middlings, Corn bran 5%, Wheat screenings 3%. | |
| 1047-11 | Manufacturer's Warehouse | Wheat bran, Corn bran, Shorts. | Sample is shipstuff. Below in fat. |
| 539-11 | E. A. & L. Cohen..... Greenville, Ky. | Wheat bran, Corn bran, Screenings 1%. | Excess of screenings. |
| 307-12 | Manufacturer's Warehouse | Wheat bran, Shorts, Middlings, Corn bran, Wheat screenings 3%. | |
| 989-11 | A. D. Ashcraft..... Irvington, Ky. | Shipstuff, Corn bran.. | |
| 1055-11 | Manufacturer's Warehouse | Wheat bran, Middlings, Corn bran. | Found no corn bran. |

TABLE II.—MIXED FEEDS, COMPOSED OF WHEAT AND CORN PRODUCTS, AND DISTILLERS' AND BREWERS' GRAINS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 342-11 | Mixed Feed | Tell City Flouring Mills<br>Tell City, Ind. | 15.56<br>14.00 | 4.71<br>4.00 |
| 31-12 | Belle Brans | J. W. Thompson<br>Madisonville, Ky. | 15.28<br>14.75 | 6.33<br>4.29 |
| 825-12 | Cow Feed | Trenton Milling Co.<br>Trenton, Ky. | 14.44<br>13.91 | 4.85<br>4.77 |
| 743-12 | Mixed Feed | Uniontown Roller Mills<br>Uniontown, Ky. | 16.06<br>15.00 | 3.99<br>4.00 |
| 991-11 | Concentrated Feedstuff | Vine Grove Roller Mills<br>Vine Grove, Ky. | 15.78<br>15.94 | 4.80<br>4.85 |
| 991-11 | Concentrated Feedstuff | Vine Grove Roller Mills<br>Vine Grove, Ky. | 15.81<br>15.94 | 4.43<br>4.85 |
| 975-12 | Concentrated Feedstuff | Vine Grove Roller Mills<br>Vine Grove, Ky. | 15.00<br>15.94 | 4.41<br>4.85 |
| 782-11 | Mixed Feed | Alex Walker<br>Lancaster, Ky. | 17.19<br>16.00 | 5.57<br>5.38 |
| 782-11 | Mixed Feed | Alex Walker<br>Lancaster, Ky. | 16.72<br>16.00 | 3.95<br>5.38 |
| 41-11 | Mixed Feed | Wilford Milling Co.<br>Bowling Green, Ky. | 13.31<br>15.12 | 5.98<br>6.13 |
| 951-11 | Mixed Feed | Wilford Milling Co.<br>Bowling Green, Ky. | 15.69<br>13.72 | 4.85<br>4.25 |
| 951-11 | Mixed Feed | Wilford Milling Co.<br>Bowling Green, Ky. | 17.16<br>13.72 | 3.87<br>4.25 |
| 474-11 | Mixed Feed | Winchester Roller Mills<br>Winchester, Ky. | 16.25<br>15.50 | 4.05<br>3.73 |
| 747-11 | Woolcott's Feed | J. F. Woolcott & Co.<br>S. Carrollton, Ky. | 15.94<br>15.19 | 3.73<br>4.86 |
| 821-12 | Mixed Feed | Woodburn Milling Co.<br>Woodburn, Ky. | 15.00<br>15.18 | 3.63<br>4.85 |
| 324-11 | Bonanza | J. W. Zaring Grain & Mill Co.<br>Richmond, Ky. | 14.13<br>14.00 | 5.99<br>3.75 |
| 324-11 | Bonanza | J. W. Zaring Grain & Mill Co.<br>Richmond, Ky. | 13.35<br>14.00 | 4.29<br>3.75 |
| | **Brewers' Dried Grains.** | | | |
| 990-11 | Brewers' Dried Grains | West Louisville Brewing Co.<br>Louisville, Ky. | 33.35<br>33.35 | 9.09<br>9.09 |
| | **Distillers' Dried Grains.** | | | |
| 727-11 | Distillers' Corn Dried Grains | F. S. Ashbrook Distillery Co.<br>Cynthiana, Ky. | 30.25<br>31.88 | 10.93<br>12.55 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 342-11 | W. C. Kelly..... Hawesville, Ky. | Middlings, Shipstuff, Bran, Corn bran, Wht. screenings 4%. | |
| 31-12 | Manufacturer's Warehouse | Wheat bran, Corn bran. | |
| 825-12 | Manufacturer's Warehouse | Ground Corn, Wheat bran, Wheat Middlings. | Contains screenings. |
| 743-12 | W. J. Kirk..... Madisonville, Ky. | Shipstuff, Corn Bran, Wheat bran, Wheat Screenings 4%. | No corn bran present. |
| 991-11 | Manufacturer's Warehouse | Wheat bran, Corn bran. | Contains screenings and cockle. |
| 991-11 | W. C. Stader..... Vine Grove, Ky. | Wheat bran, Corn bran. | |
| 975-12 | Tom Brown..... Stithton, Ky. | Wheat bran, Corn bran. | Below in protein. |
| 782-11 | Corbin Feed Store..... Corbin, Ky. | Wheat bran, Corn bran. | Mostly middlings. |
| 782-11 | Hudson & Hughes..... Lancaster, Ky. | Wheat bran, Corn bran. | Below in fat. |
| 41-11 | F. W. Alvis..... Bowling Green, Ky. | Wheat bran, Corn bran, Wheat screenings 5%. | Excess corn bran. |
| 951-11 | Central City Feed & S. Co. Central City, Ky. | Wheat bran, Corn bran, Wheat screenings 5%. | |
| 951-11 | Park City Feed Store..... Bowling Green, Ky. | Wheat bran, Corn bran, Wheat screenings 5%. | No corn bran present. |
| 474-11 | F. P. Blair..... Morehead, Ky. | Shipstuff, Corn bran.. | No corn bran present. |
| 747-11 | Manufacturer's Warehouse | Wheat bran, Shipstuff, Corn bran, Wheat screenings 5%. | Below in fat. |
| 821-12 | R. C. Posey..... Bowling Green, Ky. | Bran, Shorts, Corn bran. | Below in fat. |
| 324-11 | Perkins Bros..... Williamsburg, Ky. | Wheat bran, Corn bran, Wheat screenings 25% | |
| 324-11 | S. E. Welch..... Berea, Ky. | Wheat bran, Corn bran, Wheat screenings 25% | Below in protein. Excess corn bran. |
| 990-11 | C. Moses..... Shively, Ky. | Malt, Corn, Grits..... | Below in protein. |
| 727-11 | Fred Rezmardt..... Erlanger, Ky. | Corn, Rye, Malt..... | Below in both protein and fat. |

TABLE II.—MIXED FEEDS, COMPOSED OF WHEAT AND CORN PRODUCTS, AND DISTILLERS' AND BREWERS' GRAINS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 470-12 | Distillers' Corn Dried Grains..... | F. S. Ashbrook Distillery Co.... | 33.13 | 10.06 |
| | | Cynthiana, Ky. | 31.88 | 10.51 |
| 77-11 | Distillers' Corn Dried Grains ..... | The Early & Daniel Co. ..... | 29.85 | 7.29 |
| | | Covington, Ky. | 30.71 | 10.53 |
| 521-12 | Distillers' Dried Grains ..... | Eminence Distillery Co. ..... | 34.97 | 9.13 |
| | | Eminence, Ky. | 34.31 | 9.43 |
| 58-11 | Distillers' Rye Dried Grains ..... | Geo. Keller ..... | 24.50 | 7.00 |
| | | Newport, Ky. | 24.35 | 7.50 |
| 58-11 | Distillers' Rye Dried Grains ..... | Geo. Keller ..... | 23.81 | 7.01 |
| | | Newport, Ky. | 24.35 | 7.50 |

TABLE III.—CHICKEN FEEDS.

| | | | | |
|---|---|---|---|---|
| 1185-11 | "Allneeda" Hen Feed ..... | Allneeda Mills Co. ..... | 9.88 | 3.06 |
| | | E. St. Louis, Ill. | 9.75 | 2.83 |
| 981-11 | "Cluck Cluck" Hen Feed ..... | American Milling Co. ..... | 11.88 | 2.98 |
| | | Chicago, Ill. | 10.00 | 3.00 |
| 981-11 | "Cluck Cluck" Hen Feed ..... | American Milling Co. ..... | 10.47 | 3.49 |
| | | Chicago, Ill. | 10.00 | 3.00 |
| 977-11 | Amco Hen Feed ..... | American Milling Co. ..... | 10.56 | 3.04 |
| | | Chicago, Ill. | 10.00 | 3.00 |
| 1042-11 | Nutro Hen Feed ..... | Corno Mills Co. ..... | 10.06 | 3.45 |
| | | St. Louis, Mo. | 10.00 | 3.50 |
| 190-9 | Corno Chick Feed ..... | Corno Mills Co. ..... | 10.78 | 3.06 |
| | | St. Louis, Mo. | 10.00 | 3.50 |
| 334-12 | Corno Hen Feed ..... | Corno Mills Co. ..... | 10.10 | 3.01 |
| | | St. Louis, Mo. | 10.00 | 3.50 |
| 891-11 | Pine Tree Scratch Feed (No Grit). | Albert Dickinson Co. ..... | 10.97 | 3.58 |
| | | Chicago, Ill. | 10.00 | 2.50 |
| 730-12 | Chicken Feed ..... | C. P. Dodd & Co..... | 10.22 | 3.48 |
| | | Louisville, Ky. | 9.62 | 3.38 |
| 1204-11 | Chicken Feed ..... | Drakesboro Milling Co. ..... | 10.66 | 3.72 |
| | | Drakesboro, Ky. | 8.75 | 3.63 |

## Analyses of Inspectors' Samples.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 470-12 | W. M. Adams..... Cynthiana, Ky. | Corn, Rye, Malt ..... | |
| 77-11 | A. B. Hartman ..... Covington, Ky. | Corn, Rye, Malt..... | Below in both protein and fat. |
| 521-12 | Order Deng Bros. Co..... LaGrange, Ky. | Corn, Rye, Barley, Malt | |
| 58-11 | John Kunkenmiller..... Cold Springs, Ky. | Rye, Oats, Corn, Barley. | Below in fat. |
| 58-11 | Geo. B. Moock..... Newport, Ky. | Rye, Oats, Corn, Barley. | Below in both protein and fat. |
| 1185-11 | T. E. Ford..... Paducah, Ky. | Kafir corn, Corn, Sunflower seed. | |
| 981-11 | G. D. Gabbert..... Owensboro, Ky. | Corn, Wheat, Barley, Kafir corn, Buckwheat, Sunflower seed. | Contains oats, oil meal and weed seeds. |
| 981-11 | W. R. Skillman & Co..... Owensboro, Ky. | Corn, Wheat, Barley, Kafir corn, Buckwheat, Sunflower seed. | Contains oats, oil meal and weed seeds. |
| 977-11 | D. A. McCormick..... Owensboro, Ky. | Corn, Wheat, Barley, Linseed Oil Cake, Sunflower seed. | Contains oats, buckwheat and weed seeds. |
| 1042-11 | Irvin, Hughes & Jones.... Hardin, Ky. | Wheat, Corn, Milo maize, Kafir corn, Sunflower seed. | |
| 190-9 | Forbes Manufacturing Co. Hopkinsville, Ky. | Wheat, Corn, Kafir corn, Millet seed. | Below in fat. |
| 334-12 | Forbes Manufacturing Co. Hopkinsville, Ky. | Wheat, Corn, Kafir corn, Milo maize, Sunflower seed. | Below in fat. |
| 891-11 | D. P. Ratican..... Owensboro, Ky. | Corn, Wheat, Barley, Oats, Kafir corn, Sunflower seed. | Contains buckwheat and Linseed meal. |
| 730-12 | H. G. Brooks..... Louisville, Ky. | Cracked corn, Wheat.. | Contains oats, cheat, Kafir corn, screenings. |
| 1204-11 | Manufacturer's Warehouse | Cracked corn, Wheat.. | Contains corn cockle. |

TABLE III.—CHICKEN FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 560-11 | Good Luck Mill Feed (Scratch Size) | Good Luck Mills, St. Louis, Mo. | 10 75<br>10.00 | 3.25<br>3.60 |
| 1140-11 | Superior Hen Feed | H. P. Hawkins, Paducah, Ky. | 10.75<br>9.04 | 3.87<br>4.15 |
| 953-11 | International Poultry Feed (Scratch Size) | International Sugar Feed No. Two Co., Memphis, Tenn. | 11.75<br>10.00 | 3.55<br>3.00 |
| 954-11 | International Poultry Feed (Chick size) | International Sugar Feed No. Two Co., Memphis, Tenn. | 10.22<br>10.00 | 3.43<br>3.50 |
| 94-11 | Veribest Chicken Feed | Louisville Cereal Mill Co., Louisville, Ky. | 11.28<br>10.00 | 2.98<br>3.88 |
| 980-10 | Bell Brand Poultry Feed | Ohio Valley Seed Co., Evansville, Ind. | 10.85<br>11.20 | 3.33<br>3.90 |
| 996-11 | Rex Chicken Feed | Paducah Milling Co., Paducah, Ky. | 10.47<br>10.78 | 3.00<br>3.54 |
| 963-11 | Gold Standard Scratch Feed | W. A. Peay, Livermore, Ky. | 10.31<br>11.91 | 4.02<br>3.46 |
| 569-11 | Quaker Scratching Grains | Quaker Oats Co., Chicago, Ill. | 9.97<br>10.00 | 3.15<br>2.50 |
| 568-11 | Schumacher Scratching Grains | Quaker Oats Co., Chicago, Ill. | 11.35<br>10.00 | 3.10<br>2.50 |
| 933-11 | Quaker Chick Feed | Quaker Oats Co., Chicago, Ill. | 9.98<br>10.00 | 3.17<br>2.50 |
| 460-11 | Purina Mill Feed (Scratch Size) | Ralston Purina Co., St. Louis, Mo. | 11.22<br>11.00 | 3.12<br>3.60 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 560-11 | Sears' Grocery Co..... Paducah, Ky. | Wheat, Corn, Kafir corn, Milo maize, Grit 10%, Oats, Barley Sunflower seed, various grain screenings 10%. | |
| 1140-11 | Manufacturer's Warehouse | Corn 55%, Wht. 30%, Barley 6%, Oats 2%, Sunflower seed 2%, Corn screenings 5%. | Contains Kafir Corn. |
| 953-11 | Capitol Produce & Feed Co. Frankfort, Ky. | Wheat, Oats, Barley, Buckwheat, Kafir corn, Molasses, Corn. | No buckwheat present. Contains wild buckwheat, wild oats, pigeon-grass, hare's ear. |
| 954-11 | Jellico Grocery Co..... Middlesboro, Ky. | Wheat, Oats, Barley, Corn, Buckwheat, Kafir corn, Molasses, Sunflower seed. | Sample is composed of corn, wheat and small per cent Sunflower seed. |
| 94-11 | DeLancey & White..... Williamsburg, Ky. | Corn, Oats, Wheat.... | Below in fat. |
| 980-10 | Owensboro Feed & Seed Co Owensboro, Ky. | Wheat, Corn, Oats, Barley, Kafir corn, whole seeds, bone, Beef Scrap. | Contains charcoal, burnt wheat, Sunflower seed. Found no oats, bone or beef scraps. Below in protein and fat. |
| 996-11 | F. A. Arant..... Paducah, Ky. | Corn, Wheat ..... | Contains oats, cob and sticks. Below in fat. |
| 963-11 | Manufacturer's Warehouse | Wheat, Corn, Granulated Bone. | Below in protein. |
| 569-11 | Curry, Brown & Snyder... Lexington, Ky. | Wheat, Kafir corn, Barley, Oats, Corn, Buckwheat, Sunflower seed, Charcoal. | No charcoal present. |
| 568-11 | W. J. Brell ..... Erlanger, Ky. | Wheat, Barley, Oats, Buckwheat, Cracked corn, Kafir corn, Sunflower seed, Charcoal. | |
| 933-11 | Curry, Brown & Snyder... Lexington, Ky. | Wheat, Millet, Corn, Kafir corn, Charcoal. | |
| 460-11 | Bryan, Goodwin & Hunt.. Lexington, Ky. | Wheat, Corn, Oats, Barley, Kafir corn, Milo maize, Sunflower seed, various grain screenings 10%. | Below in fat. |

## TABLE III.—CHICKEN FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 627-11 | Mill Feed (Scratch Size) ..... | Robinson-Danforth Co. ..... St. Louis, Mo. | 10.88<br>11.00 | 4.02<br>3.60 |
| 627-11 | Mill Feed (Scratch Size) ..... | Robinson-Danforth Co. ..... St. Louis, Mo. | 10.50<br>11.00 | 3.38<br>3.60 |
| 1051-10 | Double "S" Chicken Feed ..... | A. Schneider's Sons ..... Louisville, Ky. | 10.31<br>10.38 | 3.51<br>3.63 |
| 225-10 | Eclipse Poultry Feed (With Shells) | W. H. Small & Co. ..... Evansville, Ind. | 8.97<br>8.53 | 2.70<br>2.14 |
| 1188-11 | Eclipse Poultry Feed (Without Shells) ..... | W. H. Small & Co. ..... Evansville, Ind. | 10.03<br>9.90 | 3.02<br>3.35 |
| 829-9 | Sterling Poultry Feed ..... | I. F. Tabb ..... Mt. Sterling, Ky. | 10.10<br>9.56 | 3.15<br>3.29 |
| 932-11 | Hen Feed ..... | M. J. Yopp Seed Co. ..... Paducah, Ky. | 11.88<br>10.22 | 3.01<br>3.84 |

## TABLE IV.—MISCELLANEOUS MIXED FEEDS.

| | | | | |
|---|---|---|---|---|
| 1184-11 | Creamo Butter Fat Dairy Feed.... | Allneeda Mills Co. ..... St. Louis, Mo. | 14.19<br>14.78 | 4.56<br>5.40 |
| 24-10 | Sucrene Dairy Feed ..... | American Milling Co. ..... Chicago, Ill. | 15.47<br>16.50 | 3.47<br>3.50 |
| 23-10 | Sucrene Horse and Mule Feed.... | American Milling Co. ..... Chicago, Ill. | 11.25<br>10.00 | 3.50<br>3.50 |
| 976-11 | Sucrene Quality Feed ..... | American Milling Co. ..... Chicago, Ill. | 18.91<br>20.00 | 4.35<br>4.00 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 627-11 | J. M. Logsdon..... Owensboro, Ky. | Wheat, Corn, Oats, Barley, Kafir corn, Milo maize, Sunflower seed, various grain screenings 10%. | Grain screenings contain flax seed, wild buckwheat, mustard seed, pigeon grass seed, cheat and cockle. |
| 627-11 | J. D. Orton & Co..... Dawson Springs, Ky. | Wheat, Corn, Oats, Barley, Kafir corn, Milo maize, Sunflower seed, various grain screenings 10%. | Below in protein and fat. Screenings contain a number of weed seeds. |
| 1051-10 | Manufacturer's Warehouse | Sunflower seed, Kafir corn, Wheat, Cracked Corn. | Contains wheat and corn cockle. |
| 225-10 | C. Howard..... Russellville, Ky. | Wheat, Kafir corn, Corn, Sunflower seed, Shells 10%. | |
| 1188-11 | W. A. Young..... Greenville, Ky. | Wheat, Kafir corn, Corn, Sunflower seed. | |
| 829-9 | Manufacturer's Warehouse | Corn, Wheat, Sorghum, Kafir corn, Sunflower seed, Bone, Grit 5%. | Weed seeds. |
| 932-11 | Manufacturer's Warehouse | Corn, Wheat, Kafir corn, Sunflower seed, Wheat screenings 10% | Below in fat. Contains cockle. |
| 1184-11 | Edgewood Farm Dairy.... Paducah, Ky. | Flax Seed meal, Alfalfa meal, Corn meal, Cotton Seed meal, Wheat bran, Salt 1%. | Below in protein and fat; found 14.13% fiber, guaranty 12.28%. Adulterated with oat hulls. |
| 24-10 | Park City Feed Store..... Bowling Green, Ky. | Cotton Seed meal, Oats, Barley, Wheat, Grain screenings 20%, Malt Sprouts, Molasses, ½ of 1% Salt. | Below in protein. Large amount of inert matter; weed seeds. |
| 23-10 | Park City Feed Store..... Bowling Green, Ky. | Corn, Oats, Barley, Wheat, Molasses, Grain screenings 15%, ½ of 1% Salt. | Oat hulls, straw, large per cent inert matter; weed seeds. |
| 976-11 | D. A. McCormick..... Owensboro, Ky. | Cotton Seed meal, Dist. Dried Grains, Oats, Barley, Wheat, Malt Sprouts, ½ of 1% Salt. | Below in protein, large per cent inert matter; weed seeds. |

TABLE IV.—MISCELLANEOUS MIXED FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 224-12 | Sucrene Alfalfa Horse and Mule Feed | American Milling Co. Chicago, Ill. | 12.88<br>11.00 | 3.78<br>2.50 |
| 818-12 | Union Grains, Biles Ready Ration. | The J. W. Biles Co. Cincinnati, Ohio. | 24.72<br>24.00 | 7.05<br>7.00 |
| 199-11 | Peerless Cow Feed | Blue Grass Commission Co. Lexington, Ky. | 21.41<br>19.50 | 6.16<br>5.45 |
| 682-11 | Alfalfa and Chop Feed | A. H. Bowman & Co. Louisville, Ky. | 15.47<br>13.75 | 3.35<br>3.47 |
| ..... | Harvester Molasses Feed | Cairo Milling Co. Cairo, Ill. | 9.19<br>12.30 | 3.13<br>4.00 |
| 289-11 | Alfalfa and Crushed Feed | C. P. Dodd & Co. Louisville, Ky. | 11.44<br>11.88 | 3.68<br>3.98 |
| 104-12 | Alfalfa Cerealia | The Early & Daniel Co. Covington, Ky. | 23.81<br>23.00 | 5.30<br>5.08 |
| 378-11 | Blue Grass Horse Feed | H. Fruechtenicht Louisville, Ky. | 11.60<br>10.73 | 2.35<br>2.40 |
| 798-12 | Old Hickory Dairy Feed | F. P. Gracy & Bro. Clarksville, Tenn. | 18.53<br>18.34 | 5.41<br>5.83 |
| 646-11 | Golden Grain and Alfalfa Feed | H. P. Hawkins Paducah, Ky. | 11.19<br>10.33 | 3.89<br>3.05 |
| 973-11 | Harteno Horse Feed | Lake Shore Elevator Co. Cleveland, Ohio. | 10.91<br>10.94 | 4.22<br>4.35 |
| 973-11 | Harteno Horse Feed | Lake Shore Elevator Co. Cleveland, Ohio. | 11.81<br>10.94 | 4.08<br>4.35 |
| 781-11 | Cracker Jack Mixed Feed | Lewis & Adcock Knoxville, Tenn. | 10.31<br>10.00 | 4.81<br>4.00 |

## Analyses of Inspectors' Samples.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 224-12 | D. A. McCormick..... Owensboro, Ky. | Corn, Rolled Oats, Rolled Barley, Alfalfa, Cotton Seed meal, Molasses, Grain screenings 17½%, Salt ½ of 1%. | |
| 818-12 | H. Rouse..... Crittenden, Ky. | Distillers' Dried Grains, Choice Cotton Seed meal, Old Process Linseed Oil meal, White wheat Middlings, Winter wheat bran, Hominy meal, Barley, Malt Sprouts, ¾ of 1% Table Salt. | |
| 199-11 | D. C. Edwards..... London, Ky. | Cotton Seed meal, Shipstuff, Corn, Oats, Barley. | |
| 682-11 | F. A. Ratterman..... Louisville, Ky. | Alfalfa, Corn, Oats, Shorts. | |
| ..... | LaCenter Implement C... LaCenter, Ky. | Alfalfa meal, Ground corn, Oats, Molasses. | Below in both protein and fat. |
| 289-11 | Albert J. Richards ..... Louisville, Ky. | Oats, Corn, Alfalfa meal, Wheat bran. | |
| 104-12 | W. T. Reeves ..... Sanfordtown, Ky. | Alfalfa, Flax Seed, Cotton Seed meal, Wheat bran, Wheat Middlings, Distillers' Dried Grains, Malt Sprouts, Brewers' Grains, Barley, Salt. | |
| 378-11 | Corbin Feed Store..... Corbin, Ky. | Alfalfa, Molasses, Corn, Oats. | |
| 789-12 | I. D. Ruffner ..... Guthrie, Ky. | Cotton Seed meal, Wht. bran, Corn Meal, Corn bran, Ground Corn, Oats. | |
| 646-11 | Haynes & Dismukes..... Paducah, Ky. | Corn, Oats, Alfalfa, Molasses. | |
| 973-11 | John Jeems ..... Maysville, Ky. | Corn, Oats, Bran, Molasses. | |
| 973-11 | John Janes..... Louisa, Ky. | Corn, Oats, Bran, Molasses. | |
| 781-11 | The H. T. Hackney Co.... Middlesboro, Ky. | Wheat Bran, Corn Meal, Hominy Feed, Corn bran. | |

TABLE IV.—MISCELLANEOUS MIXED FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 781-11 | Cracker Jack Mixed Feed ..... | Lewis & Adcock ..... | 11.85 | 3.95 |
| | | Knoxville, Tenn. | 10.00 | 4.00 |
| 1228-11 | Matzos Meal ..... | William Miller ..... | 10.10 | 1.39 |
| | | Newport, Ky. | ..... | ..... |
| 647-11 | Oatequal Feed ..... | The Oatequal Co. ..... | 15.81 | 4.53 |
| | | Columbus, Ohio. | 12.00 | 5.00 |
| 807-11 | Excello Horse Feed ..... | Ohio Valley Seed Co. ..... | 16.06 | 4.28 |
| | | Evansville, Ind. | 14.00 | 4.00 |
| 995-11 | Green Meadow Corn, Oats and Alfalfa Feed ..... | Paducah Milling Co. ..... | 11.28 | 3.49 |
| | | Paducah, Ky. | 10.22 | 3.30 |
| 964-11 | Gold Standard Mash ..... | W. A. Peay ..... | 15.81 | 5.70 |
| | | Livermore, Ky. | 14.22 | 5.64 |
| 589-11 | Peter's Arab Horse Feed..... | M. C. Peters Mill Co. ..... | 11.66 | 2.51 |
| | | Omaha, Neb. | 9.00 | 2.00 |
| 589-11 | Peter's Arab Horse Feed ..... | M. C. Peters Mill Co. ..... | 11.35 | 2.78 |
| | | Omaha, Neb. | 9.00 | 2.00 |
| 591-11 | June Pasture Dairy Meal..... | M. C. Peters Mill Co. ..... | 13.00 | 0.86 |
| | | Omaha, Neb. | 10.00 | 0.50 |
| 967-11 | Purina Molasses Feed ..... | Ralston Purina Co. ..... | 11.88 | 2.93 |
| | | St. Louis, Mo. | 11.00 | 4.50 |
| 967-11 | Purina Molasses Feed ..... | Ralston Purina Co. ..... | 13.25 | 3.14 |
| | | St. Louis, Mo. | 11.00 | 4.50 |
| 967-11 | Purina Molasses Feed ..... | Ralston Purina Co. ..... | 11.88 | 2.93 |
| | | St. Louis, Mo. | 11.00 | 4.50 |
| 436-12 | Purina Molasses Feed ..... | Ralston Purina Co. ..... | 9.78 | 2.23 |
| | | St. Louis, Mo. | 10.00 | 2.50 |
| 461-11 | Purina Mill Feed ..... | Ralston Purina Co. ..... | 11.06 | 3.67 |
| | | St. Louis, Mo. | 11.00 | 3.60 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 781-11 | Central Coal & Feed Co... Middlesboro, Ky. | Wheat Bran, Corn Meal, Hominy Feed, Corn bran. | |
| 1228-11 | Gus Schuerman..... Newport, Ky. | Bakery Refuse..... | |
| 647-11 | Capitol Produce & Feed Co. Frankfort, Ky. | Oats, Corn, Alfalfa, Brewers' Grains, Molasses. | |
| 807-11 | D. A. McCormick..... Owensboro, Ky. | Wheat Bran, Oats, Corn, Barley, Brewers' grains, Alfalfa meal, Molasses. | Found cracked corn, corn bran, wheat bran, small amount brewers' grains, corn cockle, several oat grains, oat and barley hulls. |
| 995-11 | Manufacturer's Warehouse | Corn, Alfalfa, Molasses, Oats. | |
| 964-11 | Manufacturer's Warehouse | Shipstuff, Corn Meal, Corn bran, Linseed meal, Beef Scraps. | |
| 589-11 | Owensboro Fd. & Sd. Store Owensboro, Ky. | Corn, Oats, Molasses, Alfalfa meal. | |
| 589-11 | Skillman Feed Co..... Owensboro, Ky. | Corn, Oats, Molasses, Alfalfa meal. | |
| 591-11 | J. F. Casebier & Co..... Beaver Dam, Ky. | Alfalfa, Syrup. | |
| 967-11 | DeLaney & White..... Williamsburg, Ky. | Corn, Oats, Brewers' Grains, Ground Wheat screenings 10%, Ground Alfalfa, Molasses. | Below in fat. |
| 967-11 | T. E. Ford..... Paducah, Ky. | Corn, Oats, Dried Brewers' Grains, Ground Wheat screenings 10%, Ground Alfalfa, Molasses. | Below in fat. |
| 967-11 | Sparks & Brown..... London, Ky. | Corn, Oats, Dried Brewers' Grains, Ground Wheat screenings 10%, Ground Alfalfa, Molasses. | Below in both protein and fat. |
| 436-12 | J. W. Chowning & Co..... Georgetown, Ky. | Corn, Oats, Ground Alfalfa, Molasses. | |
| 461-11 | Bryan, Goodwin & Hunt.. Lexington, Ky. | Wheat, Corn, Millet, Kafir corn, Milo maize, Various grain screenings 10%. | |

TABLE IV.—MISCELLANEOUS MIXED FEEDS.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 435-12 | Protena Dairy Feed ..... | Ralston Purina Co. ..... St. Louis, Mo. | 20.63<br>20.00 | 5.24<br>4.50 |
| 1050-10 | Double "S" Crushed Feed ..... | A. Schneider's Sons ..... Louisville, Ky. | 11.72<br>12.01 | 4.15<br>4.27 |
| 1180-11 | Perfection Horse Feed ..... | W. H. Small & Co. ..... Evansville, Ind. | 11.44<br>10.50 | 2.35<br>3.00 |
| 487-11 | Cow Feed ..... | J. Allen Smith & Co. ..... Knoxville, Tenn. | 14.78<br>14.50 | 4.14<br>4.00 |
| 940-12 | Cow Feed ..... | J. Allen Smith & Co. ..... Knoxville, Tenn. | 14.03<br>14.50 | 3.90<br>4.00 |
| 70-11 | Acme Horse and Mule Feed ..... | Ziliak & Schaffer Milling Co.... Evansville, Ind. | 11.75<br>9.69 | 3.41<br>3.60 |

TABLE V.—MISCELLANEOUS MIXED FEEDS CONTAINING A MATERIAL OF LITTLE OR NO FEEDING VALUE.

| | | | | |
|---|---|---|---|---|
| 20-12 | Crushed Ear Corn ..... | Adams & Langford ..... Harrodsburg, Ky. | 8.66<br>8.00 | 3.62<br>3.60 |
| 159-11 | Sucrene Horse and Mule Feed .... | American Milling Co. ..... Chicago, Ill. | 13.38<br>10.00 | 2.73<br>3.50 |
| 225-12 | Sucrene Dairy Feed ..... | American Milling Co. ..... Chicago, Ill. | 17.66<br>16.50 | 5.36<br>3.50 |
| 1008-11 | Perfection ..... | Beaver Dam Milling Co. ..... Beaver Dam, Ky. | 12.72<br>10.41 | 4.14<br>3.19 |
| 534-12 | Creamo Brand Cotton Seed Feed.. | C. S. Brent ..... Lexington, Ky. | 21.88<br>20.00 | 4.32<br>5.00 |
| 135-12 | Pure Ear Crush ..... | Burkholder Bros. ..... Crofton, Ky. | 8.03<br>8.13 | 3.73<br>4.10 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 435-12 | J. W. Chowning & Co..... Georgetown, Ky. | Cotton Seed meal, Brewers' Dried Grains, Hominy feed, Ground Alfalfa. | |
| 1050-10 | Manufacturer's Warehouse | Oats, Corn, Wheat, Alfalfa meal, Brewers' Dried Grains. | |
| 1180-11 | Skillman Feed Co..... Owensboro, Ky. | Condition Powders ... Corn, Oats, Alfalfa, Syrup. | Below in fat. |
| 487-11 | Pineville Feed & Grain Co. Pineville, Ky. | Wheat bran, Shorts, Corn Meal, Corn bran, Wht. and Corn screenings 1%. | |
| 940-12 | The H. T. Hackney Co.... Middlesboro, Ky. | Wheat bran, Shorts, Corn Meal, Corn bran, Wheat and Corn screenings 1%. | |
| 70-11 | W. E. Ellis..... Hartford, Ky. | Corn, Oats, Wheat. | |
| 20-12 | Manufacturer's Warehouse | Corn, Cob 20%..... | |
| 159-11 | D. A. McCormick..... Owensboro, Ky. | Corn, Oats, Barley, Linseed meal, Wheat, Molasses, Oat clippings 25%, ½ of 1% Salt. | Below in fat. Contains Alfalfa. No wheat present. |
| 225-12 | D. A. McCormick..... Owensboro, Ky. | Cotton Seed Meal, Gluten Feed, Molasses, Oat clippings 20%, Ground and Bolted Grain screenings 35%, Salt ½ of 1%. | No gluten feed. |
| 1008-11 | E. P. Barnes & Bros..... Beaver Dam, Ky. | Wheat bran, Shipstuff, Corn screenings 5%, Cob 8%. | |
| 534-12 | R. F. Arnold & Co..... Richmond, Ky. | Choice Cotton Seed meal, Cotton Seed Hulls 50%. | Found 24.05% fiber, guaranty 20%. Below in fat. |
| 135-12 | Manufacturer's Warehouse | Corn, Cob 20%. | |

TABLE V.—MISCELLANEOUS MIXED FEEDS CONTAINING A MATERIAL OF LITTLE OR NO FEEDING VALUE.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 213-12 | Cotton Seed Meal and Hulls..... | Cincinnati Grain Co. ..... | 21.19 | 4.46 |
| | | Covington, Ky. | 22.00 | 5.00 |
| 952-11 | Pride of Greenville ..... | E. A. and L. Cohen ..... | 12.38 | 2.36 |
| | | Greenville, Ky. | 9.81 | 3.68 |
| 269-11 | Corno Horse & Mule Feed ..... | The Corno Mills Co. ..... | 10.44 | 3.11 |
| | | St. Louis, Mo. | 10.00 | 3.50 |
| 269-11 | Corno Horse & Mule Feed ..... | The Corno Mills Co. ..... | 11.69 | 3.58 |
| | | St. Louis, Mo. | 10.00 | 3.50 |
| 269-11 | Corno Horse & Mule Feed ..... | The Corno Mills Co. ..... | 10.53 | 3.61 |
| | | St. Louis, Mo. | 10.00 | 3.50 |
| 270-11 | Creamo Dairy Feed ..... | The Corno Mills Co. ..... | 18.41 | 4.65 |
| | | St. Louis, Mo. | 14.50 | 5.00 |
| 186-10 | Crushed Feed ..... | J. W. Davis & Co. ..... | 8.91 | 4.78 |
| | | Elkton, Ky. | 7.81 | 4.26 |
| 186-10 | Crushed Feed ..... | J. W. Davis & Co. ..... | 10.63 | 4.10 |
| | | Elkton, Ky. | 7.81 | 4.26 |
| 761-11 | Mixed Feed ..... | Dawson Milling Co. ..... | 17.75 | 4.64 |
| | | Dawson Springs, Ky. | 11.25 | 4.97 |
| 143-11 | Choice Cotton Seed Feed ..... | De Soto Oil Co. ..... | 40.00 | 8.29 |
| | | Memphis, Tenn. | 41.00 | 8.50 |
| 1199-11 | Crushed Corn and Cob ..... | Drakesboro Milling Co. ..... | 8.38 | 4.01 |
| | | Drakesboro, Ky. | 7.89 | 3.25 |
| 732-11 | Crushed Ear Corn ..... | Fuqua & Co. ..... | 8.13 | 3.99 |
| | | Livermore, Ky. | 7.50 | 4.00 |
| 665-9 | Crushed Ear Corn ..... | L. P. Gresham ..... | 8.63 | 4.23 |
| | | Eddyville, Ky. | 7.50 | 4.00 |
| 27-11 | Sterling Mixed Feed ..... | Indiana Milling Co. ..... | 9.78 | 3.55 |
| | | Terre Haute, Ind. | 9.35 | 3.02 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 213-12 | H. Hollman..... Latonia, Ky. | Cotton Seed, Cotton Hulls 50%. | Below in both protein and fat. |
| 952-11 | Louis Igelheart..... Dawson Springs, Ky. | Corn, Oats, Kafir corn, Wheat, Sunflower seed, Grit 2½%. | Below in fat. |
| 269-11 | Berea College..... Berea, Ky. | Ground Corn, Ground Alfalfa, Hominy Feed, Cotton Seed Meal, Oat Middlings, Oat Hulls 15%. | No cotton seed meal present. |
| 269-11 | Bryan, Goodwin & Hunt.. Lexington, Ky. | Ground Corn, Ground Alfalfa, Hominy Feed, Cotton Seed Meal, Oat Middlings, Oat Hulls 15%. | No cotton seed meal or hominy feed. |
| 269-11 | R. D. Sullivan..... Williamsburg, Ky. | Ground Corn, Ground Alfalfa, Hominy Feed, Cotton Seed Meal, Oat Middlings, Oat Hulls 15%. | |
| 270-11 | Forbes Manufacturing Co. Hopkinsville, Ky. | Ground Alfalfa, "C. S." Meal, Hominy Feed, Oat Middlings, Oat Hulls 15%. | |
| 186-10 | Manufacturer's Warehouse | Corn, Cob 16%, Corn bran 20%. | |
| 186-10 | Manufacturer's Warehouse | Corn, Cob 16%, Corn Bran 20%, Cotton Seed meal 25% (added). | |
| 761-11 | Manufacturer's Warehouse | Wheat bran, Corn bran, Corn Cob 12%, Screenings 3%. | Found no cob or screenings. |
| 143-11 | D. C. Edwards..... London, Ky. | Decorticated Cotton Seed, Cotton Seed Hulls 15%. | Below in protein. |
| 1199-11 | Manufacturer's Warehouse | Corn, Cob 20%..... | |
| 732-11 | Manufacturer's Warehouse | Corn, Cob 20%..... | |
| 665-9 | Manufacturer's Warehouse | Corn, Cob 20%..... | |
| 27-11 | R. J. Smith Co..... Somerset, Ky. | Wheat bran, Ground Corn, Cob Meal 30%. | |

TABLE V.—MISCELLANEOUS MIXED FEEDS CONTAINING A MATERIAL OF LITTLE OR NO FEEDING VALUE.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 27-11 | Sterling Mixed Feed ..... | Indiana Milling Co. ..... | 10.85 | 3.37 |
| | | Terre Haute, Ind. | 9.35 | 3.02 |
| 312-11 | International Horse & Mule Feed.. | International Sugar Feed No. | 12.85 | 3.96 |
| | | Two Co., Memphis, Tenn. | 12.50 | 3.50 |
| 312-11 | International Horse & Mule Feed.. | International Sugar Feed No. | 13.28 | 4.48 |
| | | Two Co., Memphis, Tenn. | 12.50 | 3.50 |
| 317-11 | International Cow Feed ..... | International Sugar Feed No. | 18.94 | 5.66 |
| | | Two Co., Memphis, Tenn. | 16.50 | 3.50 |
| 317-11 | International Cow Feed ..... | International Sugar Feed No. | 15.00 | 5.48 |
| | | Two Co., Memphis, Tenn. | 16.50 | 3.50 |
| 602-7 | Ideal Stock Feed ..... | La Center Implement Co. ..... | 8.47 | 4.07 |
| | | La Center, Ky. | 8.68 | 4.09 |
| 801-8 | Kevil Chop ..... | J. E. Martin ..... | 8.28 | 3.88 |
| | | Kevil, Ky. | 7.50 | 4.00 |
| 525-11 | Crushed Ear Corn and Shuck..... | Murray Milling Co. ..... | 7.31 | 4.21 |
| | | Murray, Ky. | 6.25 | 3.07 |
| 547-11 | Mixed Feed ..... | Newport Mill Co. ..... | 11.06 | 6.42 |
| | | Loudon,, Tenn. | 13.00 | 4.00 |
| 547-11 | Mixed Feed ..... | Newport Mill Co. ..... | 12.25 | 4.53 |
| | | Loudon, Tenn. | 13.00 | 4.00 |
| ..... | Crushed Ear Corn ..... | Nolin Milling Co. ..... | 8.63 | 3.96 |
| | | Nolin, Ky. | 9.40 | 4.80 |
| 1001-11 | Alcorn ..... | The Oatequal Co. ..... | 9.88 | 3.03 |
| | | Columbus, Ohio. | 10.00 | 3.00 |

## ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 27-11 | R. J. Smith Co. Somerset, Ky. | Wheat bran, Ground Corn, Cob Meal 30%. | |
| 312-11 | Jellico Grocery Co. Middlesboro, Ky. | Corn, Alfalfa, Wheat, Oats, Barley, Flax screenings 25%, Cotton Seed meal, Oat clips 20%, Molasses, Salt. | No wheat or cotton seed meal present. |
| 312-11 | Jellico Grocery Co. Middlesboro, Ky. | Corn, Alfalfa, Wheat, Oats, Barley, Flax screenings 25%, Cotton Seed meal, Oat clips 20%, Molasses, Salt. | |
| 317-11 | Central City Wholesale & Retail Feed & Sup. Co. Central City, Ky. | Cotton Seed meal, Molasses, Wheat, Oats, Barley & Flax screenings 45%, Oat Clips 20%, Alfalfa, Salt. | Contains a number of weed seeds. |
| 317-11 | Jellico Grocery Co. Middlesboro, Ky. | Cotton Seed meal, Molasses, Wheat, Oats, Barley & Flax screenings 45%, Oat Clips 20%, Alfalfa, Salt. | Below in protein. |
| 602-7 | Manufacturer's Warehouse | Corn, Cob 20% | |
| 801-8 | Manufacturer's Warehouse | Corn, Cob 20% | |
| 525-11 | Manufacturer's Warehouse | Corn, Cob 20%, Shucks | |
| 547-11 | J. M. Elliott & Son. Pineville, Ky. | Wheat bran, Shorts, Corn bran, Corn Cob 5%. Wheat screenings 6%, Corn screenings 6%. | Below in protein. |
| 547-11 | Pineville Feed & Grain Co. Pineville, Ky. | Wheat bran, Shorts, Corn bran, Corn Cob 5%. Wheat screenings 6%, Corn screenings 6%. | Below in protein. |
| ..... | Manufacturer's Warehouse | Corn, Cob 20% | Below in both protein and fat. |
| 1001-11 | Capitol Produce & Feed Co. Frankfort, Ky. | Oats, Corn, Alfalfa, Molasses, Brewers' Grains, Oat Middlings, Oat Shorts, Oat Hulls 10%. | |

TABLE V.—MISCELLANEOUS MIXED FEEDS CONTAINING A MATERIAL OF LITTLE OR NO FEEDING VALUE.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 1063-11 | Crushed Feed | W. A. Peay, Livermore, Ky. | 7.60 | 3.57 |
| | | | 7.50 | 4.00 |
| 1063-11 | Crushed Feed | W. A. Peay, Livermore, Ky. | 9.16 | 4.09 |
| | | | 7.50 | 4.00 |
| 965-11 | "Peay's Combination" | W. A. Peay, Livermore, Ky. | 7.88 | 3.43 |
| | | | 8.35 | 4.39 |
| 965-11 | "Peay's Combination" | W. A. Peay, Livermore, Ky. | 9.35 | 4.40 |
| | | | 8.35 | 4.39 |
| 239-12 | Cotton Seed Feed | Phoenix Cotton Oil Co., Dyersburg, Tenn. | 38.38 | 7.90 |
| | | | 38.62 | 10.50 |
| 649-9 | Schumacher Stock Feed | Quaker Oats Co., Chicago, Ill. | 11.16 | 3.26 |
| | | | 10.00 | 4.00 |
| 743-11 | Schumacher Stock Feed | Quaker Oats Co., Chicago, Ill. | 10.91 | 3.86 |
| | | | 10.00 | 3.25 |
| 743-11 | Schumacher Stock Feed | Quaker Oats Co., Chicago, Ill. | 9.53 | 3.44 |
| | | | 10.00 | 3.25 |
| 565-11 | Victor Feed | Quaker Oats Co., Chicago, Ill. | 8.25 | 4.00 |
| | | | 7.50 | 3.00 |
| 565-11 | Victor Feed | Quaker Oats Co., Chicago, Ill. | 8.38 | 3.73 |
| | | | 7.50 | 3.00 |
| 401-11 | Boss Feed | Quaker Oats Co., Chicago, Ill. | 9.00 | 4.06 |
| | | | 8.00 | 3.50 |
| 401-11 | Boss Feed | Quaker Oats Co., Chicago, Ill. | 7.16 | 2.35 |
| | | | 8.00 | 3.50 |
| 402-11 | Excelsior Feed | Quaker Oats Co., Chicago, Ill. | 8.81 | 3.60 |
| | | | 8.00 | 3.50 |
| 233-12 | Smith's Crushed Ear Corn | H. C. Smith & Sons, Harrodsburg, Ky. | 8.50 | 3.91 |
| | | | 7.86 | 3.25 |

## ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 1063-11 | D. S. Smith..... Livermore, Ky. | Corn, Corn Cob 20%, Corn Bran 2% ..... | Below in fat. |
| 1063-11 | Manufacturer's Warehouse | Corn, Corn Cob 20%, Corn bran 2%. | |
| 965-11 | Manufacturer's Warehouse | Oats, Corn, Cob 10%.. | Contains oat hulls. Below in both protein and fat. |
| 965-11 | Manufacturer's Warehouse | Oats, Corn, Cob 10%.. | |
| 239-12 | S. A. Cross..... Mayfield, Ky. | Cotton Seed meal, Cotton Seed hulls. | Below in fat. |
| 649-9 | Ben Dusing..... Covington, Ky. | Corn, Wheat Flour, Barley, Oat Middlings and Shorts, Cotton Seed meal, Oat Hulls and Dust 25%. | No cotton seed meal present. Below in fat. |
| 743-11 | John Wingermuhl..... Latonia, Ky. | Corn, Barley, Oat Middlings, Oat Shorts and Oat Hulls 25%, Cotton Seed Meal, ½ of 1% Salt. | |
| 743-11 | Leffingwell & Co..... Ashland, Ky. | Corn, Barley, Oat Middlings, Oat Shorts and Oat Hulls 25%, Cotton Seed Meal, ½ of 1% Salt. | Below in protein. |
| 565-11 | J. M. Cole..... Murray, Ky. | Corn, Oat Middlings, Oat Shorts and Oat Hulls 25%, ½ of 1% Salt. | |
| 565-11 | Leffingwell & Co..... Ashland, Ky. | Corn, Oat Middlings, Oat Shorts and Oat Hulls 25%, ½ of 1% Salt. | |
| 401-11 | W. A. Clark..... Paducah, Ky. | Corn, Oats, Hominy Feed, Oat Middlings, Oat Shorts and Oat Hulls 20%. | |
| 401-11 | Jellico Grocery Co..... Middlesboro,, Ky. | Corn, Oats, Hominy Feed, Oat Middlings, Oat Shorts and Oat Hulls 20%. | Below in both protein and fat. |
| 402-11 | H. P. Hawkins..... Paducah, Ky. | Corn, Oats, Oat Hulls 20%. | |
| 233-12 | Manufacturer's Warehouse | Corn, Cob 20%. | |

TABLE V.—MISCELLANEOUS MIXED FEEDS CONTAINING A MATERIAL OF LITTLE OR NO FEEDING VALUE.

| Reg. No. | NAME OF FEED. | MANUFACTURER. | Analysis. Prot | Fat |
|---|---|---|---|---|
| 180-8 | Creamo Brand Cotton Seed Feed.. | Tennessee Fiber Co. ..... | 22.78 | 4.73 |
| | | Memphis, Tenn. | 22.00 | 5.00 |
| 581-12 | Creamo Brand Cotton Seed Feed.. | Tennessee Fiber Co. ..... | 21.88 | 5.01 |
| | | Memphis, Tenn. | 20.00 | 5.00 |
| 243-10 | Blue Grass Mixed Feed ..... | A. Waller & Co. ..... | 10.25 | 2.90 |
| | | Henderson, Ky. | 9.81 | 1.65 |
| 780-11 | Blue Grass Mixed Feed ..... | A. Waller & Co. ..... | 10.13 | 2.56 |
| | | Henderson, Ky. | 10.00 | 2.00 |
| 978-12 | Blue Grass Mixed Feed ..... | A. Waller & Co. ..... | 10.41 | 2.77 |
| | | Henderson, Ky. | 10.00 | 2.00 |

ANALYSES OF INSPECTORS' SAMPLES.

| Reg. No. | SAMPLE TAKEN FROM | INGREDIENTS GUARANTEED. | REMARKS—VARIANCE FROM GUARANTY. |
|---|---|---|---|
| 180-8 | Vine Grove Roller Mills... Vine Grove, Ky. | Cotton Seed meal, Cotton Seed hulls 50%. | Fiber 22%, guaranty 20%. |
| 581-12 | J. W. Caudill..... Morehead, Ky. | Cotton Seed meal, Cotton Seed hulls 50%. | Found 22.50% fiber, guaranty 20%. |
| 243-10 | Central City Feed & S. Co. Central City, Ky. | Corn, Cob Meal 25%, Wheat bran, Middlings. | Wheat screenings. |
| 780-11 | M. A. Watkins..... East Bernstadt, Ky. | Corn, Cob Meal 25%, Wheat bran, Middlings. | |
| 978-12 | Manufacturer's Warehouse | Corn, Cob Meal 25%, Wheat bran, Middlings. | |

KENTUCKY

# Agricultural Experiment Station

OF THE

# STATE UNIVERSITY

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## BULLETIN NO. 171

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PART 1. FEEDING DAIRY COWS.
PART 2. EXPERIMENTS IN FEEDING COWS AND CALVES.

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LEXINGTON, KENTUCKY.
April 1, 1913.

# Kentucky Agricultural Experiment Station

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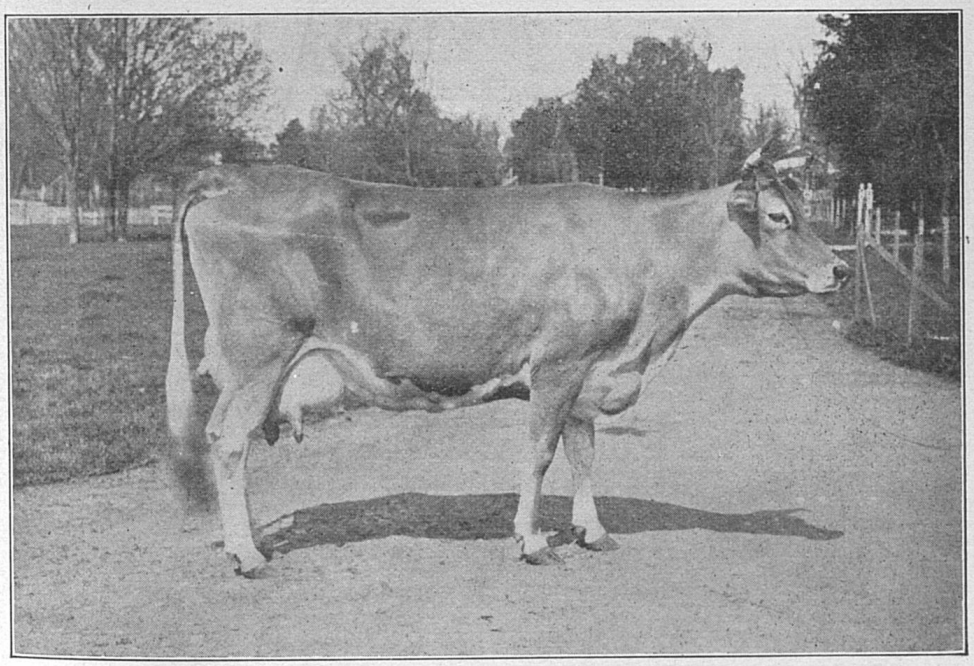
# PART 1.

## FEEDING DAIRY COWS IN KENTUCKY.

*By J. J. Hooper.*

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The question of the proper methods of feeding dairy cows in this State deserves careful consideration. An idea of the magnitude of the dairy industry will be gained by referring to the statistics relating to Kentucky, reported in the 13th census of the United States. The number of farms in this State reporting dairy cows on April 15, 1910, was 216,181, and the number of dairy cows maintained on these farms was 365,000. The milk reported amounted to 125,567,000 gallons, which would



DOLLIE'S VALENTINE 105049

Adv., Reg. No. 51. Foundation cow of the Experiment Station herd. Record 10,218 lbs. of milk, 676 lbs. churned butter in a year. She represents the big, strong, productive type of cow. Her weight was 905 lbs.

represent an average production of 344 gallons or 2,956.4 pounds per cow. The statisticians however, caution that it should be borne in mind that the quantity of milk reported is probably deficient and that the distinction between strictly dairy and beef cows is not always observed in the census returns. The census gives as the total value of dairy products (exclusive of milk and cream that is used on the farms) a value of $9,056,000.

Less than one-twelvth of the milk produced by Kentucky cows in 1909 was sold as such, the butter being valued that year at $7,118,000. The methods to be employed in raising the standard and increasing the quality and thereby the price received for this butter, will be discussed in another bulletin to be issued at an early date.

Unquestionably the quantity of milk and butter that is produced by the cows of Kentucky could be materially increased by improving the methods of feeding. Twenty-five pounds (or three gallons) of 5 per cent milk contains the following constituents: 1.22 pounds of milk sugar, .8875 pounds of albumen and casein, 1.25 pounds of butter fat and .1775 pounds of ash. A cow therefore that is producing this quantity of milk each day, will need to be fed liberal quantities of material from which she may make them. In addition she must maintain approximately 1,000 pounds of weight and if a heifer, she must be supplied with the material which will permit her to increase the size of her muscles, bones and ligaments, etc. If in calf she must make sufficient gain each day to allow the young to attain a weight of 65 to 100 pounds by the time it is born. The calf is made up very largely of protein substances and she must therefore have a liberal allowance of that material. All cows expend considerable energy in keeping their bodies warm and in the working of the heart and lungs, and in walking about.

This calls for a balanced ration or an intelligent method of feeding the cow. If she is deprived of any of the essential elements contained in milk, the milk flow will certainly be decreased. If there is a deficiency of protein material she will of necessity have to reduce the milk flow so that there will be an equilibrium between the income and outgo of protein material. But she will rob her muscular and nervous system and her skeleton to a certain extent in an effort to maintain her milk yield, and in the production of her calf This explains why some cows that are poorly fed become so thin in flesh when yielding milk.

## FEEDING STANDARDS.

In order that the cow may be fed exactly what she needs a large number of scientific men in different parts of the world have formulated feeding standards after many years of experimental work with a large number of cows. Prof. T. L. Hæcker, Chief of the Division of Dairy Husbandry, at the University of Minnesota, has furnished a table which is very complete and we are therefore presenting it on page 181 of this bulletin. This authority informs us that a cow weighing 1,000 pounds and producing 25 pounds of 5 per cent milk, requires the following amount of digestible protein, carbohydrates and fat: 2.21 lb. protein, 14.1 lb. carbohydrates and .7 lb. of fat.

The protein material in the feed is composed of the elements nitrogen, carbon, hydrogen and oxygen. The nitrogenous part of this nutrient distinguishes it from the carbohydrates and fats. The carbohydrates are composed of carbon, hydrogen and oxygen in a formula similar to $C_{12}H_{20}O_{10}$, which is the formula for starch; while the fats are composed of the same constituents but with a higher ratio of carbon. Palmitin which is one of the vegetable fats has the formula $C_{51}H_{98}O_6$. Having such a large proportion of carbon it is capable of yielding a high degree of energy and it is also more valuable for production of fat in the animal body.

## PURPOSE OF THE NUTRIENTS.

PROTEIN: The protein material contained in feeds is used by the dairy cow to increase or repair the broken down nerves or muscles. It goes to build up the hair, the hide, the ligaments, hoofs and horns. It is also required in the growth of the calf. In connection with the present discussion, however, we would impress upon the reader that protein material is required in the manufacture of the albumen and casein, that is contained in the milk. The white of an egg is a familiar form of a high grade protein material.

*Carbohydrates* are concerned chiefly in the production of the milk sugar, in the production of the fat of the milk, and of body fat and energy. Prof. Jordan of the Geneva, New York, Experiment Station, performed a classic experiment in connection with the production of butter-fat. He sent a quantity of feed to an oil mill and had practically all the fat extracted. He fed this fat-free feed to a dairy cow and she continued to produce the normal quantity of butter fat and gained in weight. After deducting the possible fat that could have been produced from the protein

material of the feed, Prof. Jordan found that she must have produced most of the butter fat from carbohydrate material. It is therefore evident that the carbohydrates are very important, in the production of some of the most important constituents of the milk. Familiar examples of carbohydrate material are starch and sugar.

FATS.—The fat that is supplied in the food is more valuable in some respects than the carbohydrates, because the fats contain a high percentage of carbon and yield a larger amount of energy than an equivalent amount of carbohydrates. The fat is therefore multiplied by the factor 2.25 and added to the carbohydrates to find the total amount of carbonaceous nutrients that are contained in feed stuffs.

The fat of the food forms animal fat and milk fat and also, as was stated, furnishes energy. Familiar examples of fats are linseed oil, cotton seed oil, oil of castor bean, etc. Feed stuffs contain a relatively small amount of fats as will be observed by referring to the table on page 180 of this bulletin.

ASH MATERIAL: All feed stuffs contain more or less ash, but it is not always of the kind that is so essential in animal nutrition Corn contains a deficiency of ash, but the chief disadvantage is that the ash of corn is composed largely of potassium and magnesium and other ash material that is not required by the animal organism in large quantities. On the other hand, clover, alfalfa, cow pea, and soy bean hays contain large quantities of the right kind of ash material. That is, the ash material of these hays is composed largely of calcium and phosphorus, which elements are utilized by the animal to a great extent in the building up of the skeleton, and in the production of the ash material in the milk. The production of the digestive juices also requires a considerable amount of ash.

## VALUE OF DIFFERENT FEEDS.

CONCENTRATES: By the term concentrates we mean the grain part of the feed in distinction to the hay or bulky part which we term "roughage." Only the most available feeds of this state are discussed herein.

CORN: Corn is usually fed to the cow in the form of corn meal, although ear corn or corn on the stalk may be fed in the fall or at any season, to dry cows. For the cow that is producing a heavy flow of milk, it is advisable to grind the shelled corn into corn meal. The corn meal is rich in carbohydrates and is a most ex-

cellent cow feed when supplemented with some of the protein feeds, which are named subsequently in this bulletin. Corn and cob meal is a useful feed also.

OATS: Oats make a most excellent feed, as this feed is fairly rich in protein and contains considerable carbohydrate and fat material and is very palatable, but it averages about 1½ cents a pound whereas corn will usually average about a cent a pound in price, therefore the oats is more expensive and is worth more ordinarily on the market as a horse feed than it is worth for a cow feed.

WHEAT: Wheat is a very good feed when ground into meal and mixed with some light form of concentrate, but its high price ordinarily precludes the possibility of feeding it.

BARLEY: Barley can be fed when ground fine and mixed with some light feed, but it is not worth any more than corn meal. It is rich in carbohydrate material, but lacking in protein.

RYE: Meal made from ground rye can be utilized to form a part of the cow's ration, but should not be used extensively, because cows are not fond of it, and excessive quantities taint the milk, and it is not especially rich. Its chemical composition is similar to that of corn meal.

DISTILLER'S DRIED GRAINS: These grains are made at the distillery by drying the slop. There will be an increasing supply of them from year to year in Kentucky. They contain 22.8 per cent of digestible protein. In selling for $24 a ton they furnish digestible protein at 5.4 cents per pound. Having been made from a sour mash they have a slight sour smell and taste to which some cows must become accustomed before they will eat very large quantities of the grains, and at the Experiment Station dairy we have experienced some difficulty in getting some of our cows to consume more than 2 pounds of this feed per day. Other cows take it more readily and consume 4 pounds when mixed with corn meal. It was necessary to mix the grain with the silage to get some cows to consume the distiller's dried grains at all.

DRIED BREWER'S GRAINS: Dried Brewer's grains contain 20 per cent of digestible protein and as they sell at $22 a ton, they furnish digestible protein at 5.5 cents per pound. Having been made from a sweet mash, the brewer's grains are consumed quite readily by dairy cows, and they furnish a cheap form of protein material.

BRAN: Wheat bran has always been held in high esteem as a feed for dairy cows because it is very palatable, and the ash material contained in it consists largely of a material called phytin, which is a valuable phosphate material. This gives the bran a laxative effect which is very beneficial. Unfortunately bran has reached a price of $25 a ton in some localities and as it only contains 11.9 per cent of digestible protein the protein costs 15 cents per pound, which makes it more costly than some other feeds.

COTTON SEED MEAL: This feed is extremely valuable for the protein which it furnishes, containing 37.6 per cent of digestible protein. By beginning with a quarter of a pound and increasing the meal gradually in the cow's ration, it can be increased to approximately two pounds per day, which is enough for an ordinary cow. It is constipating and should therefore be mixed with some laxative feed. Costing $31 a ton, it furnishes digestible protein at 4.1 cents per pound.

LINSEED OIL MEAL: This feed is laxative and has a beneficial effect on the digestive tract. It is very palatable and contains 30.2 per cent of digestible protein. It retails at $40 a ton, making each pound of digestible protein cost 6.6 cents. It is somewhat more costly therefore than cotton seed meal, and ordinarily the cotton seed meal is recommended except with animals that are being prepared for show, or being pushed for a record test.

## ROUGHAGES.

FODDER CORN: By this term is meant the stalk that has the ear attached. For dry cows this feed is quite valuable and nutritious. The resulting stover made by snapping off the ear, still contains considerable nutriment. The stover is, however, coarse and bulky and must be supplemented with some nutritious hay. The stover is not very rich in any of the elements of nutrition but contains a fair amount of carbohydrate material.

SORGHUM FODDER: Well cured sorghum is quite valuable and palatable as a cow feed, containing 44 per cent of digestible carbohydrate material. It is therefore a carbonaceous roughage.

TIMOTHY HAY: Timothy hay contains about the same amount of nutriment as sorghum fodder, and while some dairymen utilize this hay, it is worth considerably more as a horse feed than as a dairy cow feed. We do not advise its use therefore in feeding the dair herd.

MILLET HAY: Millet hay is fed to some extent by dairymen in the vicinity of Lexington, Kentucky. It is a clean hay and is easily handled and is reasonably palatable. This hay contains 4½ per cent of digestible protein, while red clover contains approximately 7 per cent. Millet hay is fairly nutritious and can be utilized, but according to our judgment, it would be advisible to mix it with clover hay rather than to feed it exclusively to cows. It is poor in ash material and when fed to horses exclusively, will produce porous bone. Mixed with clover hay which is rich in ash material and protein, the ration would be considerably improved.

RED CLOVER: Red clover hay makes a first class feed for the dairy cow. It is classed as a protein roughage, because it contains 7 per cent of digestible protein, and is also relatively rich in the carbohydrate and fat constituents and in lime.

ALFALFA HAY: Alfalfa hay contains 11.7 per cent of digestible protein and is a little richer in carbohydrate material than red clover. It is very palatable and can be fed profitably when it does not exceed the red clover hay too greatly in cost.

PEAS AND OATS: A number of Kentucky farmers are now growing a mixture of oats and Canadian field peas which are cut early in the summer and make a most palatable and nutritious hay. This mixture contains 7.6 per cent of digestible protein, and is richer than red clover hay in carbohydrates.

COW PEA AND SOY BEAN HAY: Cow pea hay has been used extensively in Shelby County. Many of the dairymen after harvesting it, cut and blow it from the cutting box into the barn loft. Cow pea hay makes an excellent roughage for the dairy cow. It is relatively rich in protein, containing 10.8 per cent digestible protein, and is readily eaten by the dairy cow. A dairyman of Shelby County who has had extensive experience in feeding cow pea hay, stated that he values it highly in the feeding of his 75 dairy cows, because he does not have to purchase as much protein rich concentrates as he would if he did not have the cow pea hay and he has found from long experience that it makes a valuable hay for his cows. This dairyman cuts the hay in two inch pieces.

STRAWS: The straw that results from wheat, and barley should be considered more as fillers than as valuable feeds. They are useful in maintaing dry cows, because of the heat that is generated in their digestion, but the animal does not derive much

net value from eating these rough feeds. That is, it takes about all the energy that is secured from the straws to digest them, but as heat is produced as a by-product in the digestion of the straws, the animals may be kept warm and with a little grain in addition, they can sometimes be wintered on the straws.

OAT STRAW: Oat straw is more valuable than wheat or barley straw because it contains a larger amount of protein and is somewhat more palatable. However, it is not as rich as the hays and can not form the sole roughage of the cow.

SILAGE: Corn silage furnishes succulence in the ration. Dairy cows will consume approximately 30 pounds of this material per day. In the winter it serves the place of grass. Because of the fact that it contains 74 per cent of water it is not very rich in its nutritive qualities, and therefore can not form the sole roughage of a cow giving a large flow of milk. It contains 1.2 per cent of digestible protein which is one-sixth as much as is contained in clover hay. It contains one-third as much digestible carbohydrate and fat material as clover hay.

We believe that every dairy farmer in Kentucky should have a silo, because it furnishes a cheap feed. We have noted in the last few years that the farmers in this state have been cutting their corn after it is well glazed, but before the leaves are thoroughly dry. Therefore they are producing sweeter and more nutritious silage than they did several years ago, when silage methods were new, and at which time they cut the corn too green and produced a more acid silage. Silage was grown and put into the silo by a Nelson County dairyman, for $2 a ton during the fall of 1911. This wooden silo was 18x30 feet in size, having a capacity of 150 tons. Corn was used and it took 16 acres to fill it, or approximately 9.4 tons to the acre, the yield having been severely cut by the dry season of 1911. On strong land well manured, we should secure a yield of 12 tons. The silo was filled full and settled 4 feet after filling. The itemized statement of cost was as follows:

| | | |
|---|---|---|
| Interest on the land | $100 00 | |
| Preparation of land for planting | 40 00 | |
| Seed | 2 50 | |
| Planting and cultivation | 20 00 | |
| Total costs of growing crop | $162 50 | $162 50 |

Labor of cutting crop and filling silo:

| | | |
|---|---|---|
| Supt. $4, 14 men two days at $1.50 per day.. | $ 46 00 | |
| Seven teams two days at $3 per day..... | 42 00 | |
| Total cost of filling silo ..... | $ 88 00 | 88 00 |
| | | $250 50 |
| Rent on ensilage cutter ..... | $ 12 00 | |
| Expense of engine ..... | 10 00 | |
| Fuel ..... | 6 00 | |
| Total expense of cutting ensilage .... | $ 28 00 | 28 00 |
| Dinner for workmen and feed for teams .... | $ 16 00 | 16 00 |
| Total cost of 150 tons of ensilage .. | | $294 50 |

Or $1.96 per ton.

The secret of getting the ensilage into the silo at this low cost was in having a large number of men and teams working methodically without stops, and the close proximity of the corn field to the silo. Ensilage has been given a value of $4 a ton for its feeding value. It is therefore a very profitable crop for the dairyman to grow.

Sorghum Silage: Many dairymen in Boyle County, Kentucky, prefer sorghum silage because of the heavier yield. However, sorghum silage contains but .6 per cent of digestible protein while corn silage contains 1.2 per cent. There is about the same amount of carbohydrates but the corn silage is three times as rich in fat. Sorghum makes a good silage if cut after the seeds are ripe but because of the large amount of sugar in the stalk, it makes an acid silage if cut while the stalk is green.

Roots: Sugar beets and mangles can be grown to furnish a succulent or watery feed during the winter time, but they will cost fully twice as much per ton to grow and harvest as corn silage. The Pennsylvania station reports that it costs five times as much to produce 100 pounds of dry matter in roots as in corn silage. They contain about the same amount of protein as corn silage, but one-half as much carbohydrates and decidedly less fat. In other words, roots are not as rich, pound for pound,

as the corn silage. Because of their high cost, they are not used in America to any great extent. Pulped or cut in slices sugar beets or mangels may be mixed with the hay or fed alone and after the cows get used to the sliced roots, they will eat 30 to 50 pounds of them and be benefitted thereby. The roots contain about 90 per cent of water and because they must be handled a number of times before they are fed, the labor problem is expensive. On the Island of Jersey parsnips are used extensively and in England all kinds of stock are fed different kinds of roots. In those countries, however, labor is cheap and the farmers there can not grow the silage corn to advantage because of climatic conditions. In Kentucky there is no question that the root crops are of little economic importance.

Essentials of a Good Ration: The dairyman should give attention to the following points when selecting a ration for his dairy cows: First, the feeds should be home grown, that is, they should be produced on the farm as largely as possible, in order that he may derive the greatest profit from growing feeds, and also save the profit which would go to the producer, the dealer and to the railroad company for transporting purchased feeds. Second, the ration should be palatable or pleasant to the cow. Extensive experiments by Pawlow of Russia have shown conclusively that if an animal is consuming a ration that it likes, there will be more digestive juices secreted and these juices will be richer in the agencies that bring about the digestion, than if the ration is not palatable. A dairy cow must be fed on materials which she enjoys because she is a nervous organism that must be kept up to the highest state of efficiency. Third, the ration must be economical or cheap. There is only a fair margin of profit in the dairy business at best and we believe that hundreds of thousands of dollars are wasted in the purchase of expensive feeds that are not well adapted to the requirements of Kentucky cows. We have found that we can decrease the cost of a ration materially by replacing one feed with another according to their respective market values. Fourth, the ration must be balanced, that is it must furnish the essential elements that will meet all the requirements of the cow.

## PROPORTION OF CONCENTRATES AND ROUGHAGE.

A dairy cow should be large and roomy so that she may consume considerable silage and hay, or in summer, a large amount of grass in order that she may make a heavy flow of milk. At the Wisconsin Experiment Station, Professor Woll has determined after keeping records of 395 dairy cows of different types, that the largest cows in the different breeds are more profitable than small cows, and they have also found that the cows that consume the largest amounts of roughage and concentrates are the most profitable. For ordinary cows we recommend that they be fed approximately 30 pounds of silage and 10 pounds of hay per day. They may also have as much corn stover as they will clean up. In addition they should be furnished all of the grain feed that is required. It has been found that if the cow is supplied with one pound of grain mixture for every 3 to 3½ pounds of milk she gives, she will do her best work. For 25 pounds of milk we should therefore give approximately 8⅓ pounds of grain per day.

## A VARIETY OF FEEDS DESIRABLE.

It is better to supply several different kinds of grain than to make the ration exclusively of one grain, because the cow likes a variety of feed and we will probably more nearly make a balanced ration with the mixture than with only one grain. The dry cow should have about the same kind of roughage and about the same amount of grain as a cow giving 10 pounds of milk per day. The cow should either be supplied salt in a box in the pasture, or preferably she should be furnished one ounce of salt per day in her feed. The chlorine in the salt is needed in the digestive juices and in other parts of the body.

BALANCED RATION: By referring to the table giving the nutrients in a pound of feeding stuffs on page 180 let us select corn, wheat bran, and cotton seed meal as our concentrates, and corn silage and clover hay for roughage and then formulate a ration for a cow giving 25 pounds of 5 per cent milk. By referring to the feeding standard on page 181 we find that the cow requires for maintenance .07 of a pound of protein, .7 of a pound of carbohydrates and .01 of a pound of fat, per 100 pounds of body weight. We will assume that this cow weighs 1,000 pounds, therefore we must multiply these quantities by 10 which results show that for a 1,000-pound cow, we must have .7 of a pound of protein, 7 pounds of carbohydrates, and .1 of pound of fat. These nutrients are required for maintenance.

Looking down towards the bottom of the table we find that a cow requires for one pound of five per cent milk .0604 pound of protein, which multiplied by 25 (the number of pounds of milk produced by our cow) gives 1.51 pounds of digestible protein necessary to make the protein material in this quantity of milk. We find also that she requires .284 pounds of carbohydrates for one pound of five per cent milk and for 25 pounds of milk she needs .71 pounds of carbohydrates, which are necessary to make the carbohydrates in this quantity of milk. Also .6 pound fat.

Tabulating this we find that we must supply the cow the following nutrients in the ration:

RATION FOR 1,000-POUND COW PRODUCING 25 POUNDS OF FIVE PER CENT MILK DAILY. (a)

| | Protein | Carbohydrates | Fats |
|---|---|---|---|
| For maintenance ..... | .7 lbs. | 7.0 lbs. | .1 lbs. |
| For 25 pounds five per cent ... | 1.51 | 7.1 | .6 |
| Nutriment required ..... | 2.21 lbs | 14.1 lbs. | .7 lbs. |

FEEDS USED. (b)

| | Protein | Carbohydrates | Fats |
|---|---|---|---|
| 6 pounds corn meal ..... | .468 lbs. | 4.008 lbs. | .258 lbs. |
| 2 pounds bran ..... | .238 | .840 | .050 |
| 1½ pounds C. S. Meal ..... | .564 | .321 | .144 |
| 10 pounds clover hay ..... | .710 | 3.780 | .180 |
| 35 pounds corn silage ..... | .420 | 4.970 | .245 |
| | 2.400 lbs. | 13.919 lbs. | .877 lbs. |

(a) Refer to table on page 180.
(b) Refer to table on page 181.

We have presented the above figures to indicate the exact method of figuring a balanced ration. However, the dairyman ordinarily wishes to get at this matter very quickly and to be told off-hand what he shall feed. He is some times too anxious we think, to save time in this connection, because the feeding of his cows so that they may do efficient work, requires considerable thinking and figuring.

However, in order that we may present this matter in a concise form which will be readily available we will present the following feed formulas, assuming that the dairymen will feed the roughage that we have indicated above and combine it with the following grain mixtures:

## GRAIN MIXTURES.

These grain mixtures are to be fed in addition to the hay and silage. Feed each cow one pound of the mixed grain per day for each 3 to 3½ pounds of milk that she gives daily.

1. 400 pounds corn and cob meal
   100 pounds cotton seed meal.

2. 400 pounds corn meal
   100 pounds Dried Distiller's grains
   50 pounds Cotton Seed meal.

3. 400 pounds corn meal
   150 pounds Dried Distiller's grains
   100 pounds cotton seed meal.

4. 400 pounds corn meal
   200 pounds bran
   50 pounds cotton seed meal.

5. 400 pounds corn meal
   150 pounds Dried Distiller's grains
   50 pounds cotton seed meal.

6. 400 pounds corn meal
   100 pounds wheat bran
   100 pounds Dried Distiller's grains
   50 pounds cotton seed meal.

## GRAIN MIXTURES.

Copied from Hoard's Dairyman. These mixtures have been recommended by the editors of that paper in answering inquiries from time to time.

1. 400 pounds corn and cob meal
   200 pounds ground oats
   200 pounds cotton seed meal

   One pound per 3½ pounds milk.

2. 30 to 35 pounds silage
   Alfalfa hay ad. libitum
   400 pounds ground corn

300 pounds ground oats
300 pounds barley

1:3½:4 pounds milk.
For 1100-1200 pound Holsteins.

3. 600 pounds ground corn
100 pounds cotton seed meal
300 pounds ground oats.

4. Holsteins giving 40 pounds milk.
Corn 50 cents per bushel.
Ajax. flakes $33.
Cotton seed meal $32.
Oil meal $38., Wheat bran $26.
35 pounds corn silage
Corn stover and mixed hay
500 pounds ground corn
300 pounds ajax flakes
200 pounds cotton seed meal.

Feed one pound per 3½ to 4 pounds milk.

5. Holsteins—20-60 pounds milk per day.
Oats 30 cents per bushel, corn 35 cents per bushel
Wheat 72 cents, bran $20, Oil meal $30.
Middlings $20.

30-35 pounds silage to be fed per day.

Corn stover, mixed hay.
400 pounds middlings
300 pounds ground corn
200 pounds bran
100 pounds oil meal

If too laxative reduce oil meal and increase middlings. Feed one pound grain for 3½ to 4 pounds of 4 to 4½ per cent milk.

6. 200 pounds wheat bran
200 pounds ground oats
300 pounds ground corn
100 pounds cotton seed meal

1:3:3½ pounds average rich milk.

7. Oats, Bran, Corn Meal.
Guernseys, 1,000 pounds weight.
25 pounds silage
Alfalfa hay.

400 pounds corn meal
300 pounds ground oats
100 pounds bran
Feed 1 pound of grain mixture for 3 pounds of milk.

8. Dried Brewers' Grains.
1600 pound cows.
Corn stover.
40 pounds beets
300 pounds ground oats
100 pounds bran
200 pounds Dried Brewers' grains
100 pounds cotton seed meal

1:3:3½ pounds milk.

9. 800 pound Jerseys. 35 pounds milk 4.8 per cent fat.
30 pounds silage
Mixed hay
400 pounds ground oats
400 pounds ground corn
200 pounds cotton seed meal.

1:3:3½ pounds milk.

Prof. H. R. Smith, of Nebraska, gives the following home grown rations for a dairy cow producing 25 pounds of five per cent milk.

1. 10 pounds corn (meal or shelled)
20 pounds alfalfa hay.

2. 10 pounds corn
10 pounds corn stover
12 pounds alfalfa hay.

3. 6 pounds corn meal
2 pounds wheat bran
10 pounds alfalfa or clover hay
40 pounds corn silage.

## NUTRIENTS IN ONE POUND OF FEEDING STUFFS.—DIGESTIBLE PROTEIN, CARBOHYDRATE AND FAT.

| Concentrates | Digestible Pro. | C.H | Fat. |
|---|---|---|---|
| Corn | .078 | .668 | .043 |
| Corn & cob meal | .044 | .600 | .029 |
| Gluten meal | .297 | .425 | .061 |
| Gluten feed | .213 | .528 | .029 |
| Hominy feed | .068 | .605 | .074 |
| Germ oil meal | .158 | .388 | .108 |
| Wheat | .088 | .675 | .015 |
| Wheat bran | .119 | .420 | .025 |
| Wheat middlings | .169 | .536 | .041 |
| Wheat shorts | .130 | .457 | .045 |
| Red dog flour | .162 | .570 | .034 |
| Barley | .084 | .658 | .016 |
| Oats | .107 | .503 | .038 |
| Rye | .095 | .694 | .012 |
| Rye bran | .112 | .468 | .018 |
| Rye middlings | .110 | .529 | .026 |
| Buckwheat | .081 | .482 | .024 |
| Buckw. bran | .059 | .340 | .020 |
| Buckw. middl | .227 | .375 | .061 |
| Emmer (speltz) | .100 | .703 | .020 |
| Bean meal | .202 | .423 | .013 |
| Soy bean | .291 | .233 | .146 |
| Cow Pea | .168 | .549 | .011 |
| Flax seed | .206 | .171 | .290 |
| Linseed meal | .302 | .320 | .069 |
| Cotton seed ml. | .376 | .214 | .096 |
| Dry brewers' grains | .200 | .322 | .060 |
| Dry distillers grains | .228 | .397 | .116 |
| Malt sprouts | .203 | .460 | .014 |
| Dry beet pulp | .041 | .649 | .... |

| Rhoughage, cured | Digestible Pro. | C.H | Fat. |
|---|---|---|---|
| Fodder corn | .037 | .414 | .015 |
| Corn stover | .014 | .312 | .007 |
| Sorghum fodder | .025 | .443 | .009 |
| Timothy | .028 | .424 | .013 |
| Red top | .048 | .469 | .010 |
| Prairie hay (upland) | .030 | .418 | .014 |
| Prairie hay (mixed) | .029 | .415 | .012 |
| Prairie hay (swale) | .026 | .419 | .011 |
| Red clover | .071 | .378 | .018 |
| Alsike | .084 | .397 | .011 |
| Alfalfa | .117 | .409 | .010 |
| Oat hay | .047 | .367 | .017 |
| Peas and oats | .076 | .415 | .015 |
| Wheat straw | .008 | .352 | .004 |
| Barley straw | .009 | .401 | .006 |
| Oat straw | .013 | .395 | .008 |
| Cow pea hay | .108 | .386 | .011 |
| **Silage** | | | |
| Corn | .012 | .142 | .007 |
| Sorghum | .006 | .135 | .002 |
| Alfalfa | .110 | .396 | .012 |
| Pea cannery refuse | .021 | .131 | .008 |
| Corn cannery refuse | .003 | .119 | .006 |
| **Roots** | | | |
| Sugar beet | .013 | .098 | .001 |
| Common beet | .012 | .079 | .001 |
| Mangel | .010 | .055 | .002 |
| Rutabaga | .010 | .081 | .002 |
| Turnip | .009 | .064 | .001 |
| Pumpkins | .001 | .058 | .002 |
| Wet beet pulp | .005 | .077 | .... |

## FEEDING STANDARD FOR MILK PRODUCTION.

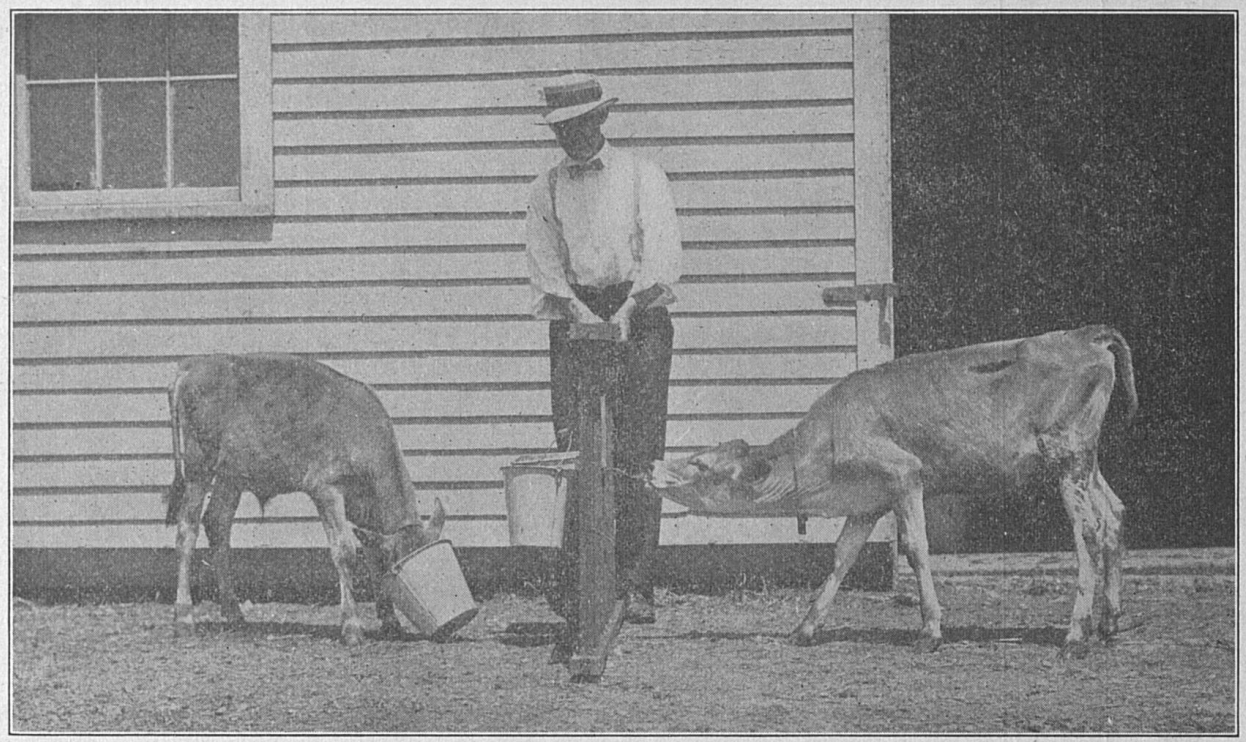
*T. L. Haecker.*

Co-efficient for food of maintenance per cwt., and digestible nutrients required for the production of one pound of milk testing a given per cent of butter fat.

| For Maintenance | Protein .07 | Carbohydrates. .7 | Fat .01(a) |
|---|---|---|---|
| *Milk Testing* (b) | | | |
| 3.0 per cent fat | .0469 | .199 | .017 |
| 3.1 " " | .0474 | .203 | .017 |
| 3.2 " " | .0478 | .207 | .018 |
| 3.3 " " | .0482 | .212 | .018 |
| 3.4 " " | .0487 | .216 | .018 |
| 3.5 " " | .0492 | .221 | .019 |
| 3.6 " " | .0501 | .225 | .019 |
| 3.7 " " | .0511 | .229 | .020 |
| 3.8 " " | .0520 | .234 | .020 |
| 3.9 " " | .0530 | .238 | .020 |
| 4.0 " " | .0539 | .242 | .021 |
| 4.1 " " | .0546 | .247 | .021 |
| 4.2 " " | .0553 | .251 | .021 |
| 4.3 " " | .0558 | .255 | .022 |
| 4.4 " " | .0565 | .266 | .022 |
| 4.5 " " | .0572 | .264 | .023 |
| 4.6 " " | .0579 | .268 | .023 |
| 4.7 " " | .0584 | .271 | .023 |
| 4.8 " " | .0591 | .276 | .024 |
| 4.9 " " | .0597 | .280 | .024 |
| 5.0 " " | .0604 | .284 | .024 |
| 5.1 " " | .0611 | .288 | .025 |
| 5.2 " " | .0618 | .291 | .025 |
| 5.3 " " | .0625 | .295 | .025 |
| 5.4 " " | .0632 | .299 | .026 |
| 5.5 " " | .0639 | .302 | .026 |
| 5.6 " " | .0644 | .307 | .026 |
| 5.7 " " | .0651 | .310 | .027 |
| 5.8 " " | .0656 | .314 | .027 |
| 5.9 " " | .0663 | .318 | .027 |
| 6.0 " " | .0668 | .322 | .028 |

(a) Note that these amounts must be fed per 100 pounds weight of cow.

(b) The nutrients given must be fed per pound of milk produced, per day.



NIPPLE VS. BUCKET.

# PART II.

# EXPERIMENTS IN FEEDING DAIRY COWS AND CALVES

*J. J. Hooper.*

## I. Nipple Versus Bucket Feeding of Calves.

Eighty calves (principally Jerseys) were employed in five separate experiments to determine the advisability of using the calf nipple for feeding the young calf. In all the tests two lots of calves were fed, one lot of calves being fed milk direct from the bucket and the second lot was fed through a nipple. Three kinds of patent nipples or "calf feeders" were used. The simplest and in most respects the most satisfactory calf feeder was made of a round wooden block with a one inch hole bored in the middle through which the nipple was pulled. This block with the nipple was placed on top of the milk in a bucket and we never had any trouble cleaning this nipple and it cost very little. One type of calf feeder had the nipple placed in the bottom of the bucket, which was hung above the calf's head. Because of the fact that the bucket was not very strong, we had some trouble from leaks and this "feeder" did not give absolute satisfaction. The third type was composed of a rubber tube, a metal core, a spring and a nipple. The bucket in this type was hung on a hook outside the calf's stall, and the rubber hose extended from the bucket through the wall and spring to the nipple. This feeder was quite successful and altogether satisfactory.

The lots of calves were divided equally into two groups with regard to age, sex, weight and thrift. The same amount of feed, pasture and milk was given to all calves. In the beginning of the experiment the calves were approximately two weeks of age. Careful weights of each calf were taken on three successive days of each month. The milk was warmed before being fed to the calves and the rubber parts were soaked in three per cent formalin solution after each feeding. The calves were fed milk twice each day and hay and grain as they grew.

Conclusion: It required on an average for all the calves, 39½ seconds for the bucket fed calves to drink their milk, while the calves sucking their milk through the nipple required an

average of two minutes and 21 seconds to drink the same quantity of milk. Our weights show conclusively that during the first 7 to 10 weeks of the calf's life, they were more thrifty when fed through the nipple, which was due to the fact that as they suck the milk they mix it thoroughly with saliva and take it slowly. After the 70th day the nipple was no more effective than bucket feeding and in fact calves fed carefully from the bucket, will make almost as large growth by the time they are six months old as those fed on the nipple when they are young.

## II. Kerry Milk for Jersey Calves.

Twenty registered and grade Jersey calves varying in age from three to four weeks were separated into two lots of ten calves each, age, sex and thrift being considered. The experiment began May 6th and ended June 15, 1911. The purpose of this experiment was to determine whether or not the milk from Kerry cows would nourish Jersey calves better than Jersey milk. It has been claimed by some breeders of dairy cattle that milk that is medium in richness is better than rich milk for calves. This experiment was carried on at the Elmendorf Farm, through the kindness of Mr. C. H. Berryman, Manager. Kerry milk from nine different cows was secured. It averaged 4.14 per cent fat, while the average milk from the dairy herd which was fed to the other lot of calves in this experiment averaged 5.07 per cent fat. Eight pounds of whole milk was fed each day and was fed within one hour from the time it was drawn from the cows, and it was carefully warmed to 100 degrees F. before being fed.

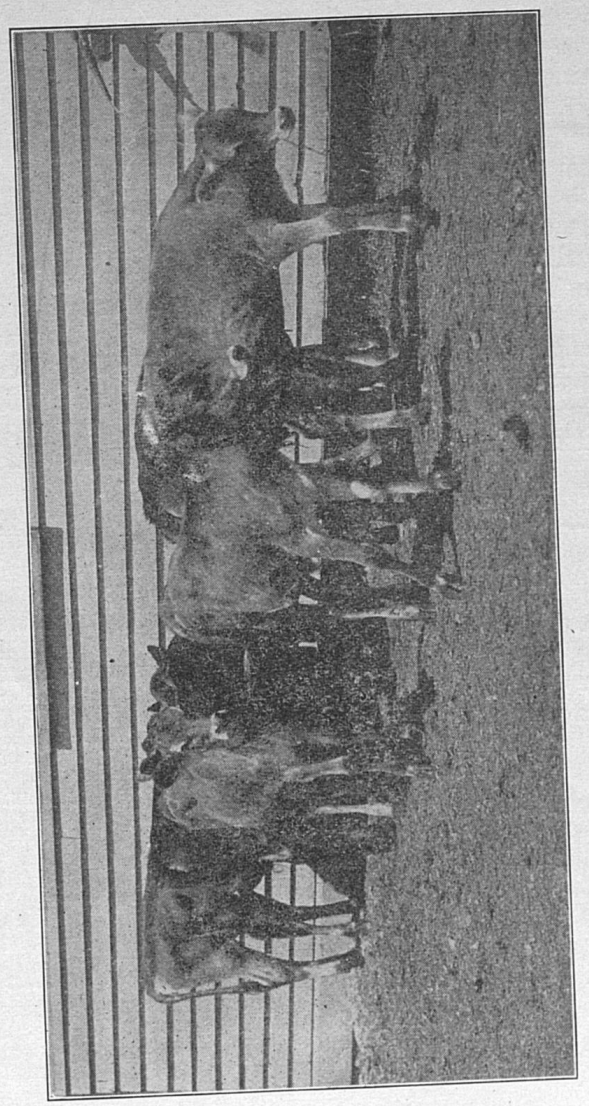
Results: The ten calves fed on Jersey milk developed only one slight case of scours which was readily cured. With the lot on Kerry milk we had some trouble. Two of the weaker calves developed severe cases of scours and in spite of medical attention, died. Two other calves had cases of scours but they were easily cured. No definite conclusions were drawn from this experiment because not a sufficient number of calves were fed to warrant us in drawing conclusions, but the experiment will be repeated.

## III. Calves, Fed Corn, Flax Seed, and Whole Milk.

On February 15, 1911, an experiment was begun with 18 grade and pure bred Jersey calves to test the relative efficiency of corn, flax seed, and whole milk as feeds for calves.

In Kentucky the butter fat in whole milk is valued at 30 cents a pound and it is advisable from a financial standpoint

to use as little butter fat as possible for calf feeding. These calves were two months old and were divided into three lots. Lot I received one pound of shelled corn, 12 pounds of skim milk and two pounds of alfalfa hay, and a pint of grain made of a mixture of corn, bran and oats. These calves soon learned to eat what corn was thrown into the bottom of the milk bucket after they had drunk their milk. They showed less tendency to suck the ears of their stall mates than the calves in lots II and III. The experiment continued 60 days.



A GROUP OF CALVES FED IN ONE OF THE EXPERIMENTS.

Lot II was fed four pounds of whole milk, 12 pounds of skim milk and two pounds of alfalfa hay and the grain mixture.

Lot III was fed one-third pound of flax seed which were made into a jelly with hot water. This jelly was added to 12 pounds of skim milk. The calves were fed in addition two pounds of alfalfa hay, and the grain mixture. The flax seed are rich in oil and this was used to replace the fat which was taken from the skim milk. In lot II the four pounds of whole milk was supposed to furnish some fat for the calves which were otherwise being nourished on skim milk. In lot I the shelled corn furnished heat giving elements which is also the function of butter fat.

All the calves thrived to about the same extent, those in lot I gaining 1.44 pounds daily, those in lot II 1.38 and those in lot III 1.26 pounds, but the feed for the six calves in lot I cost $34.50, for lot II $68.92 and for lot III $40.46.

In this experiment shelled corn is valued at 65 cents a bushel, oats at 43 cents and flax seed at $4.25 per bushel, bran $25 a ton, skim milk 30 cents a hundred pounds, whole milk 32 cents per gallon and alfalfa hay $20 per ton.

In conclusion we are led to make the statement that it seems unnecessary to use high priced whole milk or to purchase expensive oil bearing seeds such as flax seed, to supplement skim milk for calves that are two months old. We do not advocate the exclusive use of corn for young calves, but it may be advantageously fed in connection with skim milk to two months' old calves.

## IV. Feeding Calves Whole Milk, Skim Milk, and Rolled Oats.

The purpose of this experiment was to determine if as good calves could be grown on skim milk and on rolled oats as on whole milk. We began with 18 calves July 13, 1912 and fed them 79 days until Sept. 30th. In the beginning of the experiment all the calves were given whole milk, which was gradually replaced in lot II with skim milk and in lot III with rolled oats. The rolled oats were the same as those used for human food. Grain mixture consisting of one part oil meal, one part corn meal and one part bran, by weight, was fed to all the calves to the extent of one-half a pound per day to each calf, and they were soon eating about one-half a pound of hay which was increased to one and one-half pounds by July. Due to the exceptionally hot weather, several of the calves scoured considerably and did not make the gains that were desired.

The average gain of those fed on whole milk was .84 of a

pound per calf per day for 79 days, while the value of whole milk (which at 40 cents per gallon) was fed to each calf amounted to $31.60.

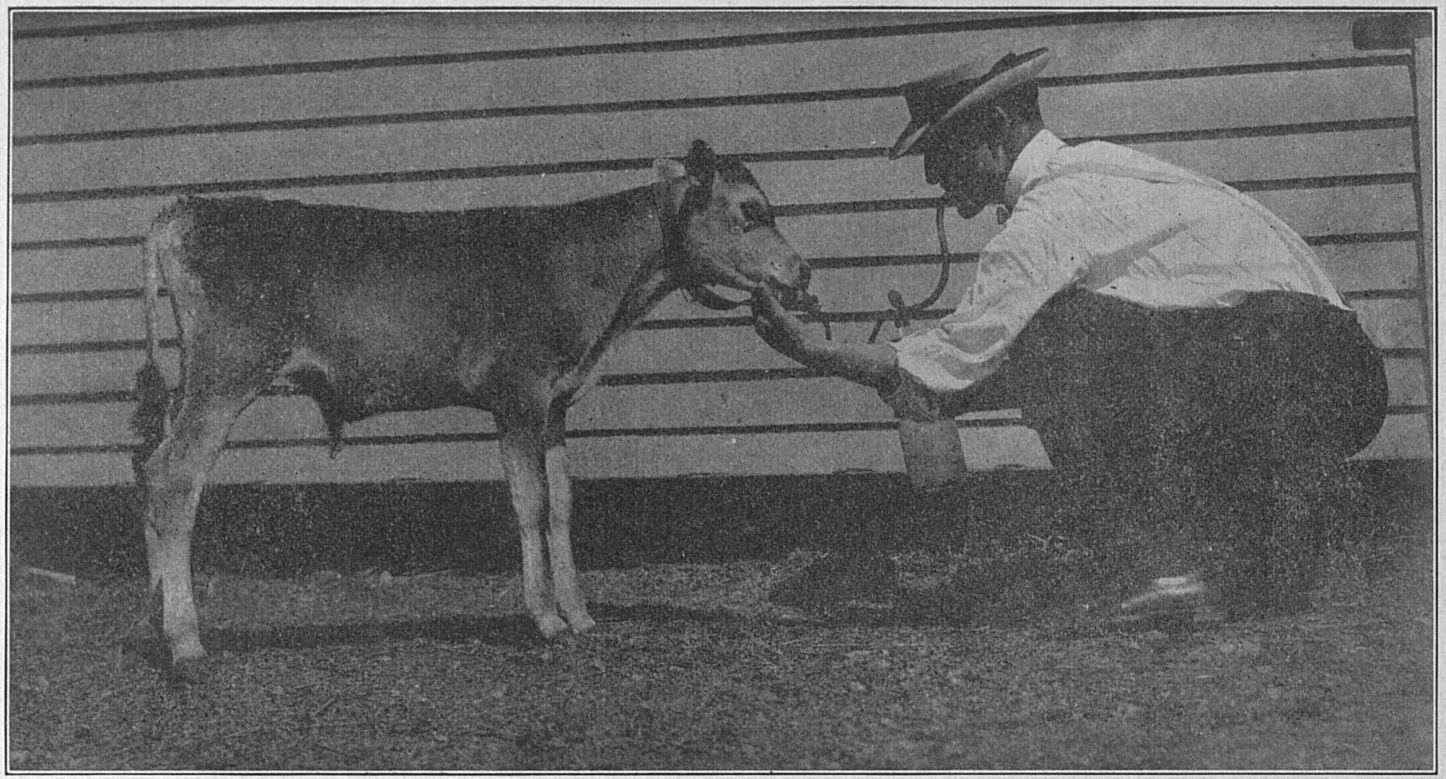
Calves in lot II which were fed on skim milk at 10 cents per gallon, (with whole milk during the first few days until it was replaced with skim milk) gained .88 of a pound per day and the whole and skim milk was worth $14.03.

Calves in lot III fed on rolled oats (at 3½ cents per pound) consumed whole milk at first which was gradually replaced with skim milk and rolled oats.

Calculating from the composition of the feeds we estimated that one pound of rolled oats was approximately equal in feeding value to one gallon of whole milk and these experiments were conducted upon that basis. The rolled oats were prepared by adding one gallon of boiling water to 12 ounces of rolled oats. The mixture was then allowed to stand until cool enough to feed. The calves relished the oats and would have eaten considerably more than we fed, but we limited them to a pound per day. Prof. John Michels in bulletin 199 of the North Carolina Station reports results on a similar experiment and he strongly recommends the use of rolled oats for calves to be used by dairymen who either have no skim milk or an insufficient quantity for calf rearing. He states that he confidently expects that if the dairyman will acquaint himself with the use of rolled oats, he will afterwards rear every calf that promises to become valuable. The total cost of whole milk, skim milk, and rolled oats for each calf was $5.42 for the 79 days and the calves gained .465 of a pound per day per calf. The cost was very small in comparison to the other lots but the calves fed on rolled oats did not become as vigorous as we would desire, not being heavy enough for their age at the end of the experiment. The skim milk calves were as vigorous as the whole milk calves and this experiment would lead us to advise the farmer to use skim milk freely, supplementing it with some grain as the calf attains the age of six weeks to two months and begins to eat feed.

## V. Summer Feeding of Cows.

Through the kindness of Manager C. H. Berryman, of the Elmendorf Farm, we were enabled to carry on an experiment with five lots of five cows each. Lot I was fed no other feed than that furnished by a blue grass pasture, and during the summer there was some scarcity of grass and the cows were driven considerable distances over macadamized roads to pastures on the estate. At the beginning of the experiment the cows in all



TEACHING A CALF TO SUCK THE NIPPLE, BY BLOWING MILK FROM THE BOTTLE INTO THE NIPPLE. Experiment I.

the lots were giving the same amount of milk. The experiment was begun on July 13, and continued seven weeks. The cows in lot I were pastured without additional feeding while the cows in lot No. II were fed four pounds of a grain mixture made as follows: 50 pounds of cotton seed meal, 100 pounds of bran and 250 pounds of corn meal. Cows in lot III were fed 10 pounds of silage and those in lot IV were fed four pounds of the grain mixture and 10 pounds of silage, while the fifth lot was fed eight pounds of the grain mixture and 10 pounds of silage. In every case the cows returned a profit for the grain feed which was furnished them, the cows in lot I decreasing rapidly in milk yield as the summer progressed and flies and hot weather increased in severity.

RESULTS: In making a survey of the experiment, and considering the last week of the experiment, we find that lot No. II (fed four pounds of grain mixture) produced $1.54 worth more of milk than those in lot I which were fed no grain or silage. This $1.54 is clear profit because we have deducted the cost of feed and the profit is due simply to the fact that on an average the cows in lot II were able to each produce 103 pounds of milk during the seven days of the seventh week, while those in lot I produced 60.6 pounds per cow.

The profit figured in the same way for lot II (fed 10 pounds of silage) was 43 cents per cow more than the profit of each cow in lot I. Lot IV (fed four pounds of grain mixture and 10 pounds of silage) made an average of $1.13 more profit than each cow in lot No. I, while the cows in lot V (fed eight pounds of grain mixture and 10 pounds of silage) each made an average profit of 81 cents more than each cow in lot No. I.

## RESULTS OF FEEDING THE COWS WHICH WERE ON PASTURE, BASED ON FORTY-NINE DAYS' EXPERIMENT.

The following table summarizes concisely the results of this cow feeding experiment, for the entire period of 49 days.

| Lot | Av. Pounds milk per cow. | Val. of milk per cow. | Cost of grain. | Cost of Silage. | Total cost of feed. |
|---|---|---|---|---|---|
| I. | 681.1 | $31.05 | | | |
| II. | 971.5 | 43.21 | $2.94 | | $2.94 |
| III. | 723.3 | 32.74 | | $0.98 | .98 |
| IV. | 898.2 | 40.97 | 2.94 | .98 | 3.92 |
| V. | 913.8 | 41.67 | 5.88 | .98 | 6.86 |

In figuring the cost of the grain mixture it was taken at 1½ cents a pound, the silage was valued at $4 a ton, and the milk at 40 cents a gallon. This experiment while conducted with very few cows and therefore not conclusive, yet demonstrates the fact clearly that it is a profitable proposition to supplement poor pasture with grain, and especially is this true during fly time, and when the cows are kept in the barn for several hours each day.

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KENTUCKY

# Agricultural Experiment Station

OF THE

# STATE UNIVERSITY

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## BULLETIN NO. 172

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# FUMIGATION AND SPRAYING

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LEXINGTON, KENTUCKY,
May 1, 1913

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Correspondents will please notify the Director of changes in their postoffice address, or of any failure to receive Bulletins.

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KENTUCKY AGRICULTURAL EXPERIMENT STATION,
LEXINGTON, KENTUCKY.

# BULLETIN NO. 172

## FUMIGATION AND SPRAYING

By H. GARMAN, Entomologist and Botanist of the Station

There is no avoiding the fact that we must reckon with the San Jose scale if we are to raise fruit in Kentucky. We have escaped it longer than most of the other states about us, partly because we are not so generally engaged in fruit growing, partly perhaps because we began at once to look after the pest when its presence was discovered in the eastern states. But the scale has been gradually invading our orchards until it is now liable to be discovered on fruit trees anywhere in the State. This means simply that we shall be compelled to do what our neighbors are doing if we wish to compete with them in the production of good fruit. The recent growth of interest in fruit growing in Kentucky and the disposition to plant new orchards has led to the adoption of improved methods of caring for fruit trees on the part of our more progressive people, but many farmers and even fruit growers are still not provided with spraying outfits, without which they cannot hope to save their trees from scale insects. These trees are perhaps not in all cases sufficiently valuable to justify the expense of spraying, but neighbors who have invested more extensively in fruit and depend more on the crop, should not be made to suffer because of neglect on the part of people who have nothing at stake. Everyone ought, it would seem, to be required to destroy infested trees in his possession whenever he is unwilling to treat them. Certainly one has nothing to gain by keeping them, since the scale will destroy them anyway, and a neighbor's risk should of itself be sufficient motive to impel one to get rid of the pests.

The importance of giving attention to spraying and other means of destroying scale insects is growing greater every year, as our acreage in fruit increases. Kentucky is credited with having produced over six million dollars worth of fruit in 1909. It is customary to concede to insect pests of ordinary crops one-tenth of the total value of the crop, and

applying this to our fruit crop of 1909 we may be said to have lost as a result of insect depredations over a half million dollars. Most fruit growers will be disposed to estimate insect injuries as reducing the fruit crop more than this, since fruit is particularly liable to attack. Our fruit will probably increase in the next decade so as to be worth at least twice what it was in 1909, in which case we may expect to lose annually a round million of dollars from insect injuries, unless we take measures to prevent.

Most of the injury and resulting loss can be prevented. Spraying alone will save the greater part. More than three-fourths of the loss from codling moth can thus be saved. This has been demonstrated by very carefully made tests. More than nine-tenths of the San Jose scale on the bark of fruit trees can be removed by a single thoro spraying in winter with lime-sulfur solution. There seems to be no good reason, therefore, why everyone interested in farming and fruit growing should not equip himself with the necessary apparatus and do his share in keeping pests under control.

Nurseries are in great and constant danger from the unimpeded spread of pests. For their protection it is important that orchards be looked after more closely than they have been in the past, since they are frequently the source from which nurseries become infested. But since the scale is now well established thruout the eastern United States, it will be necessary, whatever precaution orchardists may take, that nurserymen guard their establishments with special care if they are to merit the confidence and patronage of the buyer of nursery stock.

The treatment now being adopted everywhere as a means of rendering nursery stock safe when it leaves the hands of the grower is fumigation with hydrocyanic acid gas, and some suggestions are made below with reference to fumigation and other methods of treating trees in the nursery, and, with the protection of the nursery chiefly in view, also in the orchard.

## FUMIGATION OF NURSERY STOCK

To confine the gas about the stock it is necessary to construct a gas-tight house or box. Which it shall be depends

chiefly on the quantity of stock to be treated. For a small nursery with a few thousand trees a box measuring 8½ by 3½ by 3½ feet can be constructed, giving a capacity of about 100 cubic feet; or if the stock is very small a box more easily handled can be made, say 8 by 2½ by 2½ feet, thus containing 50 cubic feet. The box should be of matched stuff, without knots, the walls and lid of double thickness, with two thicknesses of tarred building paper between. The inside of the box should be painted and the joints closed carefully with white lead. The lid should be closely fitted by means of felt glued along the edges of the box. When the lid is in place it should be secured tightly by wedges so as to prevent the escape of gas, as shown in figure 2, B.

A house may be constructed of the same material and in the same way. It should have a door fitting very tightly, and for convenience in airing out quickly a small door at the back should be made. Its exact size does not matter greatly, but the dose used must be carefully computed to comply with the following instructions:

### THE DOSE TO BE USED

For each 100 cubic feet enclosed the following chemicals are required for each lot of trees treated:

Cyanide of potassium, 1 ounce (98 per cent. pure),
Commercial sulphuric acid, 2 ounces (of good grade),
Water, 4 ounces.

After filling the space with trees the water is poured into a crock, then the sulphuric acid is added little by little and the crock is placed in the box or house. The cyanide of potassium, broken into bits no larger than a hickory nut, is poured into the crock and the door is quickly shut. At the end of fifty minutes, or an hour, the doors are opened for ten minutes to air out, when the trees can be removed to make room for another lot.

The trees should not be fumigated when wet.
They should not be too tightly packed in the house.
The time of exposure must never be shortened.
The chemicals should be of the quality specified.

To make sure that the house or box is gas-tight it should always be tested before beginning operations, with a dense

smudge made of cobs, rags, or other material. If the smoke escapes, the crevices will be apparent and must be closed.

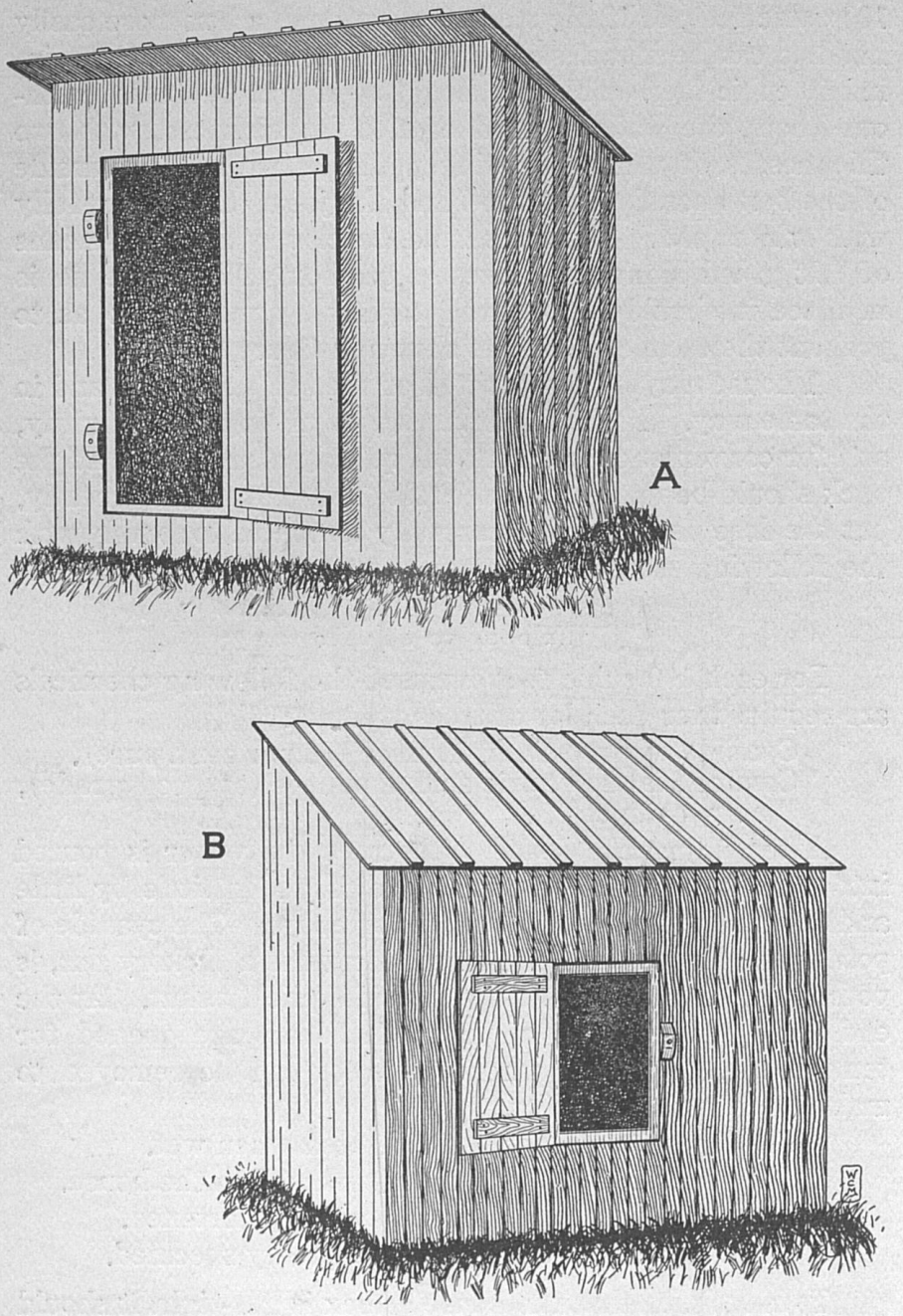



FIG. 1.—Showing construction of fumigating house. B, showing door at back for airing out quickly.

All fumigating houses or boxes must receive approval from this office before certificates will be issued.

Trees evidently bearing San Jose scale should be burned. The fumigation is to remove danger from the few scales very likely to escape notice, under buds and bark. Evergreens need not be fumigated ordinarily, since they do not become infested with San Jose scale.

Fumigation must not be expected to destroy crown gall, black rot, or canker. It can not be expected to destroy the eggs of insects, nor insects in their active stages when burrowing in the stems of trees. It will destroy woolly aphis, or any other exposed insects in the larval or adult condition when sufficient chemicals are used and the exposure is long enough.

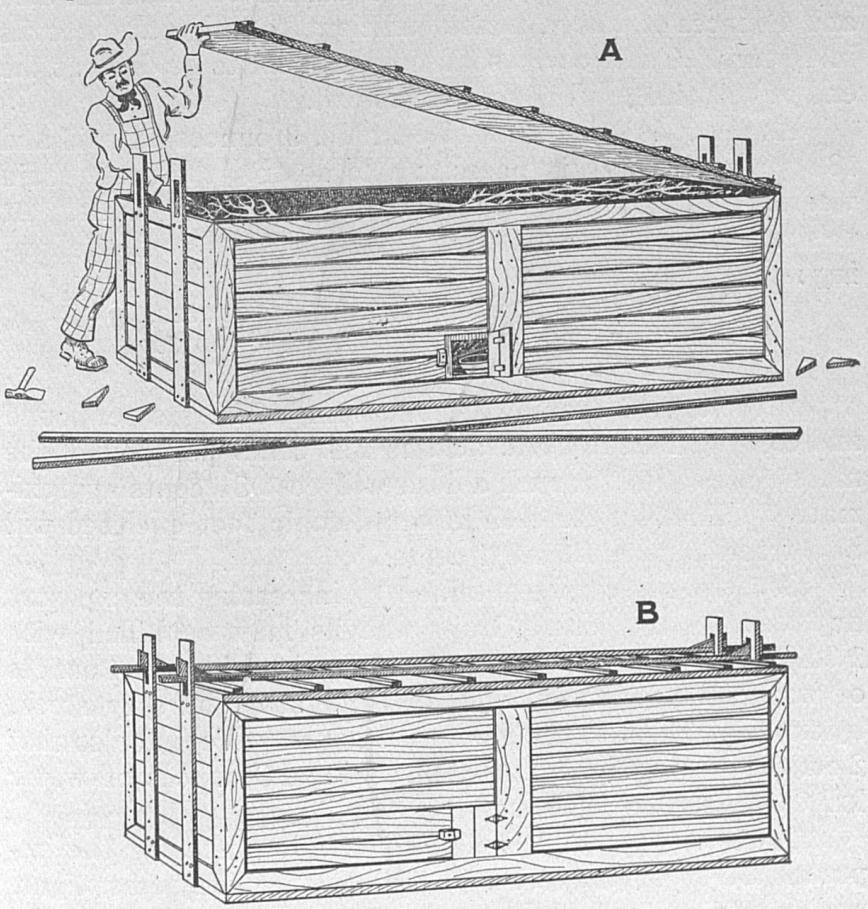



FIG. 2.—Showing construction of fumigating box. B, in use.

The gas is very poisonous, and must not be inhaled. A notice should be placed on the door of a house in which it is being used to prevent any one entering.

## FUMIGATION OF DWELLINGS, MILLS AND SEED HOUSES

People sometimes apply to this Division of the Station for advice about clearing dwellings or store-houses of insect pests. Hydrocyanic acid gas may be used for the purpose about as safely as any gas known, always remembering its poisonous character. But for fumigating buildings it is necessary to make longer exposures than for nursery stock, especially buildings that can not be closed very tightly.

In one hundred cubic feet of space, a dose consisting of 1 ounce of cyanide of potassium, 2 ounces of sulphuric acid and 4 ounces of water, is not sufficient to kill grain weevils in 4 hours. The weevils sometimes appear to be dead at the end of this time, but revive afterward.

As much as 4½ ounces of cyanide, 9 ounces of acid and 18 ounces of water is necessary to destroy the adult grain weevils (*Calandra granaria* and *C. oryzae*) in 4 hours. At this rate the dose for a room 10 by 12 by 8 feet is the following:

Cyanide of potassium (98%), 43.2 ounces,
Sulphuric acid (commercial), 86.40 ounces,
Water, 172.80 ounces.

If the cost of cyanide of potassium is 25 cents per pound and commercial sulphuric acid is 2½ cents per pound, the materials needed for such a dose will cost 81 cents approximately. The cost for each hundred cubic feet enclosed will be a fraction more than 8½ cents.

Good results can be obtained by increasing the exposure and reducing the dose. Grain weevils may be killed with 1 ounce of cyanide, 2 ounces of sulphuric acid and 4 ounces of water, the dose employed in fumigating nursery stock, by exposing them to the gas for 24 hours. We find also that 2 ounces of cyanide, 4 ounces of acid and 8 ounces of water kill these insects in 8 hours.

One is compelled to make some allowance for the impracticability of rendering dwellings perfectly gas tight, and the following may therefore be suggested as a satis-

factory dose for each 100 cubic feet enclosed and an exposure of twenty-four hours.

Cyanide of potassium, 2 ounces,
Sulphuric acid, 4 ounces,
Water, 8 ounces.

In case it is important to complete the fumigation as quickly as practicable, the following is suggested for each 100 cubic feet and for a 4 hour exposure:

Cyanide of potassium, 5 ounces,
Sulphuric acid, 10 ounces,
Water, 20 ounces.

Rooms should always be aired thoroly after fumigating and before entering them.

## FUMIGATING HOT HOUSES WITH HYDROCYANIC ACID GAS

Cyanide of potassium must be used carefully in fumigating living plants in hot houses. They differ somewhat widely in susceptibility to injury in the first place, and all when growing and in a moist atmosphere suffer more from the gas than do dormant plants. Our experience shows that very tender plants can be treated effectively in this way for aphides and adult white fly with the following dose for each 1000 cubic feet enclosed, leaving the gas in the house all night:

Cyanide of potassium, 0.25 ounce,
Sulphuric acid, 0.30 ounce,
Water, 0.75 ounce.

For less tender plants we have used for each 1000 cubic feet and exposing in the evening for two and a half hours, the following:

Cyanide of potassium, 0.50 ounce,
Sulphuric acid, 0.60 ounce,
Water, 1.50 ounce.

## FUMIGATION WITH BISULFID OF CARBON

This substance is sold as a fluid, commonly in pound bottles, but may be bought of wholesale dealers in chemicals in cans holding 50 or 100 pounds, in which quantities the cost is reduced to about 10 cents per pound. It evaporates quickly if the temperature is high as soon as exposed to the air, less rapidly if the temperature is lower.

Its fumes are poisonous to man and also inflammable, hence it is necessary to exercise some caution in handling it. Fire in any form should not be brought near rooms or boxes while filled with the fumes, and care should be taken not to inhale the fumes.

In experiments made here recently with gas-tight receptacles, 1.6 ounce of carbon bisulfid to 100 cubic feet of enclosed space killed only 50 per cent. of the grain weevils in 24 hours.

2.4 ounces in 100 cubic feet killed 100 per cent. in seven out of eleven tests, in the remaining four tests from 55 to 80 per cent. were killed.

3.2 ounces to each 100 cubic feet killed only ten per cent. of the beetles in five hours.

3.2 ounces to 100 cubic feet killed all of the insects in from 10 to 24 hours.

## FUMIGATION WITH CARBON TETRACHLORID

The disagreeable odor of commercial bisulfid of carbon renders it objectionable to some people for use on fabrics nfested with moth, and has led to the suggestion that carbon tetrachlorid, which has a rather pleasant odor, be used in its stead. This also is a fluid, and is used in the same way as carbon bisulfid, namely, by pouring it into open dishes, or crocks, and allowing it to evaporate in a box, bin, or room.

We find it not nearly as effective in small quantities as either cyanide of potassium or carbon bisulfid, and the large quantities that must be used increase the cost of treatment.

Some tests recently made here with grain weevils gave the following results, the quantities given being for 100 cubic feet.

| AMOUNT | | HOURS | KILLED |
|---|---|---|---|
| 6.4 oz. | Carbon tetrachlorid, | 24 | 10 per cent. |
| 9.6 oz. | | 24 | 50 " " |
| 16.0 oz. | | 24 | 75-100 " " |
| 19.2 oz. | | 24 | 100 " " |
| | (In four tests out of six) | | |
| 20.8 oz. | | 24 | 100 " " |
| | (In nine cases out of twelve) | | |

Even in large quantities and very long exposures it thus

seems to be much less effective than carbon bisulfid. It is quoted in a list of chemical reagents at hand at 40 cents per pound.

## FUMIGATION WITH TOBACCO EXTRACTS

A very satisfactory fumigant for the destruction of plant lice in hothouses and on low-growing plants in the garden is an extract of tobacco. If it could be produced as conveniently as the fumes of carbon bisulfid its value would be much greater. When used in experimental work in our hothouse the fumes have been driven off by dropping hot iron into the diluted extract. So produced they clear a house of plant lice very quickly, and do no harm to the plants.

A forty per cent. extract used in the proportion of one ounce to two of water for each 2500 cubic feet enclosed has been found effective for destroying aphides of various species. The fumes are driven off by pouring the tobacco extract and water into a pan, then dropping in this a flat piece of iron heated red hot and leaving the fumes about the plants over night.

The same procedure is effective in ridding plants growing in the garden, of plant lice, as was demonstrated in this Division a good many years ago. At that time I employed heat in producing the fumes, using for the purpose a gasoline burner, and driving the fumes thru a spout into a box or can covering the infested plants. But heat is inconvenient for the purpose. Some chemical substance added to the extract to drive off the fumes would be much better.

Recently in experiments we have obtained good results by the use of a strong alkali, such as sodium hydroxid or potassium hydroxid. A solution of either added to the Black Leaf 40 made by the Kentucky Tobacco Products Company produces fumes which quickly kill plant lice, plant bugs (Pentatomidae), flesh flies, and grain weevils (*Calandra oryzae*). The latter are not easily killed even with hydrocyanic acid gas, but the tobacco extract mixed with sodium hydroxid killed them in ten to eleven minutes.

The adult white fly and one of the clover plant lice were also killed on a pot of red clover in the hothouse, using one fluid ounce each of Black Leaf 40, and of sodium hydroxid in

concentrated solution. The plant was exposed at 11 A. M., the insects still alive an hour later, but at 4.40 P. M., when the box was opened finally every insect was dead, while the plant was in fine condition.

The space in the box used was only 1.17 cubic feet, which means an ounce of the extract to about one cubic foot. This makes the extract much too costly for the florist, and it is hoped that some method will be devised for liberating the nicotine quickly and completely, without an extravagant use of materials.

It is surprising to find tobacco so deadly in its effects. The strong fumes would kill a man quickly, and inhaling a little for any length of time would doubtless affect the health injuriously. Nicotine is a deadly insecticide. Insects of all sorts succumb to it with a completeness and suddenness that is quite impressive. "Struck dead" is an expression which describes its effect on them very exactly, when they rae exposed either to a strong watery extract, or to the fumes produced from such an extract.

## THE FUMIGATION OF SEEDS

To be practicable as a means of destroying weevils and other grain insects it is necessary that fumes shall not injure seeds so as to prevent germination, and also, when grain is to be used for food, that no objectionable residue be left on the seeds.

In all our tests on insects, seeds have been treated at the same time, and careful germination tests of them have been made afterward. No injurious effect of any of the fumes mentioned above has been observed, in fact hydrocyanic acid gas actually stimulates the germination, causing fumigated seeds to germinate somewhat more promptly than others, tho no better in the end.

The carbon bisulfid and carbon tetrachlorid leave nothing hurtful on the seeds, but fumigated grain to be used for food ought always to be aired thoroly afterward to get rid of any odor that might otherwise remain. This is particularly important if hydrocyanic acid gas is used. The gas is very poisonous to man, and a little of it might produce illness, if it had no worse effect.

The following are records of tests of seed made recently under my direction in the Insectary of this Division by Mr. Niswonger. The germination percentages of seeds treated with hydrocyanic acid gas average a little higher, it will be observed, than those of the untreated seeds. The check seeds average a little better in tests with carbon bisulfid. Treated and untreated were practically identical in germination when carbon tetrachlorid was used.

THE EFFECT OF HYDROCYANIC ACID GAS ON SEEDS

Two ounces of cyanide of potassium in 100 cubic feet of space for eight hours.

| | Treated, % germinated | Checks, % germinated |
|---|---|---|
| Corn | 90.0 | 80.0 |
| Cowpeas | 100.0 | 98.0 |
| Navy beans | 99.3 | 97.3 |
| Soybeans | 93.3 | 97.3 |
| Wheat | 90.0 | 88.0 |
| Rye | 92.6 | 92.6 |
| Oats | 87.3 | 89.3 |
| Barley | 82.3 | 82.0 |
| Millet | 97.6 | 96.3 |
| Clover | 65.3 | 57.3 |
| Orchard grass | 92.6 | 90.6 |
| Bluegrass | 60.3 | 57.6 |

THE EFFECT OF CARBON BISULFID ON SEEDS

Three pounds to 1000 cubic feet enclosed, for forty-eight hours.

| | Treated, % germinated | Checks, % germinated |
|---|---|---|
| Corn | 100.0 | 100.0 |
| Cowpeas | 100.0 | 100.0 |
| Navy beans | 100.0 | 97.3 |
| Soybeans | 100.0 | 98.6 |
| Wheat | 90.0 | 93.3 |
| Rye | 92.6 | 94.0 |
| Oats | 56.6 | 64.2 |
| Barley | 76.0 | 83.3 |
| Millet | 96.0 | 95.3 |
| Clover | 64.6 | 74.3 |
| Orchard grass | 94.3 | 95.5 |
| Bluegrass | 60,6 | 60.3 |

THE EFFECT OF CARBON TETRACHLORID ON SEEDS

Nine pounds to 1000 cubic feet enclosed, for forty-eight hours.

| | Treated, % germinated | Checks, % germinated |
|---|---|---|
| Corn | 100.0 | 100.0 |
| Cowpeas | 98.6 | 97.3 |
| Navy beans | 94.6 | 92.0 |
| Soybeans | 100.0 | 100.0 |
| Wheat | 91.3 | 100.0 |
| Rye | 90.6 | 88.0 |
| Oats | 64.0 | 70.6 |
| Barley | 90.0 | 85.3 |
| Millet | 98.0 | 98.3 |
| Clover | 68.0 | 68.0 |
| Orchard grass | 94.6 | 96.0 |
| Bluegrass | 61.3 | 59.6 |

## SPRAYING

Our bulletins on spraying are exhausted, and a few additional suggestions relative to this subject are added for the convenience of nurserymen and fruit growers.

For winter spraying use concentrated lime-sulfur solution, one part of the manufactured solution to ten of water. Spray thoroly, and from opposite sides of the trees. Select settled, clear weather, so that the preparation will have an opportunity to dry on the bark. This treatment is intended to clear the trees of scale insects and of certain fungi attacking the leaves and fruit. The trees should always be pruned and all dead wood and shriveled fruit be removed before spraying.

### SPRAYING APPLES

In the spring as soon as the blossoming period is past in an orchard spray with Bordeaux mixture (4 pounds of bluestone, 4 pounds of lime and 50 gallons of water), to which add 2½ pounds of arsenate of lead paste. Spray again in ten days with the same mixture.

If bitter rot is troublesome it may be necessary to spray a fourth time with the same mixture in midsummer. But where an orchard is regularly pruned, sprayed, and otherwise looked after, the two spring applications are often the

the only ones required. Manufactured lime-sulfur mixture (3 quarts in 50 gallons of water) may be used in place of Bordeaux mixture for summer application

### SPRAYING PEACHES AND PLUMS

For peaches and Japanese plums, the foliages of which are tender, a different procedure is called for. They can be sprayed with the concentrated lime-sulfur solution in winter when they are completely dormant. After the leaves are out it is necessary to proceed with caution to avoid injury. Two quarts of the manufactured lime-sulfur solution may be used in fifty gallons of water, and two pounds of arsenate of lead should be added to the same mixture to control the injuries of the curculio. The lime-sulfur used thus in the summer has a good effect in controlling the rot, so destructive to stone fruits in this State.

The self-boiled lime-sulfur preparation is less likely to do harm to peach and Japanese plums than the manufactured lime-sulfur, and is preferred by some fruit growers. It is made by slaking eight or ten pounds of good lime, adding as it slakes an equal quantity of sulfur and stirring thoroly. As soon as the lime is slaked, water is added to cool the mass and prevent too much sulfur going into solution, since this is the condition causing burning of foliage. Enough water is finally added to make a barrel (50 gallons) in all, when it is ready for use.

### SPRAYING SHADE TREES

The spraying called for in the control of pests injuring large trees is the same as that employed in the apple orchard. If infested with scale insects, applications of lime-sulfur in winter are best. In summer much of the spraying necessary is the result of injuries from gnawing insects, such as the elm leaf beetle, and these can generally be controlled by applications of arsenate of lead. A power sprayer is necessary for such work if it is to be done quickly and thoroly. A hand pump connected with a barrel can be made to do fairly good work on shade trees of moderate size.

### SPRAYING FIELD CROPS

Spraying potatoes, tobacco and some other low-growing crops may be practiced with success, using the same appara-

tus and mixtures as have been suggested for trees. Bordeaux mixture, with arsenate of lead added has become a standard remedy for potato blight and the potato beetle. This spraying must be done early. It should begin as soon as the adult potato beetles lay their eggs, and an application every ten days thereafter until the plants stop growing has been proved to be profitable.

Tobacco is a difficult crop to spray because of the way it is grown. Late spraying with anything except a knapsack sprayer is impracticable. Dusting can of course be done at any time, but I am not an advocate of dusting, having witnessed some of its ill effects on both workmen and crop.

If arsenate of lead or Paris green is applied to tobacco as soon as the eggs of the tobacco moth are laid, it is possible to control the injury very well, tho it is necessary with either spraying or dusting to watch the plants and from time to time remove such worms as escape the poison. When the crop is young and the first brood of worms is appearing it is entirely practicable to spray the plants thoroly with arsenate of lead applied with a barrel or even power sprayer. These applications if generally made in plant beds and in the fields of a community, would no doubt greatly lessen the number of worms of succeeding broods and would thus tend to bring about a condition like that in western orchards where everybody sprays, the worms being so reduced in numbers that but little spraying is required of each individual to keep his crop free. For the early applications to tobacco I would suggest two and a half pounds of arsenate of lead paste in fifty gallons of water. If Paris green is used, one pound may be employed in 130 gallons of water, and a little lime may be added to make it stick and lessen its burning effect. But it is to be remembered that lime can be used only on the leaves first formed and which will not make part of the crop. Very late spraying of tobacco should be avoided.

### SPRAYING WEEDS

The chief difficulty in destroying weeds with herbicides comes from the fact that herbicides generally kill or have an injurious effect on other plants besides weeds, and hence when the two are growing together it is sometimes im-

practicable to use sprays. When weeds grow in walks it is often easy to kill them with copper or iron sulfate solutions, lime-sulfur wash, salt, and some other substances. From its cheapness and because of its very slightly injurious effect on grasses, iron sulfate has a value for weeds growing among small grains, timothy, and grass pastures. It is decidedly injurious to clovers. A twenty per cent. solution can be made to destroy much of the white top among timothy, and some other broad-leaved weeds are burned more or less severely by it when sprayed in pastures. In the Northwest it has proved of special value as a check upon wild mustard growing among oats.

An ordinary barrel sprayer with hand pump can be used in applying the solution, but it should be provided with a bar at the end of the wagon, with nozzles at intervals so as to spray a strip at least 8 feet wide. A power sprayer is of course a great advantage when large areas are to be sprayed. Some sprayers suitable for spraying weeds will do good work also on potatoes and other field crops when these are attacked by pests. In buying a sprayer it is well to keep in mind its use for these different purposes. A general purpose sprayer is best unless one is devoting his attention to special crops, in which case types of sprayers completely adapted to this crop may be economically employed.

### SPRAYING ORNAMENTALS

Frequent inquiries reach me concerning the treatment of rose bushes and other ornamental plants infested with plant lice or slugs. For the former there is no better spray than a strong tobacco extract either homemade or manufactured. The homemade extract is produced by putting a pound and a half or two pounds of chopped tobacco stems (mid-ribs) in a bucket holding two and a half gallons, and pouring over them in the evening boiling water and leaving to soak until the next morning. The Kentucky Tobacco Product Company puts on the market an extract under the name "Black Leaf 40", which can be made to do good work as a spray, if diluted with about seventy parts of water.

Rose and raspberry slugs, also currant worms, may be sprayed, or sprinkled, with powdered white hellebore, two

or three heaping tablespoonfuls in an ordinary bucket of water. Under some conditions it is practicable to use on these insects the more certain sprays of arsenate of lead or Paris green. For the rose bug or beetle, "strong" mixtures of arsenate of lead are necessary. Three pounds in fifty gallons of water is not too much to kill this beetle quickly.

## TREATMENT FOR UNDERGROUND PESTS

Inquiries sometimes come to this Division with reference to getting rid of ants and other soil-frequenting animals in lawns and along walks. Though the ants occurring in this part of the United States do not attack plants, visiting them only to obtain sweets of one sort or another, they are often accused of such injury and in any case their mere presence becomes annoying to nervous people. They are commonly attracted to plants by plant lice, which furnish them with a sweet exudation, this when excessive taking the form of "honey dew". These plant lice are very serious enemies to roses, chrysanthemums, nasturtiums and other ornamentals. They are easily destroyed by sprays of tobacco extract, as already stated. The ants do not succumb to this treatment, and their burrows in the soil must be fumigated with bisulfid of carbon, or treated with coal oil.

The bisulfid of carbon has been extensively employed in European vineyards for the root-infesting Phylloxera, being injected into the soil about the plants in small quantities some distance out from the stems. Larger animals, such as gophers, living in closed burrows may be destroyed by rolling balls of cotton saturated with bisulfid of carbon into their burrows.

When used too freely the fumes will destroy grasses and other plants.

## THE REQUIREMENTS OF THE KENTUCKY NURSERY AND ORCHARD INSPECTION LAW

While our nurserymen were prompt to take advantage of the nursery and orchard inspection law, owners of orchards have shown less disposition to profit by it, and a provision in the law for the inspection of orchards when the owners suspect them to be infested with San Jose scale or other destructive pests, is not often enough invoked as a means of detecting and checking the injuries of pests. The expense of such inspections is paid by the State. The words of the law are: "Whenever a nurseryman, fruit grower, or agriculturist in this Commonwealth shall know, or have good reason to believe that his trees, vines or plants are affected with San Jose scale, yellows, rosette, or other destructive insect or fungus enemies, he shall have the privilege and it shall be his duty to notify the State Entomologist", etc.

Attention is called below to several requirements of the law that should be kept in mind by everybody interested in Kentucky agriculture.

The law requires that all nursery stock be inspected before it can be sold in Kentucky.

It requires that every package shipped or delivered by a resident nurseryman shall bear a written certificate from the nurseryman stating that the contents have been inspected as required by law.

It requires that all stock shipped or delivered by a non-resident nurseryman shall bear a copy of a valid certificate by an official inspector and a list of contents, together with the name of the consignor and consignee.

Failure to comply with the law on the part of a resident nurseryman is punishable by a fine of fifty dollars for each and every such shipment or delivery.

Stock that does not comply with the law, when shipped into Kentucky, must either be inspected at the expense of the agent, or consignee; or must be returned, or destroyed.

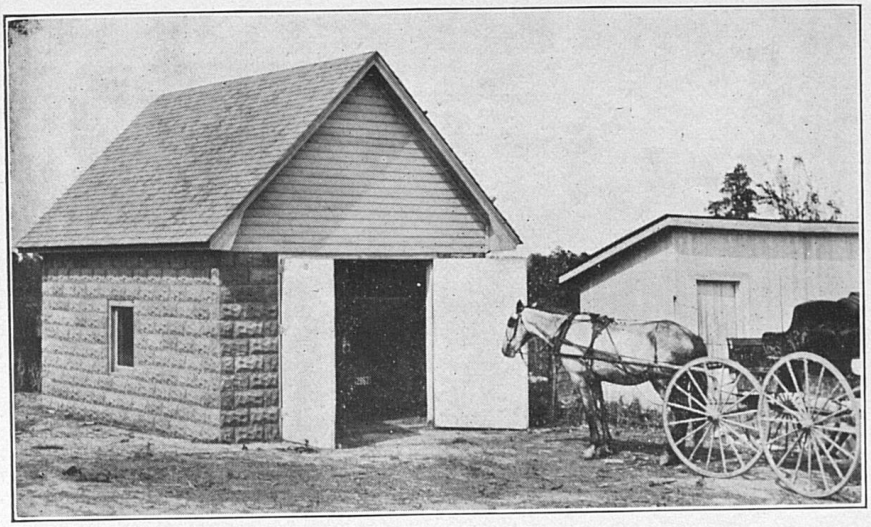


FIG. 3.—A fumigating house recently erected by O. Piper, of Clinton, Ky. Inside dimensions 12x17x7½ feet. Floor of concrete. Old house at right.

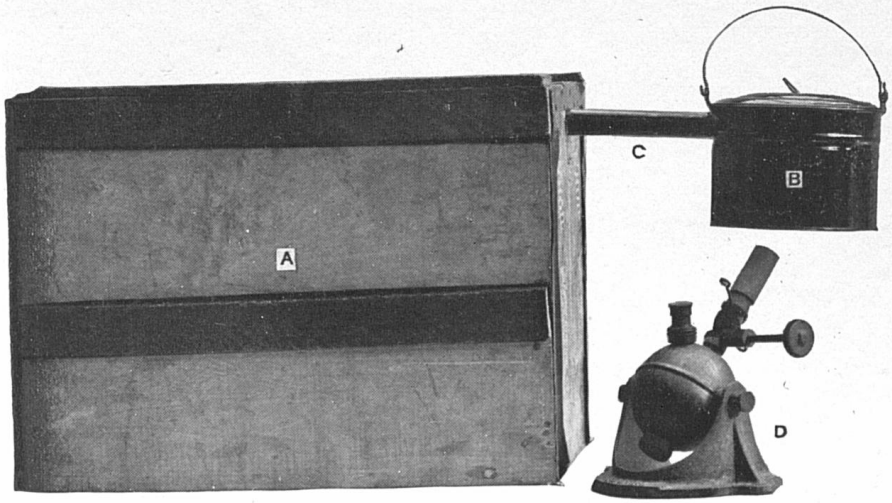



FIG. 4.—A fumigating box for melons and other low-growing plants. For tobacco extract.

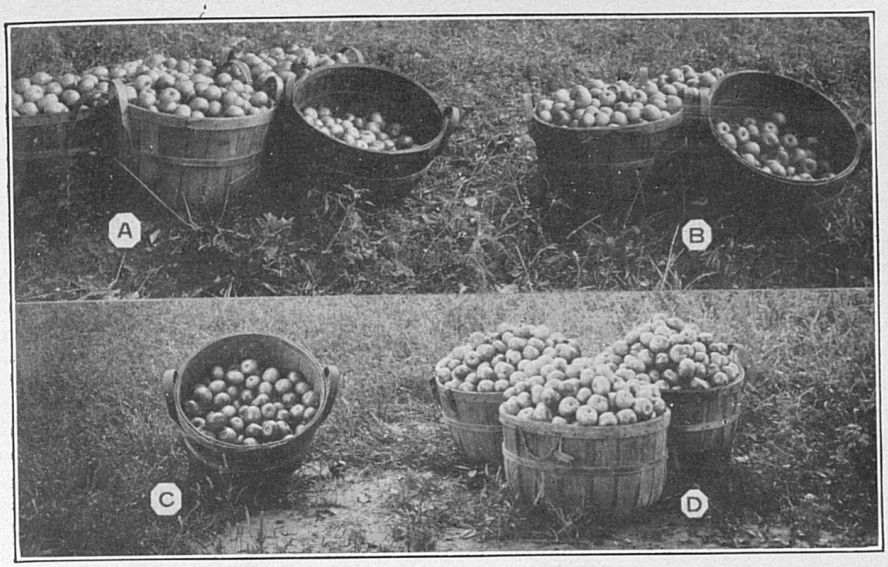



FIG. 5.—Showing the results of spraying maiden's blush apple trees in Hardin County for apple blotch. A, four and a third bushels sound clean-skinned apples from sprayed tree; B, two and a third bushels of seconds from the sprayed tree; C, one-half bushel of sound apples from the unsprayed tree; D, three bushels of badly blotched and wormy apples from the unsprayed tree.

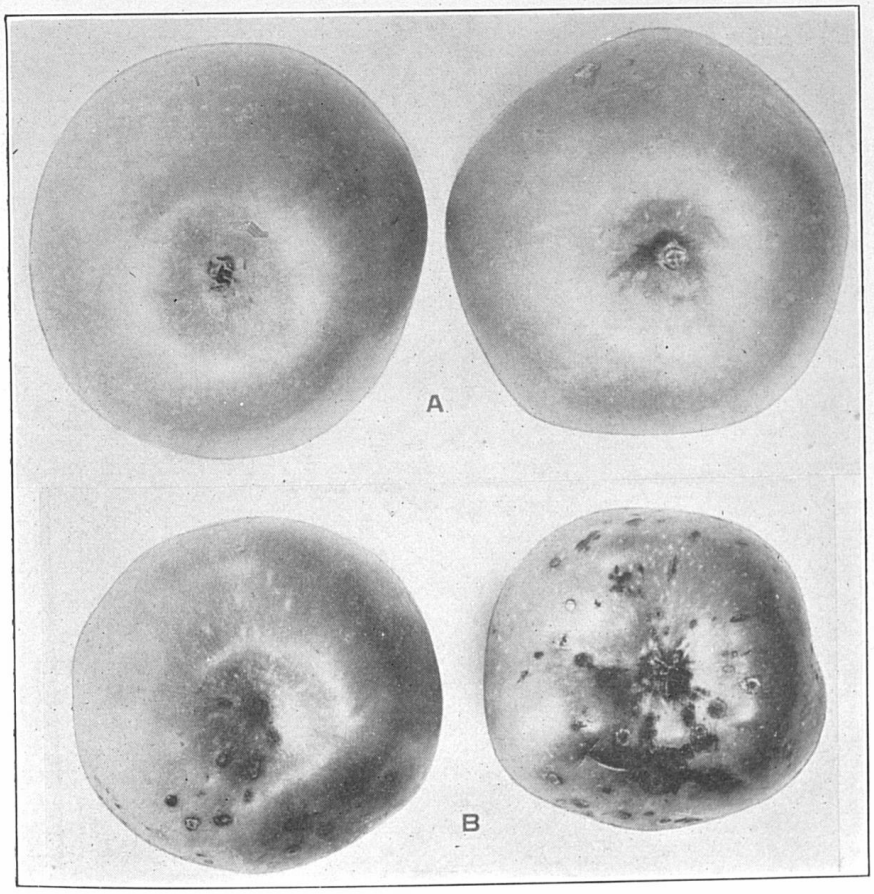



FIG. 6.—A, maiden's blush apples from sprayed tree; B, same from unsprayed tree.

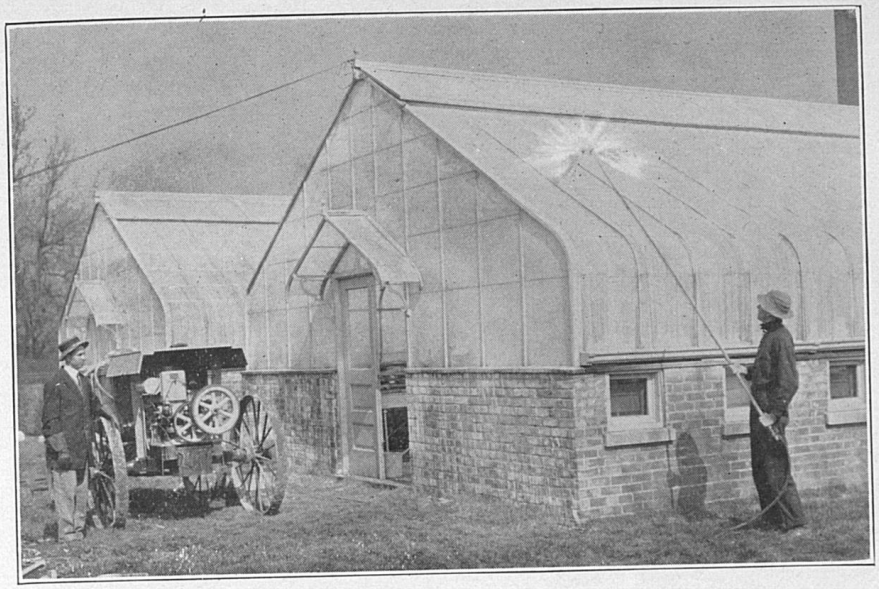


FIG 7.—Whitewashing the conservatory with the power sprayer.

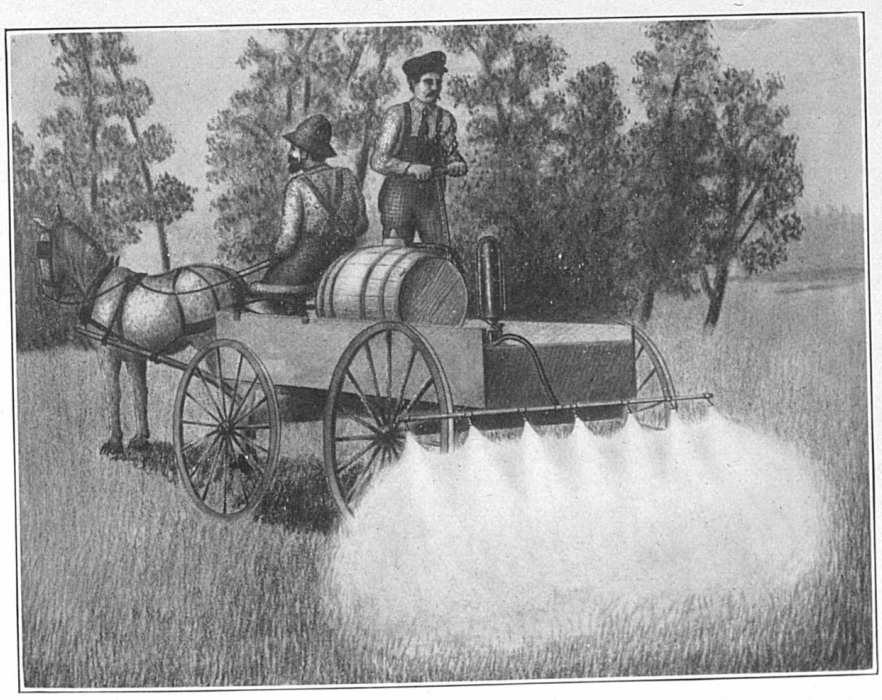


FIG. 8.—Showing the use of a hand sprayer connected with a bar provided with seven nozzles for spraying weeds and low-growing crops.

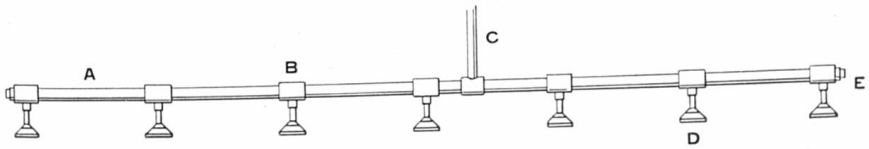



FIG. 9.—Showing construction of bar for use at back of wagon or cart. A, section of bar; B, coupling; C, connection for hose coming from pump; D, nozzles; E, plugs at ends.

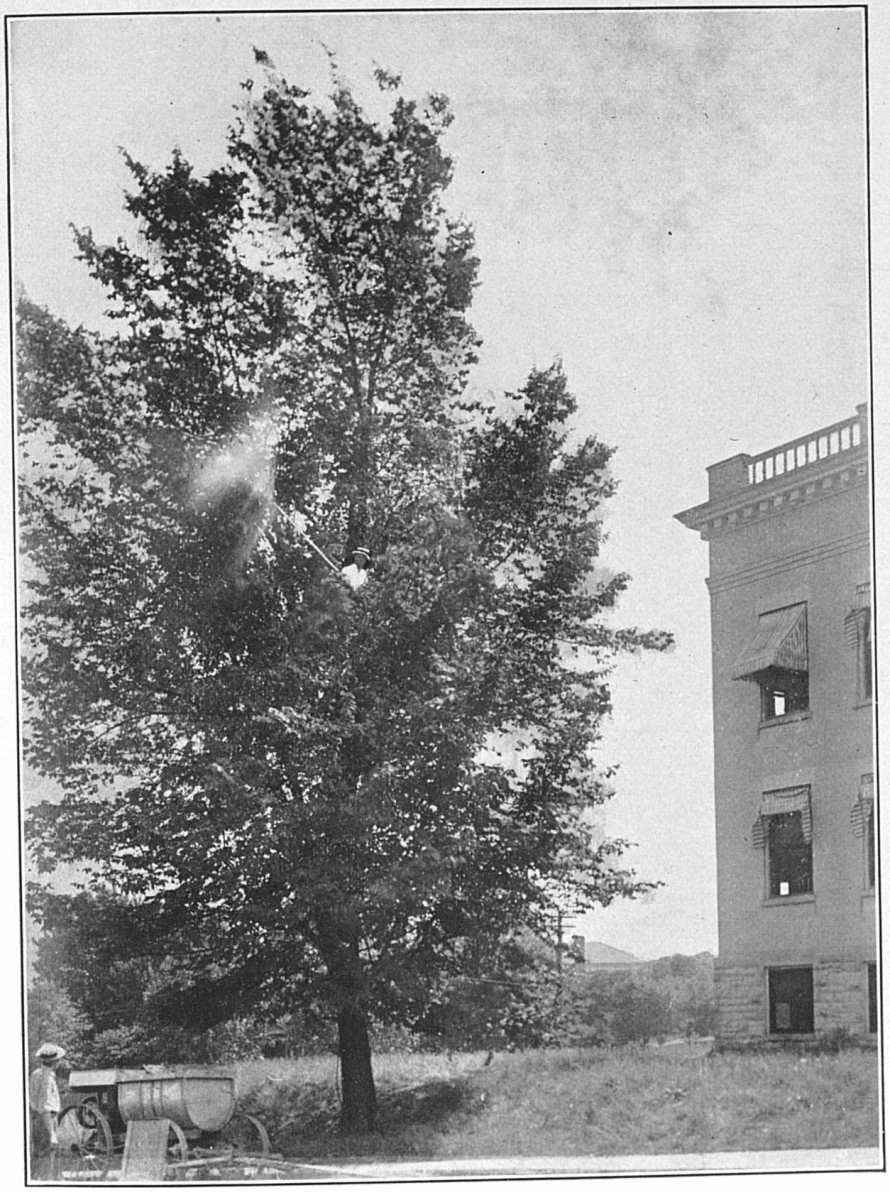


FIG. 5.—Showing use of power sprayer belonging to the Division, spraying for the elm leaf beetle.

KENTUCKY
AGRICULTURAL EXPERIMENT STATION

OF THE

STATE UNIVERSITY

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BULLETIN No. 173

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# THE MUNICIPAL ABATTOIR

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LEXINGTON, KENTUCKY

AUGUST 1, 1913

211

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BULLETIN No. 173

# The Municipal Abattoir

By R. M. Allen and J. W. McFarlin.

In 1908, with the extension of the State pure food law, the Food and Drug Department of the Experiment Station began investigations into the sanitary condition of the slaughter-houses and meat markets throughout Kentucky. The conditions were noted and photographs taken. Investigations were also made to determine the best remedy for the conditions found. Neither the pure food law and the general health statutes of the State, nor the present ordinances of the cities afford effective control.

The systems of meat inspection in Germany, France, Austria and other countries, and in Chicago, Cincinnati, Cleveland, Nashville, Paris (Texas), Greenville, (S. C.), and other cities and towns in the United States, where inspection is in daily operation, were studied. The municipal abattoir is the only effective remedy to control both the sanitary condition and eliminate diseased animals. This is the conclusion of all who have investigated meat slaughtering and its proper control, for the following reasons:

(*a*) It is necessary to concentrate killings in order to maintain the equipment and method necessary for sanitary plants, and to handle the sewage so as to prevent contaminating streams. Small individual plants, killing comparatively few animals, have, generally, insufficient capital to prevent unsatisfactory conditions.

(*b*) The central abattoir gives opportunity to save all

offal and to maintain the equipment necessary to render the same into fertilizers and other profitable by-products.

(*c*) Centralized killing makes it possible for the city or town to maintain the inspection force necessary to inspect each animal before slaughter and each carcass after slaughter. When all animals are driven through one pen and killed in one plant, the costs of inspection are small compared with the cost of inspections throughout a number of small scattered plants, and of course, is more inclusive and efficient.

(*d*) The appropriations made to the various State departments, having to do with such work, are never sufficient to justify efficient meat inspection. On the other hand, a centralized abattoir in each municipality or locality can be made a profitable investment and to pay the cost of inspection, through the saving of the offal, reducing the cost of killing, and charging a comparatively small fee for the inspection.

(*e*) A central plant gives opportunity to employ skilled men for the killing and dressing of meat. The skilled butcher takes off a hide without injury. The hides can be graded and sold in carload lots, at better prices and a saving of freight. The same advantage will apply to tallow and other by-products.

(*f*) The enforcement of the pure food and health laws of the State to require better sewerage, concrete floors,necessary water and similar items, in connection with each of the individual plants, while bringing about a temporary sanitary advantage, does not bring about the more important matter of inspecting meat for animal diseases, and results in the investment of more capital in undesirable plants. The capital which has been invested in unfit plants is one of the problems against the centralized abattoir; to increase this investment makes the problem all the more difficult.

In endeavoring to establish the municipal abattoir, the work has met:

(*a*) An apathy on the part of the majority of the public

and city officials with respect to the grave danger of uninspected and diseased meat.

(b) The money invested in individual plants, and the wish of the butcher or meat dealer, who has made a success in a community, because of honest dealings and strict attention to quality, in not wanting to associate with incompetent or dishonest butchers that may be doing business in the same locality.

(*c*) The knowledge on the part of the trade that the inspection of animals causes loss by reducing the value of an animal which has been found to be diseased, from food or fertilizer prices.

(*d*) The unscrupulous trade in meat from animals known to be diseased, or from animals killed otherwise than by slaughter.

(*e*) Lack of information as to what steps to take towards the erection and operation of a municipal plant, and a general trade conservatism towards entering on new ventures.

Most of the information given in this bulletin has been given to municipal officials, local health departments, women's club through addresses, correspondence and conference. This, together with prosecutions that have been directed against insanitary slaughter plants, meat markets, and against diseased meat, has awakened a substantial interest throughout Kentucky to the serious need for local meat inspection, and which calls for the publication of information of practical value relative to meat inspection, the organization, building and maintenance of a municipal abattoir, the objections and practical problems urged against such a system by a part of the trade, and the ordinances and regulations necessary to competent inspection.

Results, though slow, are beginning to show. In Winchester, for example, the Council and the City Health Officer have the report of our inspections before them, and are considering a plan for either the taking over of a plant and making the additions necessary for refrigeration and tankage facilities, or the building of a new plant.

In Louisville, for further example, The Home Butchers' Protective Association has appointed a committee to act with the city and State authorities. The plan is to go over jointly all of the plants in Louisville to determine the best basis for beginning centralization and the inspection of animals. The present view of this joint committee is that a practical beginning can be had in the designation of from six to ten of the Louisville plants as city abattoirs, and located throughout the various packing centers.

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## RELATION OF PROBLEM TO BREEDER AND FEEDER.

The economic phases of meat inspection extend from the farm to the retail counter. A large part of the meat supply comes from animals diseased or worn out in breeding and dairying. There has been a long neglect of animal health and sanitary care of animals on the farm, in the dairy, in the feeding pens, and in the stock yards. This neglect has accumulated a difficult and costly problem for the meat inspection service to deal with. The share of the responsibility on the part of the farmer, the dairyman, the feeder and the trader, in the matter of diseased meat, cannot be too strongly emphasized. Sanitary barns, the detection and elimination of disease before it spreads through the herds, the disinfecting of stalls, pens and cars in which animals are kept, would change a vast amount of animal flesh from the fertilizer tank to the meat food supply.

Where Federal or municipal inspection exists, most of the diseased animals find other markets, generally through the uninspected local slaughter-house or the irresponsible meat peddler's cart. To the extent that such animals pass into the yards of an inspected plant, the loss is necessarily charged to the consuming public. There should be some system to divide this loss between the feeder, the trader, the packing house and the public.

There is no more practical or valuable work in the in-

terest of public health than the growing effort to eliminate disease from the herd, and to teach those who breed, feed and deal in stock how to eliminate and prevent animal diseases. The oft-repeated statement, in the campaign for public health, that the country is spending a greater amount on its animals than on its children, is not altogther true. Such expenditures and such work on the part of animal husbandry departments of the National Department of Agriculture and the state experiment stations mean that the work for public health is being brought from a sentiment to tangible and practical methods for the protection of public health in the prevention of animal disease. Protecting consumers of meat from animal diseases has been recognized by all the nations as one of the most important measures of preventive medicine. The expenditure of money to eliminate disease in a herd is not only a fundamental necessity, but the money effectively spent in such direction is of vaster economic value than to wait until the diseased animals accumulate at the slaughter pen and begin the costly, but necessary, destruction of the food supply, or to wait further until the disease passes on into serious effects upon the public health.

No little part of the problem of food sanitation goes back to the farmer. Clean food, free from disease, is one of the most important items in the pure food reform. There has been a tendency, on the part of some of the short-sighted friends of the agricultural class, to minimize the farmer's part. The facts are, however, that if the food supply is to be cleaned up and kept clean, the agricultural class must do their part, and, in assuming this responsibility, the interest, the pleasure, and the profits are greatly increased. The states and the nation are indebted to the farmer and those who have been working in his interest for the pure food reform. It was the agricultural chemist who devised the methods for detecting adulteration and who colloborated and presented the country with the facts. The workers in the departments of dairy husbandry, connected with the National Department of Agriculture and the state agricultural

colleges and experiment stations, finally established the necessary equipment and method for the production of pure milk, to meet the sanitary facts brought forth by the agricultural bacteriologists. Adulteration and substitution in food products fall heaviest upon the agricultural classes. The trade can adjust itself to the practices, but to the extent that oleomargarine is sold as butter, glucose as honey, or anilin color substituted for the red of the fruit, in the same ratio does the prosperity of the dairy, creamery and fruit orchard decline. For this reason, the farmers instituted departments to compel honesty in the food trade, and, out of the beginning which they made, the present system of Federal, state and municipal food control has been developed.

Meat, dairy and similar lines of inspection, however, in order to maintain sanitary quality, require inspection not only in the market, but at the place of production, and the work needs still further help from the farmer in the strict maintenance of the necessary equipment and method for healthy animals on the farm. Not only is such necessary in the interest of public health, but, in the same way as the wheat and corn are graded, as are the animals selected because of good or bad showing or breeding points, in the same way as potatoes and apples and other products are graded according to ripeness, size, variety, so, also, has the time arrived when products are to meet a standard of sanitary quality and the market price adjusted accordingly.

The inspection of slaughter-houses throughout the State has impressed upon all connected with the work the fact that the feeding of offal to hogs is probably one of the substantial means for the continuance of hog cholera. Hogs purchased for slaughter are turned in to the slaughter-house lot with free access to raw offal. It is very frequently the case that a hog so fed is not suitable for killing, and is sold into the breeding or feeding pens. The abolishment of such a practice is justified, alone, from the standpoint of swine health. In the same way the exchange of unknown and frequently diseased animals through the common stock-

yards has undoubtedly been a substantial source of tuberculin infection throughout the dairy herds.

The practical side of preventive medicine is a matter in which the producer, the manufacturer, the dealer, and the consumer must engage, together with the health control worker; without such cooperation, throughout, the reform does not become practical.

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## SYSTEMS OF MEAT INSPECTION.

There are three systems of meat inspection in the United States:

(*a*) The Federal service as conducted under the amendments to the extention of the National Meat Inspection Act by Congress in 1906, the National Food and Drugs Act also applying to the condition and labeling of interstate and foreign shipments of meat products.

(*b*) State inspections, conducted to a greater or less extent in this or that state by the pure food officials, necessarily confined to the sanitary conditions, and invariably arriving at the conclusion that local meat inspection is the every-day job for the city, town or county through efficient, inspected local abattoirs.

(c) Inspection under municipal ordinances. Some good work is being done in Cleveland, Nashville, Greenville (S. C.), Paris (Texas), and Hopkinsville (Ky.)

There are four purposes of meat inspection:

(*a*) To protect against the possibility of the transmission of animal parasites (trichina and tape worms).

(*b*) To protect against the infectious diseases such as tuberculosis, glanders, anthrax, rabies, septicemia, pyemia.

(*c*) To protect against meat poisoning caused by the ptomaines and other toxins which develop in spoiled meat.

(*d*) To protect consumers from fraud, that is, from the sale of inferior meat at the price consumers are in the habit of paying for the more preferred kinds and classes.

The consumer cannot protect himself against meat diseases, for this requires veterinary skill. The Federal acts apply only to the inspection and sale of meats entering into interstate commerce. These laws afford very strict authority throughout interstate and foreign commerce, and with more appropriation could follow more of the Federal-inspected meat until it passes from interstate jurisdiction. As it is, Federal inspection not only condemns much diseased meat at the packing plants, but also millions of pounds annually of meat and meat food products because of being "sour, tainted, or otherwise unfit for food" after the inspection at the time of slaughter.

There is necessity for the continuance of such inspection on the part of State and municipal officials, after the government-inspected meat has passed out of the hands of the Federal authorities into the trade of the State. In Louisville, for example, government inspectors exercise control over the depots of the interstate packers. In Paducah, Henderson, Owensboro, Lexington, and other cities and towns of the State, government inspection is not followed up to see if the cars from interstate commerce finally deliver good meat, and numerous instances have been noted, as a result of the inspection under the State pure food law, of meat that is tainted and sour. In many instances the meat is dumped on the station platform in the summer's heat. All such practices could be controlled under a constant and efficient system of municipal inspection, along with the control of a local abattoir. It is necessary for local ordinances to provide means for the inspection and control of the meat that has passed from the control of Federal jurisdiction.

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## STATE INSPECTIONS.

The Kentucky Food and Drugs act of 1908, paragraph 6 of section 4, deems an article of food adulterated

> "If it consists of or is manufactured from in whole or in part of a diseased, contaminated, filthy or decom-

posed substance, either animal or vegetable, unfit for food, or an animal or vegetable substance produced, stored, transported or kept in a condition that would render the article diseased, contaminated or unwholesome, or if it is any part the product of a diseased animal, or the product of an animal that has died otherwise than by slaughter, or that has been fed upon the offal from a slaughterhouse, or if it is the milk from an animal fed upon a substance unfit for food for dairy animals or from an animal kept and milked in a filthy or a contaminated stable or in surroundings that would render the milk contaminated."

As to whether this provision not only prohibits the sale of an article of food which is actually found to be contaminated, but in addition any product which has been exposed to the danger of contamination, arose in the bakery case of Commonwealth of Kentucky vs. C. F. Nagel, in the Criminal Division of the Jefferson Circuit Court in June, 1911. On this point Judge Gregory held:

"2. The discussion presented in the second objection has taken a very wide range, and goes far beyond the questions presented at this time. The clause 'that would render the article diseased, contaminated or unwholesome' employed in sub-section 6, par. 4 of the act, is somewhat indefinite in its meaning. Whether the word 'would' is here employed in the sense of 'might' or whether the act intends to convey the idea that the contaminated or unwholesome condition must actually exist to constitute a violation of the act, is a matter that can be more properly considered upon the hearing in chief. A great deal can be said on both sides, but the Court is strongly inclined to the opinion that in view of the context of the act, its history and purpose, the intention of the Legislature was to so safe-guard the food supply as not only to condemn that which was actually contaminated or unwholesome, but to avoid the possibility of such food being consumed by prohibiting its sale where it, or its component parts, had been pro-

duced, stored, transported or kept in a condition that 'would' or 'might' render the article diseased, contaminated or unwholesome."

Under the above authority, the Food and Drug Department at the Experiment Station has made an inspection of 201 local slaughter-houses throughout the State. Based upon statements given to the inspectors by those in charge of the plant at the time of inspection, there are slaughtered annually 76,284 cattle, 97,406 sheep, 455,440 hogs, 21,216 veal, 18,812 lambs, or a total of 669,158 animals. This estimate is in excess of the statistics reported by the United States census or by the Department of Agriculture. The reason is evident, however, when it is noted that the Government's statistics apply only to about 28 plants. These statistics by no means represent the total number of animals slaughered in the State each year, as they do not apply to the universal custom of slaughtering pork and mutton, and, to a certain extent, beef, on the farm.

Not more than 8 per cent of these local slaughter-houses were in fit sanitary condition. There has been some material improvement since the inspections and some prosecutions. It is noticeable that the slaughter and sale of diseased meat are checked to a certain extent by the honesty of some butchers and by general knowledge in some communities of animals slaughtered. In the plants themselves the problems are insufficient sewerage facilities, lack of proper equipment and building, no facilities in most cases for the rendering of the offal into tankage; inadequate capital and a carelessness or ignorance of, or indifference towards, the established correct methods for conducting the meat business.

This list includes 12 or 15 well equipped slaughtering plants throughout the State. But, in all instances, the problem presents inadequate equipment and widespread waste of money and labor, and a waste of thousands of dollars of valuable grease, feeds and fertilizing material, the saving of which would build, equip and inspect a system of model plants throughout the State.

Each of the slaughter-houses in the State has been given a copy of the inspectors's findings, and asked to make the necessary changes in the sanitary conditions. This has been followed by prosecutions where there has been no substantial effort to clean up. These notices have encouraged the building of new plants in some sections of the State, and the cleaning up and better equipment of other plants. Further investment in individual plants, however, but works against the municipal abattoir movement.

To illustrate the results of inspection, the City of Paducah had thirteen slaughter-houses, none of which were found adequately constructed and equipped for sanitary slaughtering, and over which there is no inspection with respect to diseased animals. The obvious remedy is to bring all of these men into one model and daily inspected abattoir, to be owned by the city and maintained by fees, or to be owned by the butchers themselves under city inspection and open to the general public at a fixed fee. Such a concentration of capital and effort would not only save the heavy losses from wasted offal and eliminate the offensive nuisances to the various communities in which the slaughter-houses are located, but would make it possible to slaughter animals at much less cost than it requires in the thirteen scattered and ill-equipped plants. The majority of Paducah butchers are in favor of such a move, and will support an effective meat inspection ordinance on the part of the city.

Concurrent investigations have also been made by the State Board of Health with respect to the general sanitary condition of slaughter-houses under the general health statutes relating to sanitary conditions. Under section 8 of the Kentucky Food and Drugs act a committee was appointed to draft joint regulations for adoption by the Board and the director of the Kentucky Agricultural Experiment Station in order to point out to the meat trade the particular practice which would be considered in violation of the several statutes, and in order to suggest the constructive methods necessary to correct sanitation in the slaughter and sale of meat.

After drafting the regulations copies were referred to the Home Butchers' Protective Association of Louisville, the only association of its kind in the State of which there was record at that time, for suggestions. As in the case of the bakers the Louisville butchers endorsed the draft as practical and necessary.

Inspections have also been directed towards the retail stores and have particularly included an inspection of ice boxes and the general conditions of the meat as being offered for sale on the markets. A number of prosecutions have followed which are reported in detail in the Kentucky notices of adulteration and misbranding. These prosecutions have covered a wide range from spoiled rabbits to spoiled hog brains. The temperature of ice boxes and similar data have been collected. The municipal market house is the proper remedy, where there are no adequate facilities in the retail stores for handling meat. This will be made the subject of a separate bulletin.

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## STATE REGULATIONS.

A committee was appointed from the State Board of Health and the Experiment Station to draft regulations under the joint statutory authorities for meat inspection. These regulations have been printed in full, and can be had upon application. The regulations cover slaughter-houses; drainage and sewerage; feeding of offal; water supply; floors, walls and ceilings; trucks, tables, etc.; cleanliness of employees; health of employees; toilet facilities; screens; cleaning of utensils, and cleaning against diseased meats; protection of meat from floors; cleaning of knives, and racks; ice and water; cleaning of wagons; offal; tallow; delivery of meats; retail establishments, hotels, and restaurants; inspection for disease; the powers of city and county officials, and the erection of new plants. The regulations are available to all of the meat trade in Kentucky, and others especially interested in the subject.

## THE MUNICIPAL ABATTOIR UNDER THE STATE LAWS.

The charters of the various classes of cities of Kentucky grant full power to enact legislation necessary for meat inspection through such means as the municipal abattoir. Section 571 of the Revised Kentucky Statutes, under an Act of July 1st, 1893, confers upon cities of the first class, that is upon Louisville, the "power to pass, for the government of the city, any ordinance not in conflict with the Constitution of the United States, the Constitution of Kentucky and the Statutes thereof."

Section 1042, of the Revised Kentucky Statutes, confers upon cities of the second class the power to "provide for the erection, management and regulation of slaughter-houses, and to regulate the slaughtering of animals."

Sub-sections 20 and 21 of section 1307, of the Revised Kentucky Statutes, confers upon cities of the third class the power to "regulate the inspection of beef, pork," * * * and "to regulate the vending of meat, poultry, fish", * * * and to "establish and regulate markets and market houses and places".

Similar powers will be found conferred upon cities of the fifth and sixth classes.

In fact the cities and towns of Kentucky not only have the power, but it is their duty, to provide for the proper inspection of slaughter-houses and the animals slaughtered therein. The public health is always regarded as paramount to any other public interest. The cities and towns vote bonds for the paving of streets and other public improvements, and, in the same way, have power to erect and maintain public abattoirs. No city council or commission would have the right to grant a monopoly to any individual or corporation in this respect, and provide that all cattle and other animals should be butchered by such individual or corporation; but it has the right to provide for the erection and maintenance, at its own cost, of slaughter-houses, or to license slaughter-houses, which conform to the proper

regulations, at which inspection is maintained, and always on condition that such slaughter-houses shall be open at all times, for the slaughtering of meat by all proper persons whomsoever.

In the well known Slaughter House Cases, decided by the United States Supreme Court, in 16 Wallace, page 36, these principles are well established. In that case, the legislature of Louisiana passed an act granting to a corporation, created by it, the exclusive right for twenty-five years, to have and maintain slaughter-houses, landings for cattle, and yards for enclosing cattle intended for sale or slaughter within the parishes therein mentioned, and prohibiting all other persons from building, keeping, or having slaughter-houses, landings for cattle, and yards for cattle intended for sale or slaughter, within those limits; and requiring that all cattle and other animals intended for sale or slaughter in that district, should be brought to the yards and slaughter-houses of the corporation, and exacting certain prescribed fees for each animal slaughtered. The court held that "this grant of exclusive right or privilege, guarded by proper limitation of the prices to be charged, and imposing the duty of providing ample convenience, with permission to all owners of stock to land, and to all butchers to slaughter at those places, was a police regulation for the health and comfort of the people." The doctrine of this case has been reaffirmed in numerous cases since that time and is the law today.

In its opinion, the court says (page 61):

> "It is not, and cannot be successfully controverted, that it is both the right and duty of the legislative body, the supreme power of the state or municipality, to prescribe and determine the localities where the business of slaughtering for a great city may be conducted. To do this effectively it is indispensable that all persons who slaughter animals for food shall do it in those places and no where else.
>
> The statute under consideration defines these localities and forbids slaughtering in any other. It does

not, as has been asserted, prevent the butcher from doing his own slaughtering. On the contrary, the Slaughter-House Company is required, under a heavy penalty, to permit any person who wishes to do so, to slaughter in their houses; and they are bound to make ample provision for the convenience of all the slaughtering for the entire city. The butcher then is still permitted to slaughter, to prepare, and to sell his own meats; but he is required to slaughter at a specified place and to pay a reasonable compensation for the use of the accommodations furnished him at that place."

The principle involved is, that a central place may be designated, and the municipality may provide that all animals slaughtered for food shall be slaughtered in such places "and nowhere else." This does not create a monopoly, provided all butchers are allowed, upon reasonable terms, to do their own slaughtering at such places.

The same doctrine has been applied to the places where meats are sold. It is competent under the police power for the municipality to provide that certain kinds of food could be sold only at certain designated places. For example, in the case of the City of New Orleans vs. Faber, 53 L. R. A., page 165, the court holds:

"It is within the police power and legislative discretion of the City of New Orleans, under said act of the general assembly, to require certain food commodities to be sold only in the public markets; and the fact that the ordinance in question may have the effect of compelling dealers in such commodities to go into the public markets, or else to go out of business, does not affect the validity of the ordinance."

So then, in conclusion, and by way of resume, it is plain:

First. That the city council or commission can enact reasonable rules and regulations with reference to the inspection of beef slaughtered for sale so as to prevent the slaughtering for sale of diseased cattle and pass all rules and regulations necessary to facilitate the inspection.

Second. To prescribe rules and regulations with refer-

ence to the slaughtering of said beef or cattle (a) by permitting individuals to maintain their own slaughter pens and slaughter under rules and regulations prescribed with reference thereto, or (b) provide that all cattle shall be slaughtered at one or more places, as the council may designate and under rules and regulations prescribed therefor.

In providing penalties for the violation of such ordinances in this respect the *penalties* provided by the State for violation of the pure food law, and for violation of the general health statutes, should be taken into consideration, in order that the ordinances will not become invalid by reason of conflict therewith. This will particularly refer to any part of an ordinance which regulates the sale of adulterated or misbranded meat, or which prohibits the maintenance of any health nuisance.

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## THE GERMAN FREIBANK AND AMERICAN REGULATIONS.

The inspection of slaughtered animals and the condemnation of diseased, or parts of diseased, carcasses presents most difficult health and economic questions. Dr. Robert Ostertag, of Berlin says (1):

> "No more of the capital represented by food animals should be withdrawn from the national resources by confiscation than is absolutely necessary for the protection of human health. This tolerance is, moreover, indicated from a consideration of the production of the cheapest possible animal food for the greatest number of people. Far more human beings die from defective nutrition than from the harmful properties of meat. Moreover, the national resources suffer the loss of millions (Bollinger) when only one-half to three-fourths of one per cent of the food animals which represent values of five to six milliards is excluded from consumption."

(1) Hand Book of Meat Inspection, 1907, page 46.

The German freibank system requires diseased meat to be sold in separate stalls and otherwise properly designated and marked so as to tell the facts to the consuming public. The freibank system does not allow the sale of diseased meat to hotels and restaurants, but does allow its sale to those who wish to purchase it for home consumption with the knowledge that the meat is diseased, and with opportunity to thoroughly cook any such meat before consumption. Dr. Ostertag (2) states further, with respect to the freibank, as follows:

> "The institution of a freibank, however, not only renders it certain that the consumer will obtain in the open market what he thinks he is buying, but it also makes it possible for the sanitary police to give permission under certain regulations and restrictions to traffic in meat;—for example, measly meat after previous cooking, pickling, or preservation in cold storage;—which in the absence of a freibank would be withheld from the market as dangerous to health—for example, the meat of measly animals—and destroyed.
>
> If it is said that the classification of meat as marketable and not marketable may offer difficulties, this must be admitted for individual cases on the border line; but, even in these instances, a decision is much easier and simpler than when in the absence of a freibank we have to determine whether the meat is marketable or whether it should be destroyed. For in the latter case we have a sharp line of demarcation, while with the institution of a freibank, on the other hand, there is a broad boundary line between marketable meat and that which ought to be destroyed."

While the German freibank has been an old institution in Germany, dating as far back as the fourteenth century, and possibly previous to that, the American regulations provide for the destruction of diseased carcasses and such parts

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(2) Hand Book of Meat Inspection, 1907, page 47.

of diseased carcasses as the inspector under the regulation shall deem locally unfit for food. That part of the carcass not condemned is passed on with the rest of the meat and marked with the same stamp "U. S. Inspected and Passed." There is some difference of scientific opinion as to the safety of the American practice. Undoubtedly there are many animal diseases which affect the carcass only locally, and which, when eliminated and condemned, leave a portion of the meat fit for food. Thus, for example, an animal may have localized tuberculosis and yet, with the exception of the local diseased part, be fit for food, especially after proper cooking. The difference between the German and American system of regulation is that the German regulations require all such parts of carcasses to be labeled and sold for what they are, whereas the American regulations are very much stricter but allow any uncondemned parts of diseased animals to pass into the food supply without designation, and, as far as the elimination of disease from the meat supply is concerned, are considerably stricter than the German regulation. Our experience in Kentucky is to the effect that the Federal Government exercises a very strict supervision over the plants and animals slaughtered therein, which come under its inspection.

It is undoubtedly necessary from an economic standpoint to save the parts of diseased carcasses believed to be wholesome in order to keep the price of the meat within the reach of all the people. It is also true that the feeling against the parts of carcasses saved is frequently more a sentimental than a practical public health matter; but, the belief of some experts, and lack of investigations, are reasons why the consumer should be protected from taking unknowing chances in the eating of such meat in the form of rare beef steak, or in the form of rare juices and rare scrapings often prescribed in certain cases of sickness and rules for diet.

It may be true that it is the fault of our present method of inspection in placing the cost of losses entirely upon the packing industry. Of course, as the work of the animal husbandry departments in connection with the National

Department of Agriculture and the agricultural experiment stations becomes more effective and the farmers pay more attention to the health of animals, the amount of diseased flesh condemned at the abattoir will grow less. In addition to such work nothing would more contribute towards a closer regard for animal health on the part of the breeder, feeder and trader than constantly discouraging the sale of meat from diseased animals. This economic and health question is one which should be worked out with justice to both the packer on the one side and the breeder and feeder on the other, but also with full justice and protection towards the consuming public. In all such pure food problems strict regulations work little hardship upon the trade if the regulation is made universal, that is, if all are required to comply.

The Federal regulations with respect to diseased animals will make a good beginning for the control of any municipal abattoir, and it would undoubtedly be the better plan to begin with such regulations and then bring about uniform amendments throughout the whole country, from time to time, as experience indicates. The Federal regulations, as they stand, may be regarded as strict with respect to diseased meat, and such sections of the regulations as permit the saving of parts of diseased carcasses are undoubtedly based, in good faith, upon the belief that there will be no danger to the public health. It will be noticed in the regulations formulated by the joint committee, and adopted by the State Board of Health and the Kentucky Agricultural Experiment Station, that all such parts of diseased carcasses are required to be so labeled.

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## MEAT INSPECTION IN OTHER COUNTRIES.

The traditions of the oldest civilized nations show regulations controlling the slaughtering and consumption of meat. That such is the case is evident from the history of the Egyptians, the Isrealites, the Phoenicians, the Babylonians, the

Athenians, and we are told that Alexander the Great forbade the Lipanese the eating of flesh because of the evils attending the consumption of spoiled fish.

The Romans exercised a strict meat control from the founding of the city. The Roman records show that in year 164 the small butchers were punished because of selling meat which had not been previously inspected by the authorities. The ancient Romans maintained slaughter-houses and meat booths of the highest order of construction and sanitary condition.

The history of Germany from the Middle Ages to the Thirty Years' War shows a strict supervision of the meat supply as is shown by the records and municipal laws of the German cities during the twelfth and thirteenth centuries, an example of which is the law of the City of Freiburg passed in 1249, and which provides a heavy punishment for dishonesty among butchers.

The regulations concerning butchers in the Ausburg charter of 1276 prescribe a public slaughter-house for cattle, sheep and calves, and compulsory inspection and declaration of diseased animals, thus giving evidence of an hygienic point of view that is not observed at the present time throughout America.

The municipal record concerning Aix-la-Chapelle, or, as the Germans call it, Aachen, published in 1835, tells of the work of the master of the meat and fish market and his assistants. "Special pig inspectors" were appointed, and they were required to take the "oath of pig inspectors," as follows:

> "You shall be pig inspectors, for foreign as well as for the native inhabitants, and neither for love nor money, nor goods, nor threats, nor from friendship nor enmity, shall you declare otherwise than as you find the pigs to be."

In France, according to Morot, meat inspection was practiced in certain communities as early as 1162, and the public abattoirs of France can be traced back as far as the thirteenth century. Napoleon I, established public abattoirs in

Paris in 1807 at the expense of the city, and at the same time closed all private slaughter-houses within the city limits. By decree dated February 10, 1910, this order was extended to include all the larger and middle-size cities of France.

Germany has 740 public slaughter-houses, and Prussia about 381.

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## OFFAL WASTE.

Aside from the benefits to public health the municipal abattoir is justified alone from the standpoint of conservation. Any industry which can pay its operating expenses almost entirely out of by-products formerly wasted reduces the cost of production that, unless checked by other trade influences or control, should be finally shared in by the ultimate purchaser. Not only do adequate tankage facilities save the creeks and other streams from pollution, but it also saves a valuable source of fertilizing material from waste.

Based on the very conservative estimate of animals slaughtered, and given under the foregoing heading "State Inspections," the present waste, based on the established practices and prices in connection with the large packing centers, may be estimated as follows:

80,000 CATTLE.

Dried blood, 9 lbs. per animal, 720,000 lbs, at 2¼ct. pound ..... $16,200.00
Tankage water, 12½ gals. each, 1,000,000 gals. at 60 ct. 100 gal..... 6,000.00
Dried tankage, 9 lbs. per animal, 720,000 lbs, at 1½ cts. lb..... 10,800.00
Rough tallow at 50 cts. per head..... 40,000.00
Casings at 50 cts. per head..... 40,000.00

300,000 HOGS.

Dried blood, 2½ lbs. each, 750,000 lbs. at 2¼ ct. lb. ..... 16,875.00

Tankage water, 5 gals. each, 1,500,000 gals. at 60c 100 gals. ..... 9,000.00
Dried tankage, 5 bls. each, 1,500,000 lbs. at 1½ cts. lb. ..... 22,500.00
Rough grease at 50c each ..... 150,000.00
Casings at 50c each ..... 150,000.00

120,000 SHEEP AND VEAL.

Estimated wasted by-products at 60c each..... 72,000.00

Add to the above hoofs, horns, bones, better prices for hides that have been taken by skilled labor, the high grade of tallow as the result of better handling, cheaper freight rates from handling hides and tallow in car load lots, etc., an estimate of ..... 200,000.00

$733,375.00

The above figures are based on an undeveloped industry. It has been demonstrated that the establishment of the municipal abattoir doubles and redoubles the amount of local killings. At the present time, however, if all killings in the state are taken into consideration there is an annual waste to Kentucky of more than a million dollars, which if conserved for several years, would be more than sufficient to build well equipped abattoirs in every city, town and community of Kentucky and develop into a permanent source of state wealth.

## SUGGESTED ORDINANCES FOR MUNICIPAL ABATTOIRS IN SMALLER CITIES AND TOWNS.

The proposed ordinance given below was arranged from a more extensive ordinance drafted for several of the larger Kentucky cities. For larger cities it may be necessary to write an ordinance more in detail. The sections of the proposed ordinance explain themselves and present the main principles.

The ordinance contains alternative provisions with re-

spect to fees. The question of fees for maintenance of inspection is treated more in detail under the head of "Licenses and Inspection Fees." The ordinance also contains alternative provisions for ownership on the part of the butchers and meat dealers, or for ownership on the part of the city. This point is also presented under the head of "City versus Private Ownership."

*An Ordinance to Provide for the Inspection of Animals Intended for the Meat Supply of the City of ———— and to Provide for the Inspection of Meat Intended for Sale Within the City, and to Regulate Slaughter-Houses and Meat Markets, and to License the Sale of Meats Within the City.*

SECTION 1.

The sale of any meat within the City of———— which has not been inspected by Federal, State, or municipal authority at the time of slaughter, or at such period after slaughter as may be designated herein (or for which the inspection fee has not been paid), is hereby prohibited as well as the bringing of any such meat into the City of ———— for the purpose of sale.

Any person, firm, or corporation violating this section shall, for each offense, on conviction, be fined not less than ten dollars ($10.00), nor more than one hundred dollars ($100.00).

SECTION 2.

It shall be unlawful for any person or persons, firm or corporation to sell, offer or expose for sale, any fresh meat intended for human consumption within the City of———— ———— whether slaughtered within the city, or elsewhere, unless such person or persons shall have a permit so to do from the Board of Health of said city, the same to be issued upon the taking effect of this ordinance, and annually thereafter on the first day of May. Such permit shall be issued only upon the Board of Health being satisfied that the meat

has been inspected as provided in Section 1, and that the equipment and method connected with the slaughtering, transportation and sale of the product is sanitary and otherwise fit for the protection of the meat from contamination. Said permits shall be revoked after notice and hearing by the Board of Health whenever it is found that the conditions upon which the permit is granted are not being complied with. Wholesale dealers selling in or sending meat into ———————— for sale shall pay an annual license inspection fee of ———— dollars ($————), and retail dealers shall pay a license inspection fee of———————— dollars ($————), and no firm shall be granted a license until such license fee has been paid into the hands of the City Treasurer, and all such license fees shall be set aside for the purpose of carrying this inspection ordinance into effect, or (the city shall also collect the sum of———————— as an inspection fee for the inspection of each carcass of beef, and ———————— for the inspection of each carcass of swine, sheep, and veal, the same to be collected and paid into the city treasury at the time of inspections, and any carcass, or part of carcass, of beef, swine, sheep, veal, or other animal, which is sold without the payment of the inspection fee, shall be proceeded against as provided for in Section 1 of this ordinance. All such fees shall be paid into the hands of the City Treasurer, and shall be employed solely for carrying out the inspections provided for in this act); or (the city shall provide for the cost of inspection from general appropriation in lieu of the license and inspection fees).

Any person, firm, or corporation violating this section shall, for each offense, on conviction, be fined not less than ten dollars ($10.00), nor more than one hundred dollars ($100.00).

SECTION 3.

All meat, or meat products, from sick or diseased animals, or which is spoiled or contaminated, or which has been slaughtered in, or which has been kept in an

unsanitary condition, or otherwise adulterated, or which has been produced, kept and handled in a manner which may render the same diseased or contaminated, shall, upon discovery, be seized by the health officer, or his assistants, or other officer of the city designated by the Mayor. At the time of such seizure, or as soon thereafter as it can be done, the officer making the seizure shall deliver to the person in charge of the meat a notice that the product has been condemned as unfit for food, or, if no person is to be found in charge of same, shall post in a conspicuous place near such meat, and in both instances such notice shall notify the persons interested in the meat to appear before the Police Judge of the City of———— at the time and place stated in the notice, and which shall be not less than one hour, nor more than twenty-four hours, to show cause why such meat shall not be declared confiscated and forfeited and ordered to be destroyed. Upon hearing said Police Judge shall declare forfeited and confiscated, and ordered destroyed, or rendered unfit for food, all meat found in violation of this section. If at the time of such hearing no person appear the cause of the forfeiture shall be deemed confessed and shall be ordered, together with the destruction of the meat. Meat which is not ordered confiscated shall be delivered back to the person from whose custody it was taken.

SECTION 4.

The Board of Health, on approval of the Mayor (or Board of Commissioners), shall appoint an efficient meat inspector for the inspection of meat under this ordinance. Said meat inspector shall execute to the City of ———— a bond in the penal sum of two hundred dollars ($200.00) for the proper discharge of his duty, the sufficiency of which bond shall be determined by the Mayor. The said meat inspector shall be paid out of the license and inspection fees provided in Section 2 of this ordinance, an amount not to exceed———— dollars ($————) per year. It shall be the duty of the meat inspector to inspect the slaughter houses,

and their premises, and all markets, stalls, refrigerators and cars, wagons and places where animals are slaughtered, or where meat products are transported, kept or offered for sale, to determine the unwholesomeness and sanitary condition of same. The meat inspector shall immediately report all violations of this ordinance to the Board of Health, the City Attorney and to the Mayor. He shall perform any duty required in carrying out this ordinance.

SECTION 5.

All animals slaughtered for sale in the City of———— ———— which have not been inspected at the time of slaughter by any Federal, State or municipal authority as to disease and sanitary conditions, and all meats since and after leaving the control of such inspection, and all meats intended or offered for sale in the City of ———— shall be inspected by the meat inspector under this ordinance and under the rules and regulations as adopted by the State Board of Health and the Director of the Kentucky Agricultural Experiment Station under law to determine the fitness of same for sale. The meat inspector shall designate at what place the farmers bringing meat into the City of ———— for sale shall bring the same for inspection, and shall designate the parts of the animal which shall be attached in order to competently inspect the meat.

SECTION 6.

In addition to the remedies against diseased or unwholesome meat provided for in this ordinance, the meat inspector of the Board of Health shall report any violations of pure food laws and the general health laws of this State relating to meat, to the City Attorney for prosecution under such acts.

SECTION 7.

(*a*) Meats intended for sale in the City of———— shall be slaughtered in a slaughter-house which is clean and sanitary and equipped for the proper protection of the meat.

Such slaughter-houses shall have adequate water, free from contamination, and so as to be applied hot or cold. The slaughter-house shall have suitable floors, constructed in such a manner as to be weathertight, and which shall carry off into tubs or reservoirs, or into the sewer, all blood and waste. The floors shall be thoroughly scrubbed and cleaned each day after the slaughtering is completed. The building shall be screened and walls and all exposed surfaces inside the slaughter-house shall be kept clean and sanitary. The slaughter-house shall have an efficient system of drainage and sewer connections so that no water or refuse of any kind shall soak into the ground. Provision shall be made for the prompt removal of the offal, for the cleaning of hooks, knives, implements, tubs, buckets, and other equipment, and the slaughter-house shall be otherwise kept in a sanitary condition, as required in detail by this ordinance and by the rules and regulations of the State Board of Health and the Kentucky Agricultural Experiment Station adopted in accordance with said laws.

(*b*) The offal and refuse shall be removed from the slaughter-house on the day of slaughter and disposed of in a sanitary manner.

(*c*) No animal intended for slaughter shall be fed on any uncooked meat or offal, or any meat or offal of a diseased animal.

SECTION 8.

The Mayor shall, upon recommendation of the Board of Health, designate a slaughter-house, or slaughter-houses, which shall be constructed and equipped as provided for in this ordinance and at which inspection can be maintained, as the municipal abattoir. This shall be conditioned, however, upon the owners or lessees of the slaughter-house agreeing in writing that all butchers and other persons may slaughter animals at such slaughter-house at a fee for slaughtering to be agreed upon by the Mayor and such licensee, and which shall not be unreasonable. (Or the Mayor and Board of Health, after the money has been appro-

priated, or a bond issue secured, shall cause the erection of a properly equipped municipal abattoir to be owned and controlled by the City of ————————, and the Mayor shall proclaim the same as the municipal abattoir of the City of ————————.) It shall be unlawful to sell any meat in the City of ———————— which has not been inspected at the time of slaughter by Federal, State and other municipal authority, which has not been slaughtered and inspected in the municipal abattoir, except carcasses of meat slaughtered by farmers or others not regularly engaged in the slaughtering of animals. Provided, however, that such carcasses shall be brought to the municipal abattoir, or other place of inspection to be designated by the meat inspector, with such organs, or parts of organs, as shall be required for the purposes of inspection. And provided further that nothing herein shall exempt Federal or other inspected meat from inspection as to fit condition for food when arriving for sale, or when exposed for sale in the City of ————————.

The killing fees at the municipal abattoir shall be uniform to all and shall not exceed———————— for every beef, and ———————— for every hog, sheep, veal or other animal. The abattoir shall be open to all on equal terms.

Any meat which has not been slaughtered in the municipal abattoir, or which has not been slaughtered from a healthy animal in a sanitary condition, and inspected by the Federal or State government, or other Kentucky municipality, at the time of such slaughter, and accompanied by the official inspection stamp, shall be brought to the municipal abattoir so established, or other place designated by the meat inspector, for the purpose of inspection.

Any person violating any part of this section shall be fined not less than ten dollars ($10.00), nor more than one hundred dollars $100.00).

## SECTION 9.

(*a*) Whenever the meat inspector shall, by inspection, determine that any carcass, or part of carcass, is diseased,

the same shall be stamped or tagged in a manner so as to designate that it is unfit, and such meat shall not be brought into, or sold, in the City of ————————, but shall be tanked or otherwise rendered unfit for food, and if brought into the City of ———————— it shall be proceeded against as provided for in section 3 of this ordinance.

(*b*) The Board of Health shall designate a uniform method of marking meat which is unfit for food and meat which has been inspected and passed, and any person, firm or corporation counterfeiting, imitating or not rightfully using the stamp of the Federal Government, the stamp of any state or other municipal inspection, or the stamp of the inspection of the City of ————————, shall, on conviction, be fined not less than Fifty Dollars ($50.00), nor more than One Hundred Dollars ($100.00) for each offense.

SECTION 10.

All ordinances, or parts of ordinances, inconsistent herewith are hereby repealed.

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## BUILDING AND EQUIPMENT.

The building and equipment of a model abattoir is governed, to a large extent, by local conditions. There is generally around each of the smaller cities and towns some one plant which can probably be used as the beginning for a central abattoir. Cities of the larger class should not attempt to require well established plants, which can be put into a sanitary condition and in which there are continuous killings, to join into a municipal plant. It is better to require such plants to maintain proper sanitary equipment and method, and to provide special inspection. In the city of Louisville, for example, there are some large plants, not under Federal inspection, for which special inspection could be provided. The best plan for the others would be in grouping the various slaughtering districts into several municipal plants.

At Winchester, Ky., is a well constructed slaughter-room, 30x60 feet, with concrete floor, sewerage and water attachments, hoists, tracks and other beef killing machinery with a small engine, boiler and tank for hog scalding. The addition of facilities for scraping the hogs, refrigerating and rendering plants would complete a model abattoir large enough for the Winchester meat supply. This slaughter-room is built on land leased from the city, at a cost of about $1,600.00, with an additional investment of from $800.00 to $1,000.00 in killing machinery.

Suitable refrigerating machinery and piping would cost from $1,000.00 to $2,000.00, depending upon the size of the cooling space. The sanitary rendering and drying machine complete, depending upon the extent of attachments and size, would cost from $1,000.00 to $1,800.00. A room for handling the tankage, with concrete floor, should be built at a cost not to exceed $500.00. A p ecooling room and meat cooler for storage would depend upon the size built. In Winchester, therefore, the money already invested in the slaughter-house, and on city land, can be well utilized. A contract could be made with the owner of this plant to operate a municipal abattoir at specified charges, and open to all; the local butchers and meat dealers could organize a joint stock company and take over the present property at a fair valuation, or the city could purchase, make the additions of refrigeration and tankage and conduct a municipal owned plant.

The question, in all such cases, is the cost of the building and its proper equipment, together with proper plans. There are several sources of such information. The Bureau of Animal Industry of the United States Department of Agriculture will furnish or pass upon plans free of charge. The manufacturers of slaughter-house equipment will generally furnish plans at a nominal cost, along with purchase of equipment. The municipal plants already established throughout the country furnish information as to errors which experience in operation has pointed out in the building, its arrangement, location, and in the equipment.

First of all is the question of location from the standpoint of freight, sewerage, stock yards and space. In days gone by the slaughter-house was looked upon as an intolerable nuisance and ordered by the health departments and city ordinances to be located far beyond the city limits. As a matter of fact there is no reason why the slaughter-house should not be conducted so as to be established in or near the city's sewerage facilities. At Ashland, Ky., within a block of a hotel, are two meat markets, with well-arranged and clean slaughtering facilities in the rear. The offal is immediately hauled away and the places are conducted without any nuisance. On the other hand the tanking of the offal is attended with some odors, depending upon the promptness in rendering and the handling of the tankage. The questions of location and sewerage have been very fully set out in detail by regulations adopted jointly by the Kentucky State Board of Health and the Kentucky Agricultural Experiment Station, under the several statute authorities for the regulation of slaughter-houses, and which should be followed in the location and building of a municipal plant. The plans should also be submitted to the Bureau of Animal Industry of the United States Department of Agriculture, in order that the plant may be one which can engage in interstate commerce without costly changes after building.

In locating the abattoir, there should be taken into consideration: accessibility to pikes and roads; accessibility to a side track from a railroad line; drainage and sewerage facilities for the waste water; if the city has no sewerage plant, the septic tank or other plan for handling waste water; sufficient water supply; and located so as to admit of additions.

Among slaughter-house supply firms in the United States from which we have secured valuable information, are The Liesinger Co., Inc., 697 Ellicott Square Bldg., Buffalo, N. Y; Percy A. Kley, 1535 Chestnut St., Philadelphia, Pa; Boomer & Boschert Press Co., Syracuse, N. Y; William D. Neves, Greenville, S. C; Solomon-Norcross Co., Atlanta, Ga; Anderson & Frankel, Lexington, Ky; Cincinnati Butchers'

Supply Co., Cincinnati, O.; The Allbright-Nell Co., Chicago, Ill., The Creamery Package Manufacturing Co., Chicago, Ill.; The Automatic Refrigerating Co., Hartford, Conn.; The J. W. Johns-Mansville Co., Cincinnati, O., and New York; The Brunswick Refrigerating Co., New Brunswick, N. J.; The Triumph Ice Co., Cincinnati, O. There are a number of sanitary engineers throughout the country specializing in matters of this kind.

The Liesinger Co., Inc., have furnished us plans for two abattoirs, one which was erected at Paris, Texas, and the other for Canada.

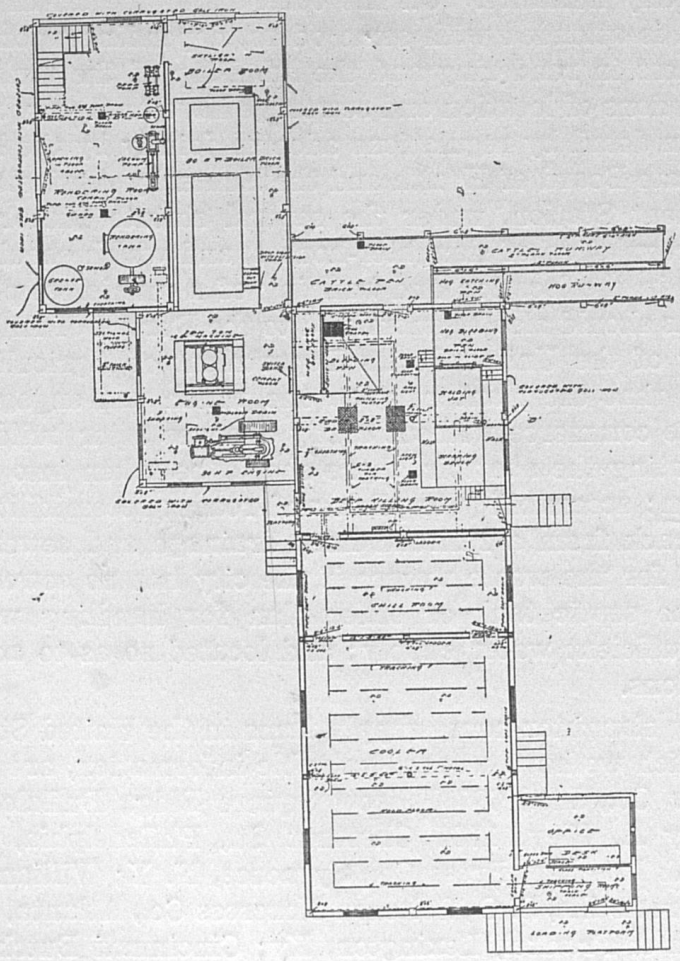
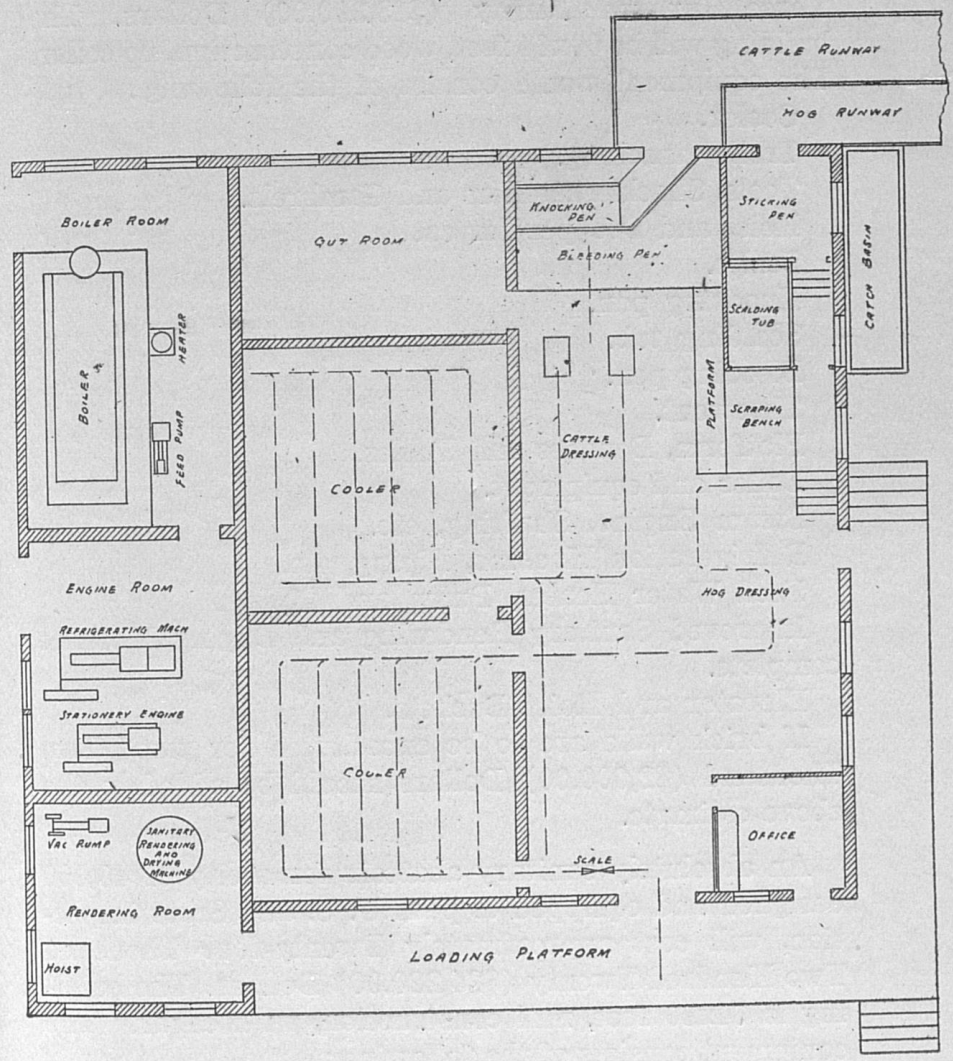


PLATE 1. GENERAL LAYOUT, MUNICIPAL ABATTOIR, PARIS, TEXAS. CUT LOANED BY THE LIESINGER COMPANY, INC., BUFFALO, N. Y.




FIRST FLOOR - PLAN

PLATE 2. FIRST FLOOR PLAN, PROSPECTIVE ABATTOIR, BERLIN, ONTARIO, CANADA. CUT LOANED BY THE LIESINGER COMPANY, INC., BUFFALO, NEW YORK.

Their statement with respect to cost and equipment, is as follows:

> "Your letter of the 22nd inst. received and in reply say that an absolutely sanitary abattoir for a population of 15,000, designed and built to pass U. S. and State inspection, will cost approximately Thirteen Thousand

Three Hundred Ninety ($13,390.00) Dollars. The building will be 60x64 feet, wood construction, no cellar. The equipment would consist of the following:

Cooler.
Trolley tracking.
Tools, Shackles, Rollers and Gambrels.
Hoist and Dropper for cattle.
Scales.
Knocking pen.
Scalding tub.
Bleeding pen.
Throwout.
Platform, Benches and Tables.
Boiler and equipment.
Steam Engine, Shafting, etc.
Refrigeration Machine, Piping, etc.
Feed Water Heater, Pump and Piping.
Improved Sanitary Rendering and Drying Machine complete.
Elevator and Hoist Buckets.

If brick walls are to be substituted for wood Two Thousand ($2,000.00) Dollars should be added to the above estimate.

An absolutely sanitary abattoir for a city of 40,000 designed and equipped to pass U. S. and State inspection, will cost approximately Twenty-four Thousand Two Hundred Twenty ($24,220.00) Dollars. The building is 64x80 feet, mill construction, with cellar. The equipment consists of the following:

Cooler.
Trolley tracking.
Tools, Shackles, Rollers and Gambrels.
Hoist and Dropper for cattle.
Scales.
Knocking pen.
Scalding tub.
Bleeding pen.

Throwout.
Platform, Benches and Tables.
Boiler and equipment.
Steam Engine, Shafting, etc.
Refrigeration Machine, Piping, etc.
Feed Water Heater, Pump and Piping.
Improved Sanitary Rendering and Drying Machine complete.
Elevator and Hoist Buckets.

If brick walls are to be substituted for the wood Four Thousand ($4,000.00) Dollars should be added to the above estimate. The above mentioned abattoirs are designed for economy and efficiency and can be built within the amounts mentioned.

We will be pleased to give estimate and foundation plan to any person or persons interested in up-to-date absolutely sanitary abattoirs or packing houses. This class of work is one of our specialties and is based upon actual practice."

"Abattoirs for cities of 15,000 and 40,000 population. 15,000 population, building 60x64 feet, wood construction, no cellar.

40,000 population, building 64x80 feet, mill construction, with cellar.

| | 15,000 | 40,000 |
|---|---|---|
| Building, with suitably insulated cooler | $7,220.00 | $15,000.00 |
| Trolley tracking | 600.00 | 1,000.00 |
| Tools, Shackles, Rollers, Gambrels | 100.00 | 200.00 |
| Hoist and Dropper for cattle | 200.00 | 350.00 |
| Scales | 50.00 | 150.00 |
| Knocking pen | 50.00 | 50.00 |
| Scalding tub | 30.00 | 50.00 |
| Bleeding pen | 50.00 | 70.00 |
| Throwout | 40.00 | 100.00 |
| Platform, Benches, Tables | 50.00 | 100.00 |
| Boiler and equipment | 500.00 | 800.00 |
| Steam engine | 500.00 | 1,000.00 |

| | | |
|---|---|---|
| Refrigeration Machine, Piping, etc. | 2,000.00 | 3,000.00 |
| Feed water heater and pump | 100.00 | 150.00 |
| Improved Sanitary Rendering and Drying Machine, complete | 1,800.00 | 2,000.00 |
| Elevator and Hoist Buckets | 100.00 | 200.00 |
| | $13,390.00 | $24,220.00 |

Brick walls 15,000 pop. add $2,000.00.
Brick walls 40,000 pop. add $4,000.00."

Above prices of equipment estimated only and subject to market change.

The Cincinnati Butchers' Supply Co., Cincinnati, O., state:

"We wish to state that we have been equipping quite a number of abattoirs recently, and we think that we have the best equipment on the market for the use in such plants. We have just shipped one of our sanitary rendering apparatus to take care of offal, etc., to the Winstone-Salem, S. C., where a municipal plant was erected. We also have the order for machinery for the Raleigh, N. C. municipal plant. We can furnish drawings for such a plant at a nominal cost to any city wishing to erect municipal abattoirs. Conditions are so different in one town against another so it is a hard matter to give a uniform set of plans. However, we will at any time be willing to submit drawings or send our representatives there to go over matters with the Board. We are today mailing you some of our descriptive matter which we hope will be interesting to you, and if you will confer further with us whenever you have anything in view in this line, rest assured we will make it our business to cooperate with you."

There are two main systems followed in abattoir building, the German system, which aims to make the plant as compact and close as possible, and the French system, which has open courts and streets between the various buildings.

These differences have probably been dictated by two reasons: climatic and efficiency in management. It would not be objectionable in the climate of Canada to put the offal rendering machinery within the same building. With the climate of Kentucky, however, it is best to make the rendering plant separate and apart from the building in which the meat is slaughtered and stored. It is well to select the meat inspector before beginning the building of the plant, and while attempt has been made to make this bulletin as full as possible, it will be greatly to the advantage of the inspector and others to consult with such sources of information as are enumerated above and to have such works as "Hand Book of Meat Inspection" by Dr. Robert Ostertag, published in English by Willian R. Jenkins Co., New York, and "Text Book of Meat Hygiene" by Drs. Edelmann, Mohler & Eichorn, published by Lea & Febiger, Philadelphia and New York. The writers acknowledge special indebtedness to these authorities in the preparation of this bulletin.

---

## KENTUCKY PLANS FOR MODEL ABATTOIR.

Plans for a Kentucky model abattoir are given herewith. The cost of the building depends, of course, upon the material used in construction and the amount of storage facilities. The cost of construction and equipment of the Kentucky plants is estimated by Prof. L. K. Frankel and Mr. J. J. Curtis of the College of Mechanical Engineering, of the University.

Plant No. 3 shows floor plan in first step of unit slaughter house system. The scale in the above is one-sixteenth inch equals one foot. This plan can be criticised from the standpoint of location of the lard and sausage room, casing room ante-casing room. It is intended that the toilet and wash room shall have skylight arrangement. The casing room should be nearer the offal room, and the lard and sausage room more convenient to the slaughtering room.

| | |
|---|---|
| Building, Insulation, etc. | $8,300.00 |
| Trolley Tracks, Switches, etc. | 690.00 |
| Cattle Knocking Pen | 50.00 |
| Cattle Hoist | 200.00 |
| Catching Pen and Killing Chute | 65.00 |
| Scalding Trough | 50.00 |
| Cleaning Table | 50.00 |
| Rendering Tank and Drying Machine | 1,800.00 |
| Toilet Room Fixtures | 130.00 |
| Hoist and Buckets | 100.00 |
| Scales | 50.00 |
| Boiler and Pump | 450.00 |
| Refrigerating Machine and Piping | 2,000.00 |
| Generator Set and Switch Board | 375.00 |
| Lard Room Equipment | 325.00 |
| Total Cost | $14,635.00 |

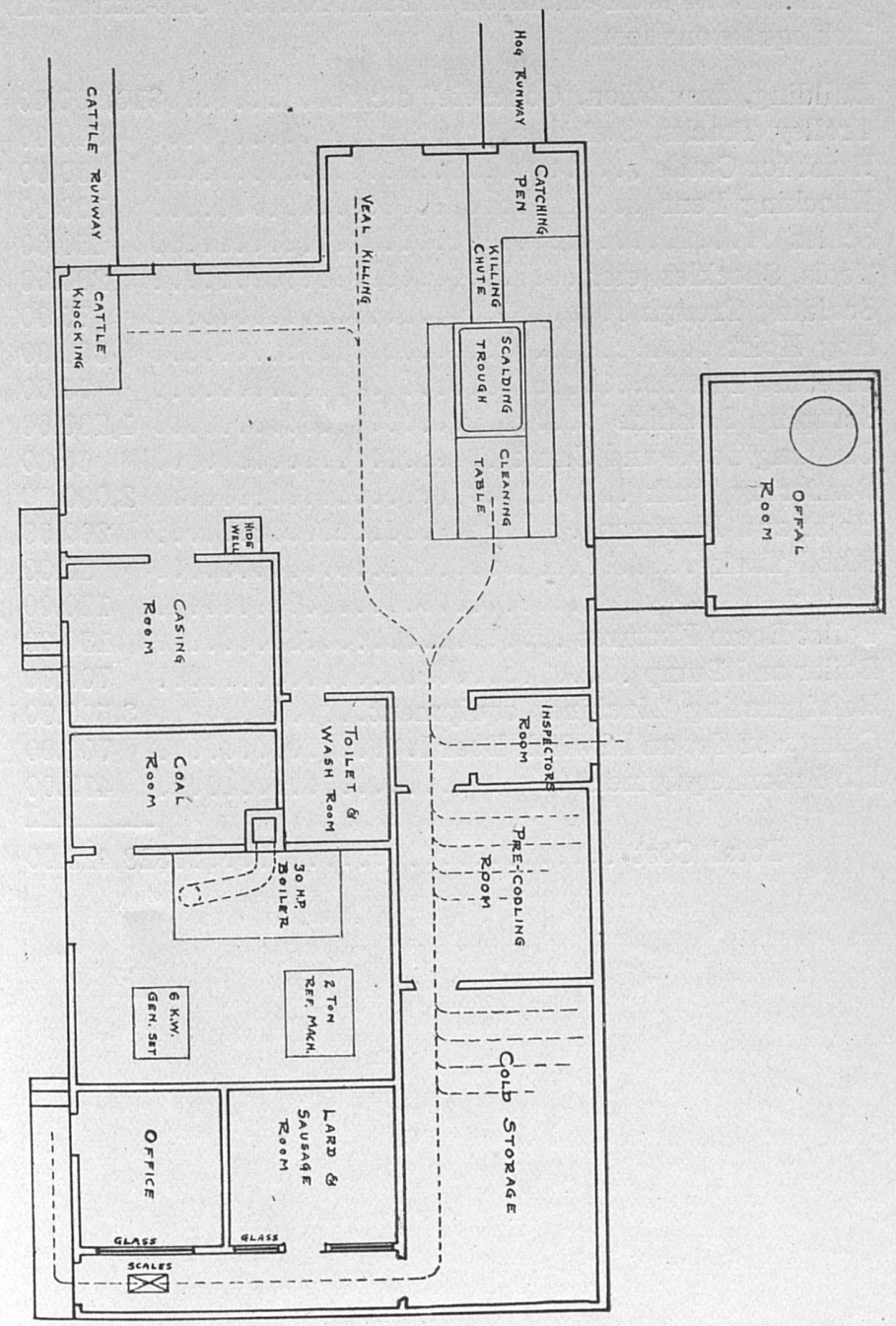



PLATE 3. Scale: 1-16 Inch equals 1 Foot

Plant No. 4 is an extension of Plant No. 3. One-sixteenth inch equals one foot.

| | |
|---|---|
| Building, Insulation, Concrete, etc. | $16,900.00 |
| Trolley Tracks, Switches | 940.00 |
| Hoist for Cattle | 450.00 |
| Knocking Pens | 100.00 |
| Scales | 150.00 |
| Tools, Shackles, etc. | 200.00 |
| Scalding Trough | 75.00 |
| Hog Hoist | 300.00 |
| Bleeding Pen | 75.00 |
| Scraping Machine | 1,200.00 |
| Cleaning Table and Chute | 60.00 |
| Rendering Tank | 2,000.00 |
| Hoist and Platform | 200.00 |
| Blood Tank | 80.00 |
| Motor | 190.00 |
| Toilet Room Fixtures | 130.00 |
| Boiler and Pump | 700.00 |
| Refrigerating Machine, equipment | 3,500.00 |
| Generator Set and Switch Board | 700.00 |
| Lard room equipment | 475.00 |
| Total Cost | $28,425.00 |

PLATE 4. Scale: About 1-16 Inch Equals 1 Foot

Plant No. 5 shows extension of unit cold storage system. ¼ equals five feet.

| | |
|---|---|
| Building and Insulation, complete | $23,500.00 |
| Trolley Tracks, Switches, etc. | 1,475.00 |
| Hoists for Cattle | 600.00 |
| Cattle Knocking Pens | 150.00 |
| Scales | 150.00 |
| Tools, Shackles, Hooks, etc. | 250.00 |
| Scalding trough | 75.00 |
| Hog Hoist | 300.00 |
| Bleeding pen | 75.00 |
| Scraping Machine | 1,200.00 |
| Cleaning Table and Chute | 60.00 |
| Shower Cleaner and Casing | 40.00 |
| Sanitary Rendering Tank | 2,200.00 |
| Hoist and Platform | 225.00 |
| Blood Tank | 90.00 |
| Motor | 215.00 |
| Toilet Room Fixtures | 130.00 |
| Boilers and Pump | 1,425.00 |
| Refrigerating Machine, equipment | 6,700.00 |
| Generator and Switch Board | 725.00 |
| Lard Room equipment | 500.00 |
| Total Cost | $40,085.00 |

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085.00




PLATE 5. Scale: 1-4 Inch Equals 5 Feet

The design of Plant No. 6, one-sixteenth inch equals one foot, followed criticisms and suggestions of the above plants. The same unit system of cold storage, however, can be followed. In building the plant the slaughtering room proper should be made large enough for growth and the equipment installed to take care of the increase in slaughtering. In this plant the engine room is located on the side of the offal room. The lard and sausage room is located of easy access to both the precooling and slaughtering room. It would be better to divide the wash and toilet corner so as to give each room an outside window, with an arrangement so as entrance would first be into the wash room, then into the toilet.

All of these plans are merely suggestions with a view to including the necessary arrangement of a small abattoir, and subject to such changes as the location, size of lot and so on. The regulations adopted under the State laws should be consulted in the building of the plant and the location of sewerage. Any plans sent to the Food and Drug Department will be checked over and submitted for further criticism and suggestion to the State Board of Health and the Bureau of Animal Industry of the United States Department of Agriculture.

The estimates of the above plants do not include a concrete basement. This is desirable and it should be constructed with light and ventilation. Practical butchers recommend that the offal tanks be placed in a basement under the offal room so as to allow offal to go into the tops of tanks on a level with the ground floor.

| | |
|---|---|
| Building, Insulation, etc. | $6,800.00 |
| Trolley Tracks, Switches, etc. | 485.00 |
| Scales | 50.00 |
| Cattle Knocking Pen | 50.00 |
| Cattle Hoist | 200.00 |
| Catching Pen and Killing Chute | 65.00 |
| Scalding Trough | 50.00 |
| Cleaning Table | 50.00 |
| Rendering Tank and Drying Machine | 1,500.00 |

| | |
|---|---|
| Toilet Room Fixtures | 80.00 |
| Hoist and Buckets | 100.00 |
| Boiler and Pump | 300.00 |
| Refrigerating Machine and Piping | 1,400.00 |
| Generator Set and Switch Board | 300.00 |
| Lard Room Equipment | 240.00 |
| Total Cost | $11,670.00 |

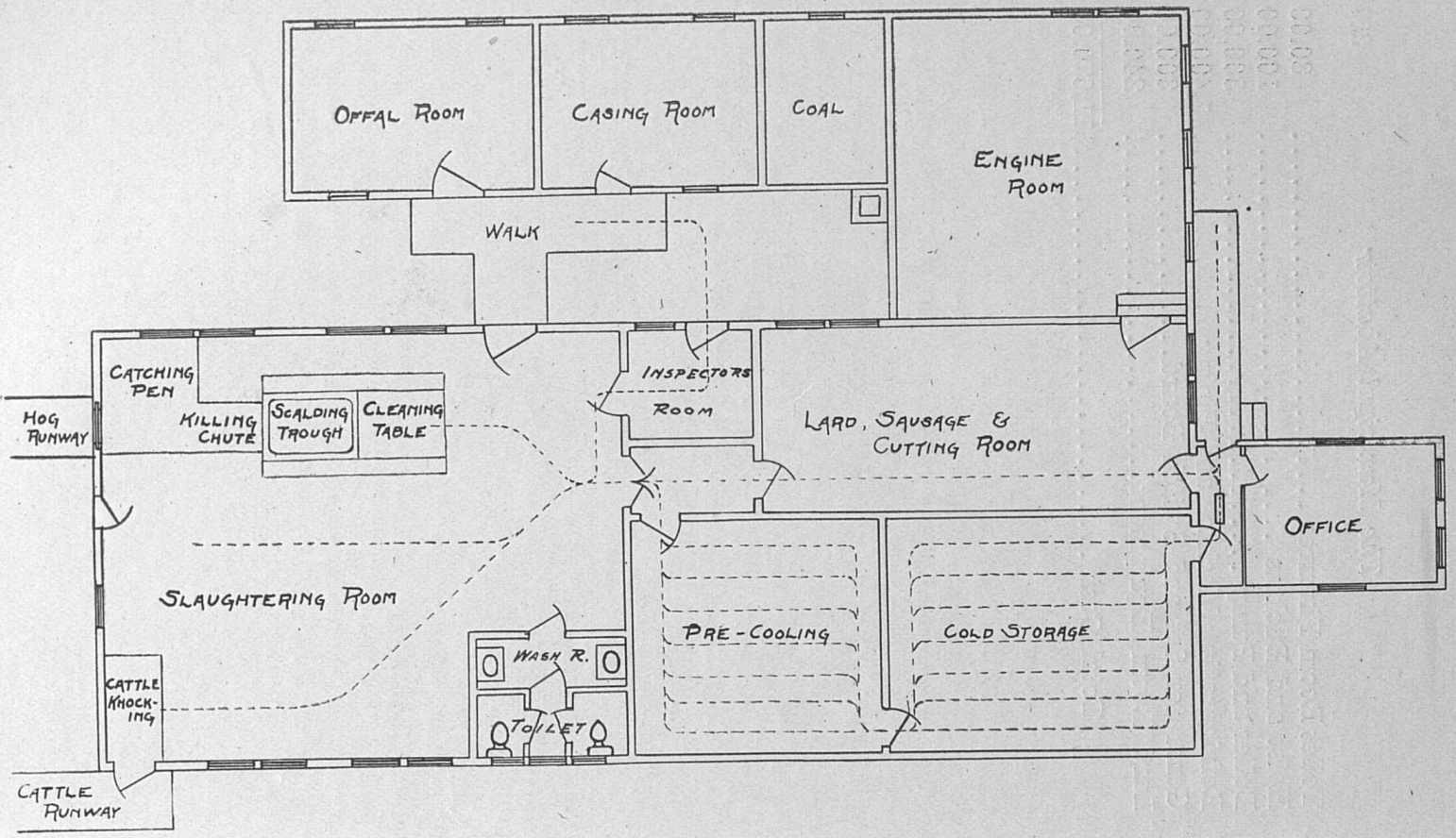



PLATE 6. Scale: 1-16 Inch equals 1 Foot

## LICENSE AND INSPECTION FEES.

The costs of inspection may be covered through the license of meat dealers, or through an inspection fee for each animal, or both. The amount of license and the amount of fees so charged must be determined by the number of inspectors on the one hand, and the number of animals slaughtered on the other. Statistics can be readily secured in each locality as to the number of animals slaughtered annually. There is some question as to whether the city should not pay all the costs of the inspection, as does the Federal Government. On the other hand the inspection fees can be so distributed as not to create a burden. The saving of offal, the decrease in cost of killing and other advantages should more than offset license and inspection fees. In some localities twenty-five cents per beef and ten cents per hog, sheep, or veal will return enough revenue to maintain inspection. In all cases the fees should be paid into the City Treasury and the inspectors employed at a fixed salary.

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## CITY VERSUS PRIVATE OWNERSHIP.

The best plan is city ownership with a rental charge for slaughtering. In Cleveland a joint stock company of butchers and meat dealers have erected and operate municipal plants. Drawbacks to the organization of municipal plants often come from two sources in the community, the one or two higher class butchers who have built up an independent business and who do not favor the plan of entering into an arrangement with men of less ability or lower trade standards, and secondly, from those engaged in slaughtering and selling diseased animals whose trade, of course, will be eliminated through municipal inspection.

The abattoir must be financed. If undertaken by the city it will probably be necessary to issue bonds. If undertaken by joint stock company, with a part of the money subscribed, it should be easy to borrow the rest from local banks. In undertaking the movement the meat conditions

of the Kentucky cities and towns, as they have been surveyed under the pure food law, are available. It will be well, however, for the members of the council or commission, health officials and other city officials, in connection with representatives from citizens' leagues, to visit slaughter-houses and to ask butchers and meat dealers to meet in a joint conference to decide upon a definite program and push it through. The butchers should have it emphasized that most of the present plants are in violation of the law and that they are liable under the State laws for the sale of the diseased meat for which there is at present no inspection to determine. If butchers will not undertake a joint stock company the citizens of the community should back the introduction of an ordinance to appropriate the money, or to provide for a bond issue together with an inspection ordinance along the lines set forth elsewhere in this bulletin. Many difficulties will arise, such as lack of appreciation on the part of some of the public officials and conservatism or opposition on the part of the trade, etc. One point, however, should be remembered, and that is that there will not be an efficient inspection of the local meat supply until the matter is demanded by an aroused local public sentiment, not willing to give up until the inspection is established.

If the plant is built by the city and properly operated, it will pay the interest on the investment from the first, will create a sinking fund for the payment of the debt incurred and soon become a source of revenue to the city. The practicability of the municipal slaughter-house has been tested for centuries throughout Europe, and during the last ten or fifteen years in several of the American cities. In February, of 1910, Mr. Ed. H. McCuiston, Mayor of Paris, Texas, stated, with respect to the municipal abattoir in his city:

> "The City of Paris began the operation of a municipal abattoir on the first day of December, 1909, and we are delighted both with the service rendered and the plan which we are pursuing. Our plant consists of an abattoir and cold storage house, which in height

is two stories, also a reduction plant, which is operated with the same machinery and under the same roof, but in different departments.

Our plan is that all animals slaughtered for the local markets shall be brought to the municipal plant, and there undergo first a live inspection by a thoroughly competent inspector, after which they are slaughtered and then undergo the dead inspection. The rules governing the inspection are the same as observed by inspectors of the National government in the packing plants of the country.

After the second inspection all carcasses pass into a chill room on overhead trolleys, where the temperature stands at 40 degrees Fahr., remaining there twelve hours, and are then removed into the refrigerating room proper, where the temperature is maintained at about 30 degrees Fahr.

Immediately after the animal is slaughtered the offal is taken in tubs by a pulley up to the second story, and then by an overhead trolley into the reduction department, and is dumped into the reduction plant.

The chill room, cold storage, and, indeed, all floors, except in the boiler room, are of concrete and the entire building is constructed with special reference to perfect sanitation. Water hydrants are everywhere. Concrete floors are laid to grade, which enables them to be washed and drained properly and perfectly. All water from the washing of floors or walls goes out through bell traps, which are water-sealed, into a near-by septic tank. All condensation and wash water when the floors are washed in the refrigerating room is likewise promptly trapped out.

The products of our reduction plant are tallow and tankage. The odors from the reduction plant which are not condensed and trapped into the sewers go under the fire-box of the boiler and are consumed there.

We charge for inspection, slaughtering and delivering on the hook in the butcher shop the sum of $1.25

for each beef, and 75 cents for each hog, calf, sheep and goat carcass. These charges also include five days' refrigeration. Refrigeration in excess of five days is charged for at the rate of 10 cents per day per carcass.

In the arrangement at our abattoir, every butcher has his own stock pens and they are required to deliver all animals to them. We then inspect, slaughter and place in cold storage, and deliver for the price above stated.

The type of our reduction plant is such that after a charge is placed into it and this hermetically sealed it is not opened until the finished products are taken off in a condition that they are practically odorless.

We have never undertaken any enterprise which has commended itself to our people as strongly as our abattoir and reduction plant. When we undertook to vote bonds for it there was quite a good deal of opposition among all our people. Both the plant and the plan were considered impractical and visionary, but there is not now, so far as I have been able to hear since we began operations, a single dissenting voice, and our people appreciate it more than any improvement we have ever undertaken."

After making the above statement, and after two years of operation, Mayor McCuiston, says:

"Our municipal abattoir continues to be the same howling success as it was the day we started it. It has grown in popularity with our people and in favor with our meat cutters with every passing month."

## NEEDED STATE LEGISLATION.

Additional State legislation regulating the sale of meat products and including the regulation of cold storage of meat and meat products is needed. The legislature should provide a uniform meat inspection act for the whole State, and specify the duties of municipalities and local health officers thereunder. Such a law should make effective methods of local meat inspection, under its provisions, compulsory on the part of each municipality. Recommendations are made more in detail in connection with the forth-coming report of State pure food work to the Governor and the Legislature.

## RESULTS OF THE RECENT MEAT CONFERENCE IN LOUISVILLE.

(R. M. A.)

Since the work, reported in the foregoing pages, has been in progress a substantial change is seen in the sanitary condition of Kentucky slaughter-houses. Recently, the Health Officer of the city of Louisville, the city inspectors, a committee from the association of butchers in that city, and representatives from the State departments made a joint tour of all plants. A large majority of the Louisville slaughter-houses were found in a greatly improved condition.

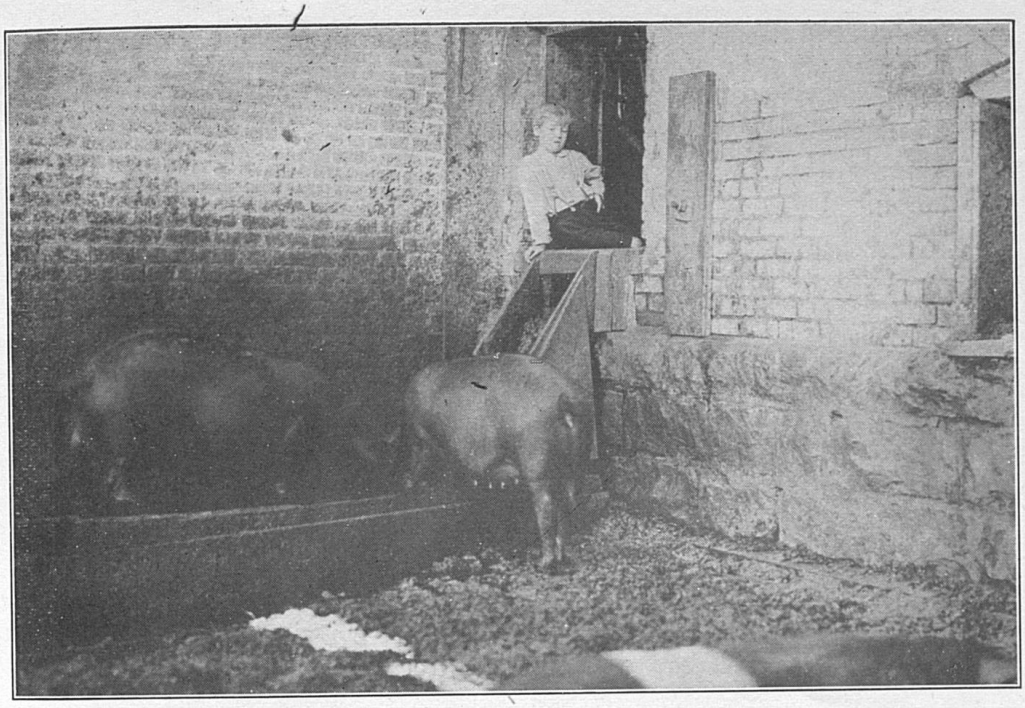
With the facts of sanitary condition, equipment, location, capacity, refrigeration, tankage facilities, and other conditions before all of us, the joint conference will agree upon a plan for concentrating into cooperative municipal plants, and agree upon the essentials of an ordinance for city inspection of animals, carcasses and sanitary control. The committee from the butchers show that spirit of helpful co-

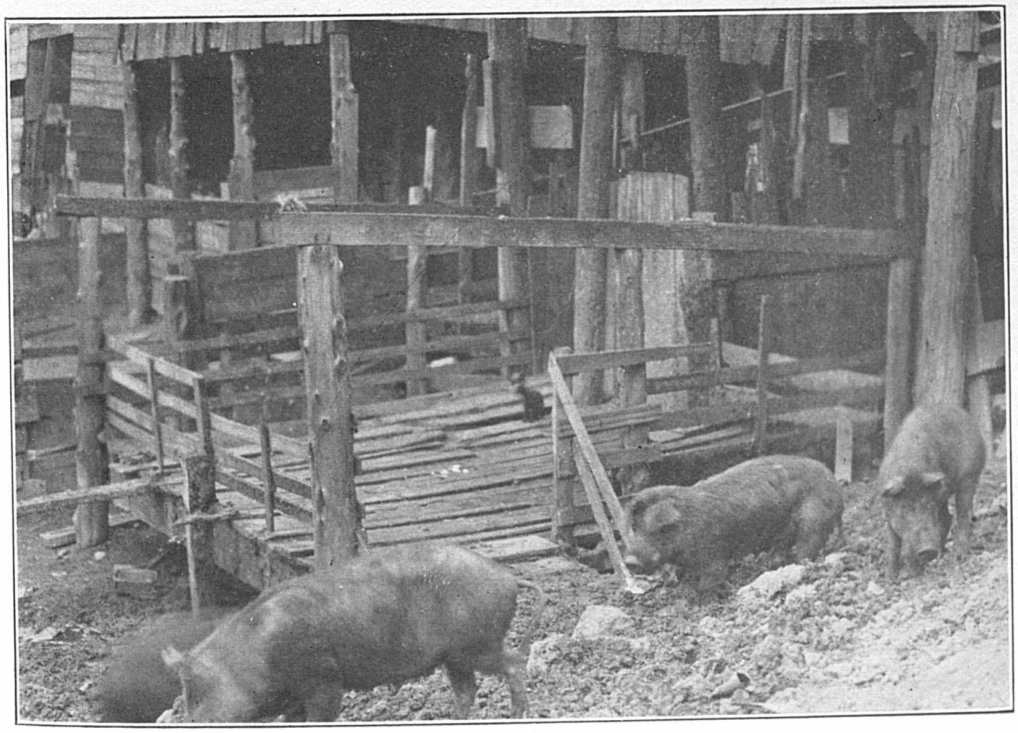
operation which is bound to bring a model municipal meat control plan into existence in Louisville.

Such plan of joint investigation illustrates the need of full study, at first hand, on the part of those who must finally deal with the real problem. It is not enough for inspectors to report that this or that slaughter-house is in a filthy condition, and stop with court fines. The system, or lack of system, primarily responsible for the conditions must be studied and permanent remedies supplied.

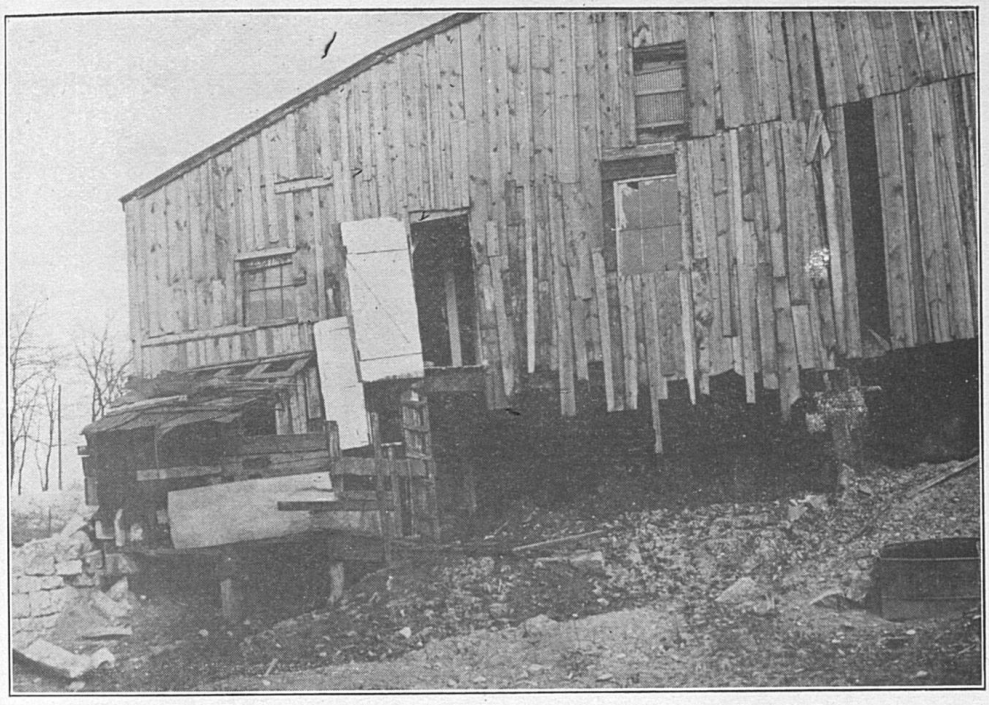
We met many splendid men in the rounds of investigation, whom the final plan to be adopted must undertake to keep in business; men who represent that independent type of citizenship which modern conditions are too rapidly eliminating from the cities. From this experience, it is the writer's present opinion that the municipal plants should be organized only to the extent of economical and efficient inspection. It would seem that the extent of centralization for inspection can well follow that amount of trade cooperation among the butchers necessary to establish economical slaughtering, refrigeration, tankage, and similar trade advantages. One plant, killing a few animals, cannot afford the overhead investment and running expense of modern refrigeration and adequate tankage facilities. A group of butchers can install such equipment, at a great saving to each individual, and thus we should be able to yoke together the necessity for trade economy and cooperation with the necessity for centralized inspection.

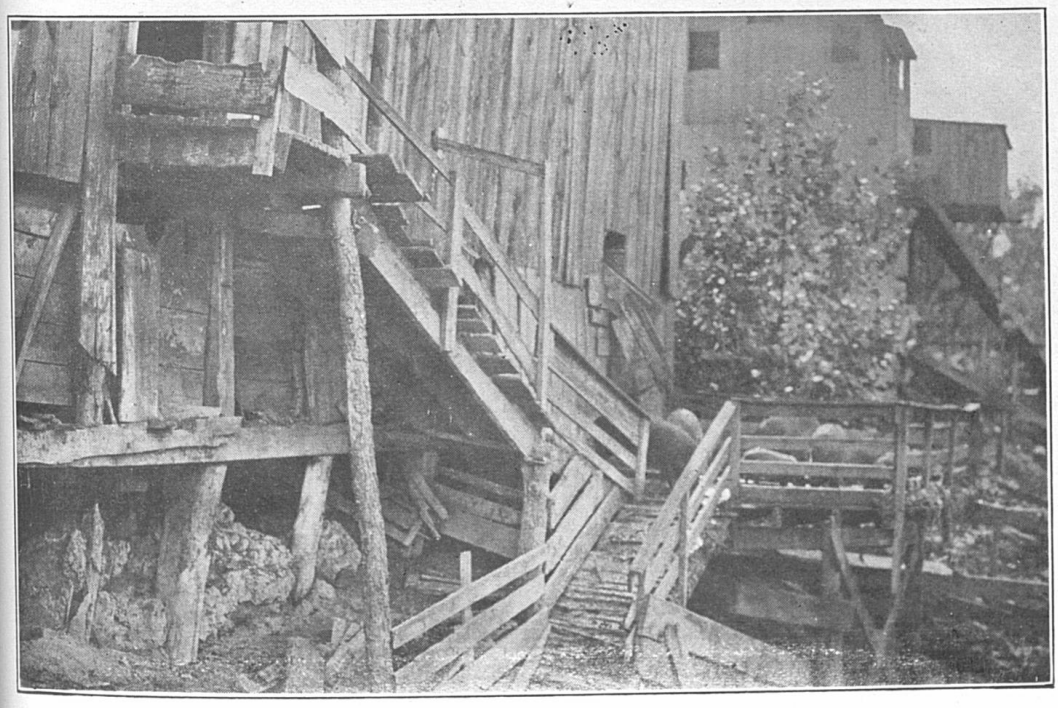
One out-standing point for such investigation is the fact that the wasteful and costly methods on the part of the local butcher, such as the giving away of offal, the purchase and hauling of ice, lower prices for carelessly-handled hides and tallow, from small plants and through several middlemen, and the maintenance of plants and labor, for a few animals, capable of greatly increased slaughterings, afford little or no element of economic competition from the unorganized, uninspected local meat supplies, and these economic errors have a substantial and direct influence in fixing the high meat prices.



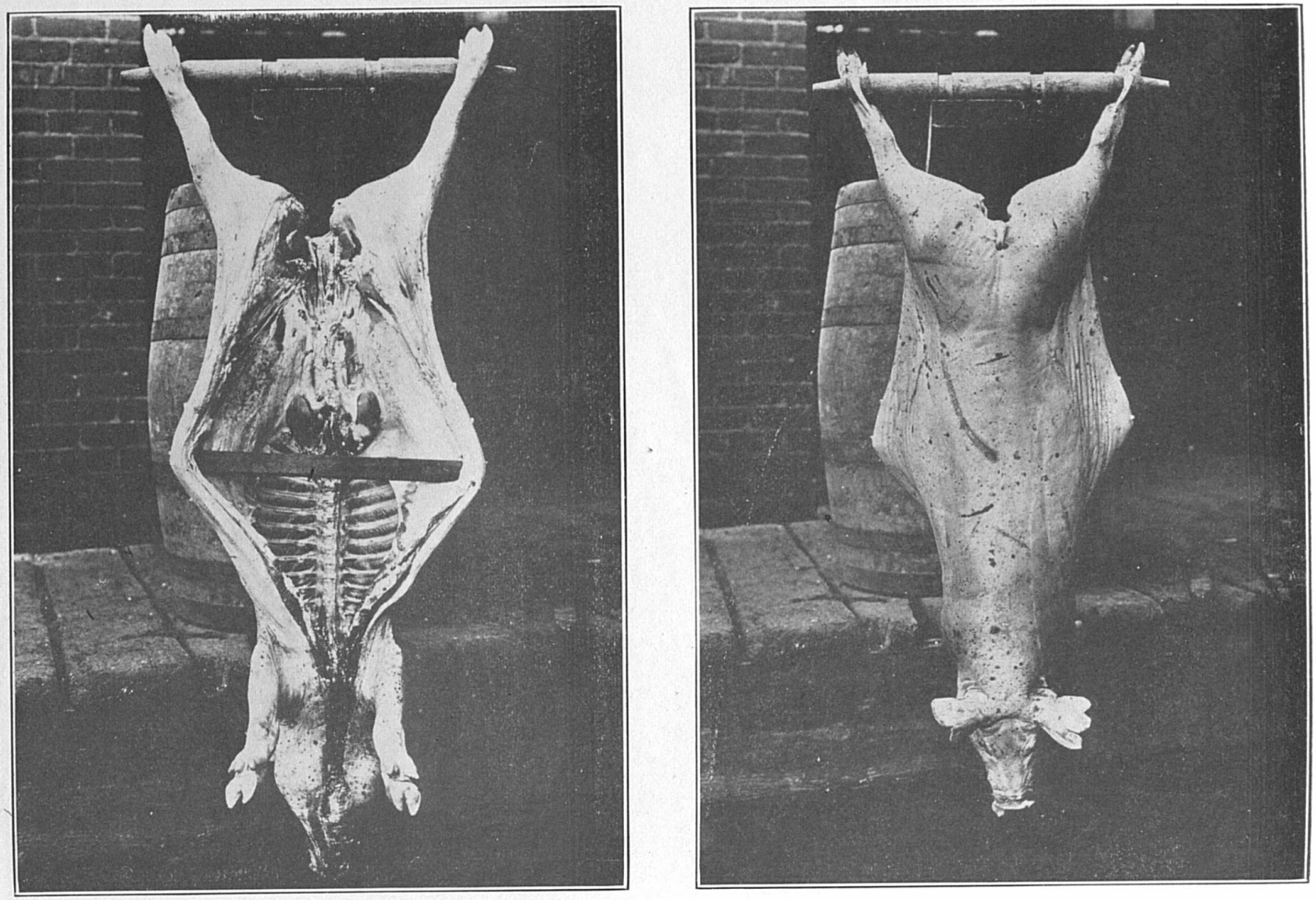


Plants No. 7 and 8. Feeding hogs on offal from insanitary plant. The thin hogs of a lot purchased for slaughter infected with cholera, or those diseased from the raw offal, are frequently sold into feeding or breeding pens. The law prohibits the sale of meat from animals fed on raw offal.

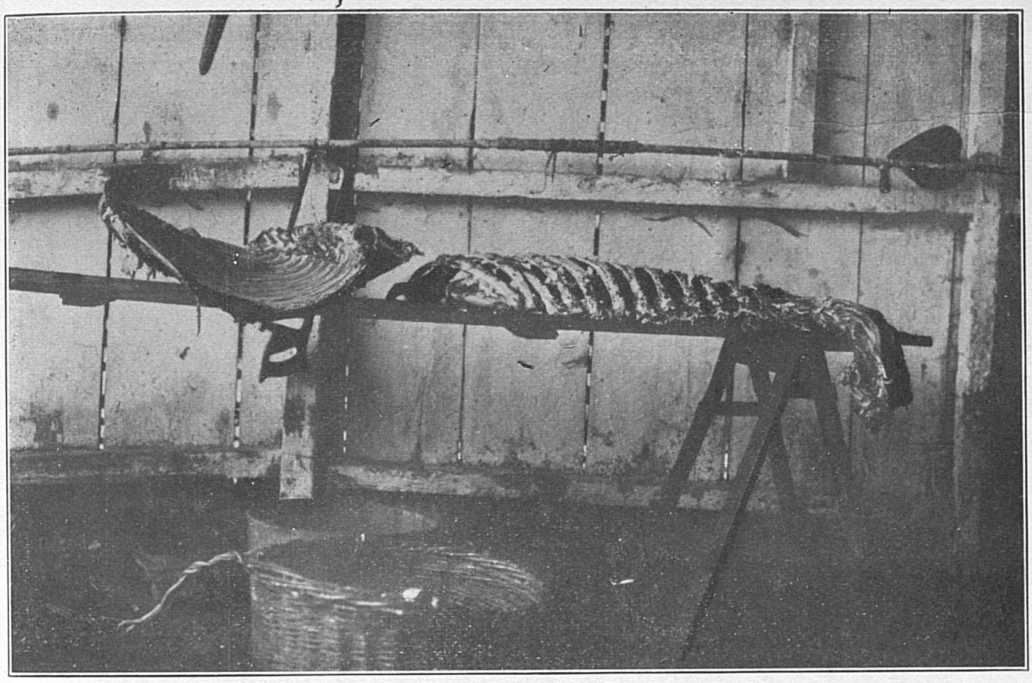




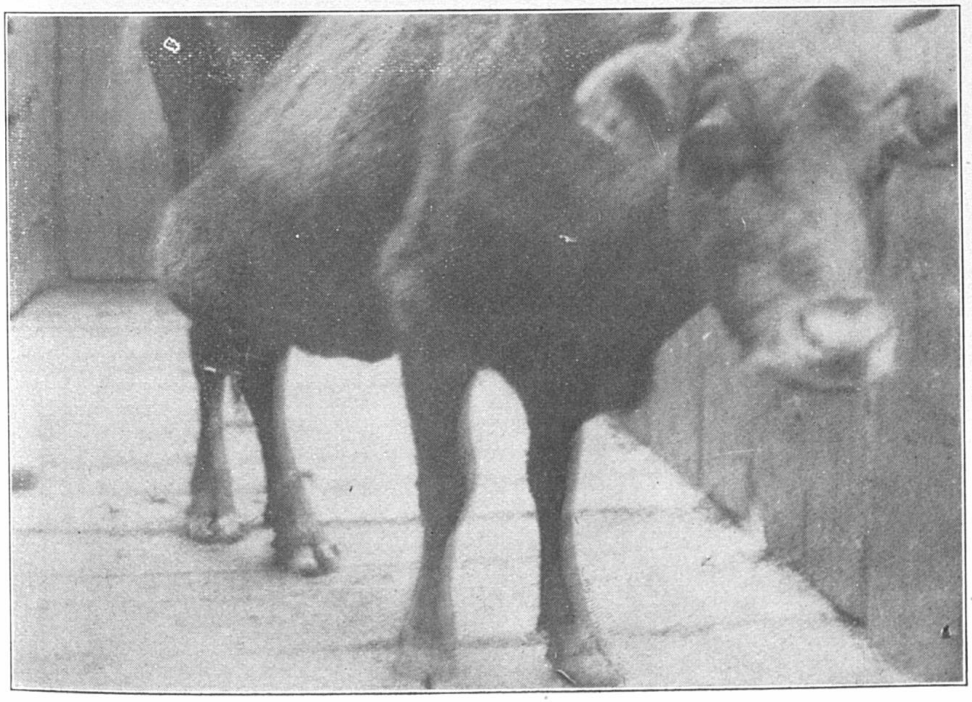
Plants Nos. 9 and 10. Showing insanitary conditions and offal waste around city plants.



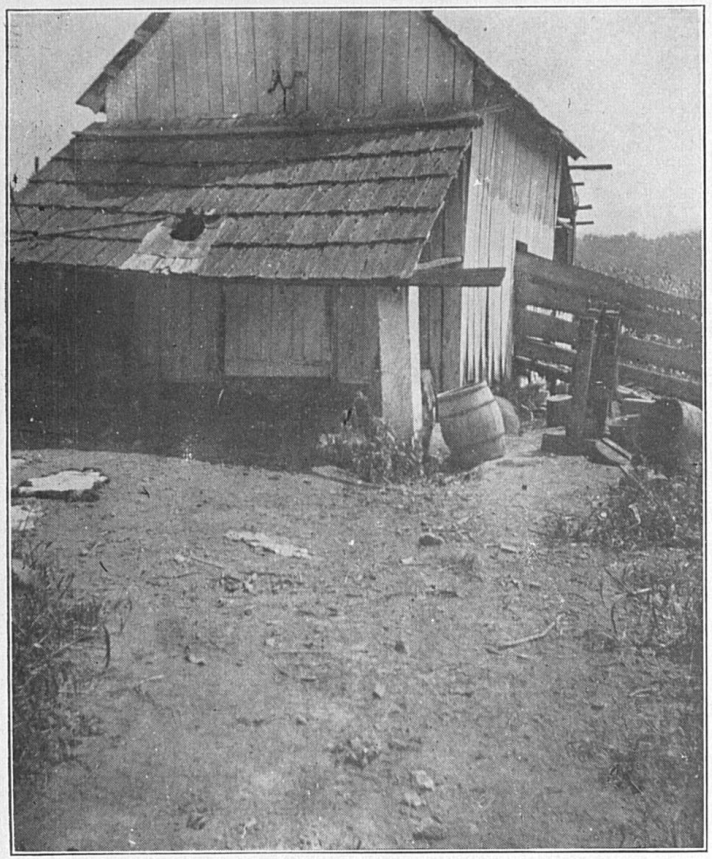
Plants Nos. 11 and 12. **Showing hogs affected with cholera, killed and sold from uninspected plants.**

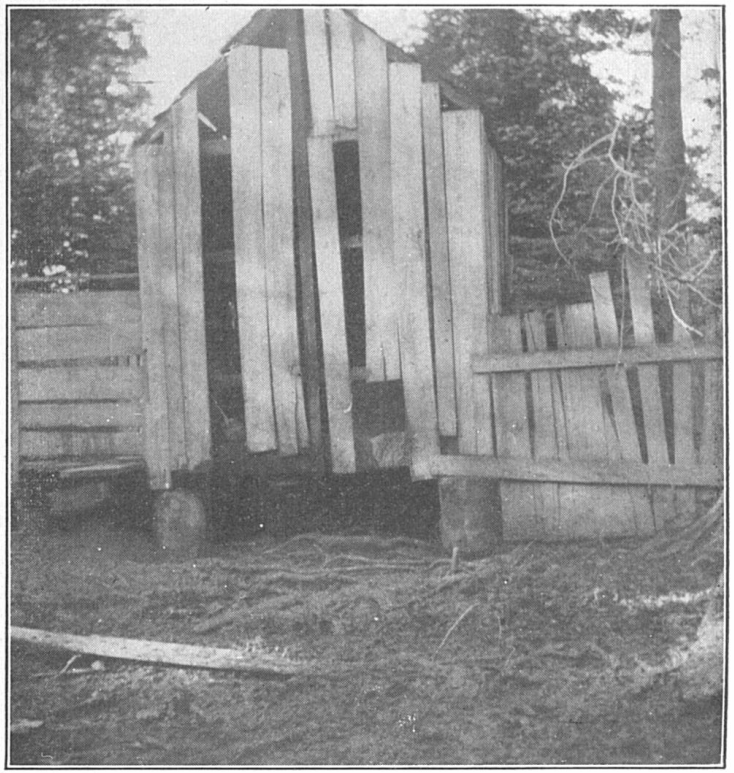


No. 13. A remnant of emaciated carcass too thin and bad looking to sell except as hamburger or sausage.



**No. 14 is a diseased cow which the inspector saw killed and offered for sale from uninspected plant.**



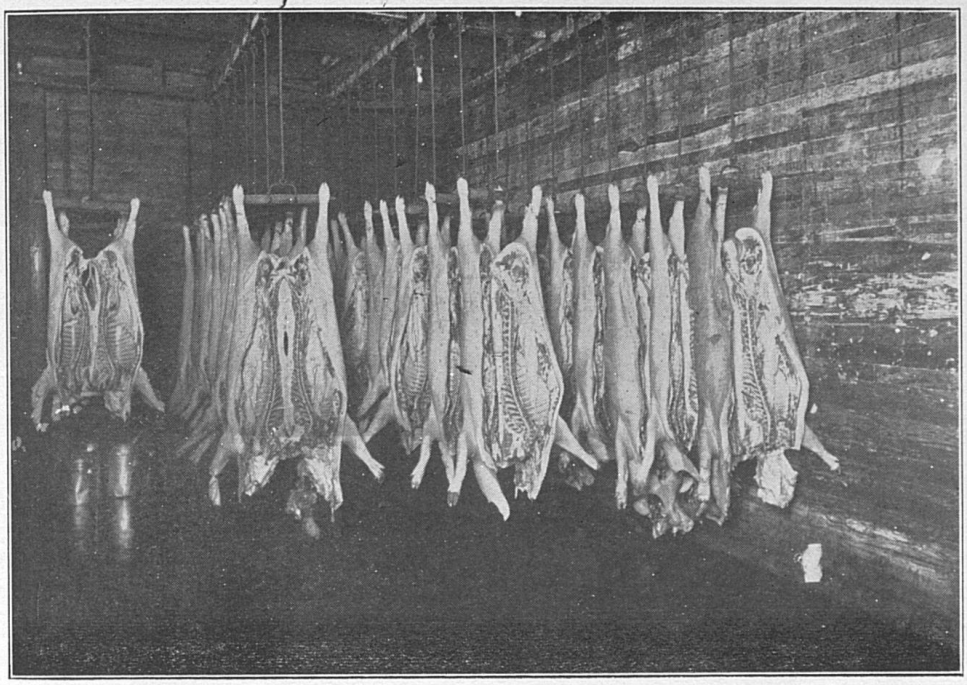


Nos. 15 and 16. The usual type of slaughter-house around the small towns.





Nos. 17 and 18. Views in a municipal inspected plant. The inspector examines each animal before slaughtering and each carcass for disease.





Nos. 19 and 20. Scenes in modern chill room where meat is immediately hung after being killed.

## NOTICE

The Bulletins of the Station will be mailed free to any citizen of Kentucky who sends his name and address to the Station for that purpose.

Correspondents will please notify the Director of changes in their postoffice address, or of any failure to receive Bulletins.

Address:
KENTUCKY AGRICULTURAL EXPERIMENT STATION,
Lexington, Ky.

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Photographs for illustrations by W. R. Pinnell, formerly sanitary inspector, bacteriologist of the department, and Mr. McFarlin.

KENTUCKY

# Agricultural Experiment Station

—— OF THE ——

# STATE UNIVERSITY

BULLETIN No. 174

## The Sulphur Content of Some Typical Kentucky Soils.

LEXINGTON, KENTUCKY,
September 1, 1913
—267—

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## Notice

**The Bulletins of the Station will be mailed free to any citizen of Kentucky who sends his name and address to the Director.**

BULLETIN No. 174

# The Sulphur Content of Some Typical Kentucky Soils.

By O. M. SHEDD.

Sulphur has been known for a long time as one of the ten essential elements of plant food. These are nitrogen, potassium, phosphorus, calcium, magnesium, carbon, hydrogen, oxygen, iron and sulphur. They are so called because if any one is not supplied to the growing plant it will starve and finally die for the lack of this particular element.

The first three are regarded as the most important from an agricultural standpoint, because plants require large amounts of them and frequently there are not sufficient quantities in available form in the soil to meet the needs of the growing crop. For this reason they are generally supplied by the use of the different commercial fertilizers, manures, etc., to meet the requirements of the particular crop under cultivation.

Iron, calcium and magnesium are fairly abundant in our soils and when it is found necessary to add calcium, either in the form of its carbonate or oxide to neutralize the acidity of the soil, it can be cheaply applied by the use of crushed limestone or common air slaked lime.

Carbon, hydrogen and oxygen are supplied in abundance by the air and rainwater, while sulphur has generally been regarded as occurring in sufficient amounts in the soil and in rain water to furnish the small amounts supposed to have been required by plants.

Recently however, by improved methods of analysis, it has been shown that plants contain considerably larger amounts of sul-

phur than was formerly supposed to be the case. The reason for this was that by the old method, the plant was incinerated and the sulphur in the original material was calculated from the amount found in the ash, assuming that all the sulphur would be contained therein. Subsequently, it was found by using the improved method that in several plants over 90 per cent of the total sulphur, chiefly in organic combination, was volatilized and lost in ashing the plant and hence the total sulphur content commonly attributed to these plants was entirely too low.

The table below, taken from Hart and Peterson's[1] results, shows the large differences between the actual amounts of sulphur contained in some feeding stuffs and the amounts found by the old method of making an analysis of the ash:

## SULPHUR IN FEEDING STUFFS—AIR DRY.

| Material | Total Sulphur Percentage | Sulphur in Ash* Percentage |
|---|---|---|
| Alfalfa hay | .287 | .170 |
| Barley | .153 | .024 |
| Barley straw | .147 | .083 |
| Beans (white garden) | .232 | .052 |
| Cabbage | .819 | .527 |
| Clover, red | .164 | .089 |
| Corn, white | .170 | .004 |
| Corn stover, sample 1 | .126 | .113 |
| Cotton seed meal | .487 | .037 |
| Hay, mixed | .160 | .142 |
| Linseed meal, sample 1 | .404 | .076 |
| Oats, sample 1 | .189 | .022 |
| Oat straw, sample 1 | .195 | .092 |
| Onions | .568 | .120 |
| Rape tops | .988 | .453 |
| Rapeseed meal | .456 | .153 |
| Rice | .126 | .001 |
| Rice bran | .181 | .009 |
| Soy bean | .341 | .034 |
| Sugar beet, late field sample | .128 | .064 |

* Wolff's Aschen Analysen.

| Material. | Total Sulphur Percentage | Sulphur in Ash Percentage |
|---|---|---|
| Sugar beet tops | .433 | .316 |
| Timothy | .190 | .078 |
| Turnips | .740 | .359 |
| Turnip top | .900 | .438 |
| Wheat, sample 1 | .170 | .003 |
| Wheat bran, sample 1 | .200 | .002 |
| Wheat gluten | .860 | .004 |
| Wheat straw, sample 1 | .119 | .053 |

Realizing that the importance of sulphur in the soil until this time had probably been neglected in dealing with the problems of soil fertility and maximum crop growth, several investigators have made numerous experiments in the last decade in supplying sulphur to different crops and the results tend to show that the value of this element has been overlooked and that it may be one of the limiting constituents, like nitrogen, phosphorus and potassium in crop production.

Sergir M. Bogdanoff[2] has found that plants contain much more sulphur than is indicated in Wolff's tables of ash analyses and it is believed that the amount of sulphuric acid in soils is of practical importance. In some Russian soils, certain crops gave considerably higher yields after manuring with sulphates.

Dymond, Hughes and Jupe,[3] in an article entitled, "The Influence of Sulphates as Manure Upon the Yield and Feeding Value of Crops," have shown that the importance of sulphur in crop growth and especially the amount of sulphates that may be in the soil have been overlooked.

They have also found that sulphur takes as important a position as phosphorus in the quantitative composition of some plants. According to these authors, published analyses show that the crops below contain the following number of pounds of sulphur and phosphorus per acre:

| | Sulphur | Phosphorus | | Sulphur | Phosphorus |
|---|---|---|---|---|---|
| Barley | 6.1 | 9.0 | Vetches | 3.9 | 5.6 |
| Oats | 8.0 | 8.4 | Beans | 9.3 | 12.7 |
| Maize | 3.8 | 7.9 | Swedes | 17.8 | 9.9 |
| Meadow hay | 5.7 | 5.3 | Cabbages | 32.9 | 25.3 |
| Red clover | 9.4 | 10.9 | | | |
| | | | Average | 10.8 | 10.6 |

They have proven that a sufficiency of sulphates in the plant food is necessary to the formation of a high percentage of albuminoid. It is therefore not only a question of yield but also of feeding value.

These authors state that the average British soil contains less sulphur than phosphorus, the average of the analyses of 21 typical soils showing .020 per cent sulphur and .059 per cent phosphorus.

By experiments, they have demonstrated that the usefulness of sulphate manuring is generally confined to heavy yielding crops containing a high proportion of albuminoid. That the application of sulphate increased the percentage of albuminoid as well as the total weight of the crop appears to be conclusive evidence that albuminoid formation is directly dependent on a sufficient supply of sulphate.

In two different crops in which the percentages of albuminoids were increased by the application of sulphates, they have found that in these crops, the percentages of amides, soluble carbohydrates and oils were increased, the fiber was decreased, while the ash remained about the same as in the check crops.

The authors sum up the general conclusion of their enquiry as follows:

There is not sufficient sulphuric acid in the soil or supplied by rain for heavy yielding crops rich in albuminoid, either for the production of the greatest yield or the highest feeding value, and for such crops, a sulphate should be included in the artificial manure. For cereal crops and for permanent pasture, the soil and rain provide all the sulphuric acid necessary.

Hart and Peterson[4] in an article entitled, "Sulphur Requirements of Farm Crops in Relation to the Soil and Air Supply," have found by improved methods of analysis that sulphur is of sufficient importance in soil fertility to be classed with the chief elements of

plant food like nitrogen, potassium and phosphorus. In a few analyses of the sulphur in their soils, they show that continuous cultivation from fifty to sixty years without sulphur fertilization has decreased the sulphur content enormously and in some cases to about one-half of the amount contained in the corresponding virgin soils.

On the other hand, they have shown that the ordinary farm crops remove nearly as much sulphur as phosphorus, and probably more in proportion to the amounts of each contained in the soil. In some crops, such as cabbage, turnips, alfalfa and tobacco, considerably more sulphur than phosphorus is taken from the soil.

For the purpose of showing the amounts of sulphur as compared with the amounts of phosphorus required by the average farm crops, the following table is taken from their work:

## POUNDS OF SULPHUR AND PHOSPHORUS REMOVED PER ACRE BY AVERAGE CROPS.

| Crop | Pounds Dry Weight | Pounds Sulphur | Pounds Phosphorus |
|---|---|---|---|
| Wheat grain, 30 bushels | 1,530 | 2.6 | 6.2 |
| Wheat straw | 2,653 | 3.7 | 3.0 |
| Total crop | 4,183 | 6.3 | 9.2 |
| Barley grain, 40 bushels | 1,747 | 2.6 | 7.0 |
| Barley straw | 2,080 | 3.1 | 2.1 |
| Total crop | 3,827 | 5.7 | 9.1 |
| Oat grain, 45 bushels | 1,625 | 3.0 | 5.7 |
| Oat straw | 2,353 | 4.9 | 2.8 |
| Total crop | 3,978 | 7.9 | 8.5 |
| Corn grain, 30 bushels | 1,500 | 2.6 | 4.4 |
| Corn stalks | 1,877 | 2.2 | 3.5 |
| Total crop | 3,377 | 4.8 | 7.9 |
| Bean grain, 30 bushels | 1,613 | 3.8 | 10.0 |
| Bean straw | 1,848 | 2.0 | 2.8 |
| Total crop | 3,461 | 5.8 | 12.8 |

| Crop | Pounds Dry Weight | Pounds Sulphur | Pounds Phosphorus |
|---|---|---|---|
| Turnips, root | 3,126 | 23.1 | 9.8 |
| Turnips, leaf | 1,531 | 13.8 | 4.7 |
| Total crop | 4,657 | 36.9 | 14.5 |
| Sugar beet root | 4,320 | 3.8 | 8.8 |
| Sugar beet leaf | 1,848 | 8.0 | 5.7 |
| Total crop | 6,168 | 11.8 | 14.5 |
| Tobacco leaf | 1,800 | 6.4 | 3.5 |
| Tobacco stalk | 3,200 | 2.0 | 3.5 |
| Total crop | 5,000 | 8.4 | 7.0 |
| Potatoes | 3,360 | 4.6 | 9.4 |
| Meadow hay | 2,822 | 4.5 | 5.4 |
| Red clover hay | 3,763 | 6.2 | 10.9 |
| Alfalfa hay | 9,000 | 26.0 | 17.4 |
| Cabbage | 4,800 | 39.2 | 26.6 |

Chancrin and Desriot[5] refer to experiments made in Germany in 1909 (Deut. Landw. Presse, 37, 1910, No. 18, page 204) in which it was found that the use of sulphur for potato diseases was not only effective in reducing the disease but increased the yield of potatoes and report experiments of their own in which sulphur was used at the rate of from 250 to 500 kilograms per hectare (about 223.14 to 446.28 lbs. per acre), in connection with superphosphate, potassium sulphate and sodium nitrate on potatoes and beets. In all cases, there was a decided increase in the yield of potatoes on the plats receiving sulphur, and in every case except one, there was an increase in the yield of beets following its application.

E. Boullanger,[6] in the course of some experiments on catalytic fertilizers, carried on a series with carrots, beans, celery, lettuce, chicory, potatoes, onions, etc., in which 70 grams of sulphur was added to 30 kilograms of soil. The influence of the sulphur was apparent in every case and in some, very conspicuous, exerting a favorable action on the growth of the plants and notably increasing the yield.

Another series of experiments with sulphur used in connection with sterilized and non-sterilized soil showed that the action of the

sulphur was quite pronounced with ordinary soil but had a very feeble effect with the soil that had been sterilized. From this it is believed that sulphur does not act directly upon the bacterial flora of the soil nor assist materially in the development of certain organisms.

A. Demelon[7] states that the amount of nitrogen and its state of combination in crude ammonium salt residues from gas works is insufficient to explain the beneficial effects of this material in agriculture. Its efficiency as a manure is attributed to the presence of free sulphur. In a study of the cause of the fertilizing effect of the crude ammonia which contains on an average of 40 per cent of free sulphur, he tested the effect of adding flowers of sulphur (10 grams per square meter of soil), to rutabagas, beets and parsnips in pot experiments and found a marked increase in yield in every case. He also studied the rate of transformation of the sulphur into sulphate in certain soils and found that it was partly oxidized to sulphuric acid. He is of the opinion that the gradual oxidation to sulphate has an important bearing upon the fertilizing effect of the sulphur.

E. Boullanger and M. Dugardin[8] have shown that the favorable influence which very small doses of sulphur exert on vegetation is due to its activating effect on the bacteria which break down nitrogenous matter in the soil to ammonia and also to its influence on the nitrification ferments. Larger doses of sulphur, whilst enhancing the first effect, check the second.

V. V. Sabasknikov[9] has found that flowers of sulphur, when applied at the rate of 10 grams per square meter to barley and rye growing on a fertile clay soil containing .082 per cent sulphuric acid which had previously been in beets, gave a decided increase in the yield. The effect of the application of sulphur was observed from the beginning to the end of the season in the more vigorous growth and greener color of the crops.

Bernhard[10] reports experiments which show marked benefits from the application of sulphur (44 lbs. per plat of 600 sq. yds.) on hoed crops, especially potatoes and mangolds.

Degrully[11] states that Gastine suggests that the fertilizing effect of carbon bisulphide is due in part at least to the sulphur left in the soil in a fine state of subdivision.

Demelon[12] has made further experiments with sulphur which

show that it can act as a useful addition to farmyard manure as a fertilizer but that its action diminishes and vanishes in the presence of large amounts of organic and mineral fertilizers. Potatoes benefit most by the addition of sulphur. On light lands, it has an injurious effect on cereals. Addition of sulphur in amount equal to the nitrogen supplied has given the same results as a complete mineral fertilizer. The fertilizing action of sulphur is due (a) to its action on the soil bacteria, (b) to its progressive transformation into sulphuric acid.

M. Cercelet[13] states that sulphur has been found to act as a strong "catalytic fertilizer." It has also been shown[14] that beans grown in soil sulphured at the rate of 5 to 10 grams of sulphur per square meter did not give an increased yield but a sulphuring of 20 grams per square meter increased the yield 50 per cent. Peas, onions, potatoes and asparagus, on the addition of small amounts of sulphur to the soil, gave increased yields of 2 to 25 per cent.

F. Gianitto[15] has found that sulphur applied alone at the rate of 400 pounds per acre decreased the yield of potatoes but combined with other fertilizers increased the yield.

Josef Urban[16] has also found that applications of flowers of sulphur slightly increased the yield of sugar beets. The sulphur was without effect on the color of the leaves and also had no effect on the amount of sugar and the quality of the juice.

The results on the whole indicate that certain crops are materially benefited by applications of free or combined sulphur. Curious to note, certain investigators started their experiments with the idea in view of testing sulphur either as one of the so-called "stimulants," or as a "catalytic fertilizer." These terms have been applied to certain substances either because they force the growth of plants for some unknown reason, or promote growth by their presence but do not necessarily enter into the composition of the plant and therefore are not supposed to furnish any plant food. For instance, the good effect of small amounts of carbon bisulphide has generally been attributed to its favorable action on certain soil bacteria. Several of the workers in this field have finally come to the conclusion that sulphur furnishes plant food in addition to any other favorable action that it might have on the plant.

The interesting results which have been obtained by several of the investigators mentioned above, suggested to the writer an

outline of the experiments which are included in this article. For the purpose of showing what effect continuous cultivation without adding any barnyard manure or commercial fertilizer has had in decreasing the sulphur content of some of our representative types of soils, numerous samples have been analyzed from the different geological areas of the state. These results have then been compared with those obtained in the corresponding virgin soils.

The chief difficulty encountered in this work has been in obtaining the soils desired from the numerous samples sent to this Station for analysis. It is not an easy matter to obtain samples of soil, the history of which shows that they have been cultivated, for say fifty years, and no fertilizer or manure of any kind has been added during this time, for this is contrary to ordinary farm practice. When such samples were found among those sent to the Station, in many instances, the corresponding virgin soils were not available, for most of the samples have been sent by farmers from cultivated areas. Again in certain areas of the state, commercial fertilizers are generally used and as much of the land is rented to tenants, no accurate history of the soil was obtainable. The best plan would have been to have samples collected for the work but as this would have caused considerable delay and expense, only in some instances were samples taken for this purpose.

After a search through the many hundred of samples sent to the Station together with those collected throughout the state for this particular work, the writer feels that a sufficient number have been worked upon to form a preliminary survey of the different types of soils comprised in the different geological areas of the state.

The plan followed has been to determine the total sulphur in the top or surface soil taken to a depth of 6 inches and also in the subsoil taken from 6 to 18 inches in depth. This has been done wherever possible in both the cultivated and virgin soils. Several of the samples were taken from permanent fence rows alongside of the cultivated areas and in some instances from adjacent woodland.

The method used in this work was with a slight modification the same as the one worked out by Hart and Peterson and included the sodium peroxide fusion which was proposed by Osborn a few years ago. This is generally considered a very reliable and ac-

curate method for determining sulphur in organic combination. The procedure used was as follows:

Ten grams of the air dried soil were placed in a 100 cc nickel crucible, moistened with water, about 10 grams of a weighed 20 gram portion of sodium peroxide added, and the mixture thoroughly stirred with a nickel rod. The crucible was placed over a natural gas flame and heated moderately until the mass was nearly dry. The remainder of the peroxide was then added, strong heat applied gradually and the mass thoroughly stirred, after which the cover was placed on the crucible and fairly strong heat applied for one hour. After cooling, the crucible was placed in a 500 cc beaker, hot water added and the fused mass removed. It was neutralized with hydrochloric acid and further acidified with 10 cc of hydrochloric acid. The beaker was placed on the steam bath and heated for 5 to 6 hours until no undecomposed portion of the fused mass remained on the bottom and all chlorine gas was expelled from the solution. It was then transferred to a 500 cc flask and after cooling made to the mark. The solution was allowed to stand for several hours with frequent shaking, after which it was filtered and an aliquot of 250 cc, i. e. 5 grams of soil, was taken for the determination. This was heated on the steam bath and 10 cc of hot 10 per cent barium chloride solution added slowly and allowed to stand on the steam bath for 2 to 3 hours and set aside for about 24 hours. The volume was not allowed to decrease as silicic acid may be precipitated if much evaporation takes place.

The solution was then filtered from the barium sulphate, the latter washed, ignited to a white mass, treated with one drop of sulphuric acid and about 2 cc of hydrofluoric acid and finally heated over the blast to constant weight.

In the preliminary trials, treatment with hydrofluoric acid after igniting over the blast showed that no silica was contained in the precipitate but to feel safe on this point, all precipitates were treated with hydrofluoric acid before finally heating over the blast.

Blank determinations were made on all the sodium peroxide used but no sulphur was found in any of the samples. The fact that none was obtained in any of the blank determinations also shows that the fusions can be made over natural gas without taking up any sulphur from the flame provided the crucibles are kept covered.

The plan of making the soil solutions to 500 cc with the silicious residue present was found more convenient in the work. The error due to the volume occupied by this residue was inappreciable as it did not measure over a few cubic centimeters.

For convenience, the soils have been arranged according to the different geological areas to which they belong and a brief history of each so far as was known is included.

The samples in which the results are strictly comparable, both in the surface and subsoil of the virgin and cultivated areas, are given in the tables in the same horizontal line. In computing the percentages of sulphur to pounds per acre, the calculations were made by assuming the surface or first 6½ to 7 inches of soil as weighing 2,000,000 pounds and the second six inches or subsoil as weighing the same. The pounds per acre of sulphur given for the subsoils approximately represent the second six inches, or from 6½ to 12½ inches, although the subsoil samples were taken from 6 to 18 inches in depth, unless otherwise specified. This of course assumes that the second and third six inches of soil will have about the same sulphur content and they probably will be close enough so that the differences which are shown in the tables between the surface soils and subsoils taken to these depths will not be materially changed.

The total phosphorus was determined in the samples by the magnesium nitrate method and for the purpose of comparing it with the sulphur, the results are included in the tables.

## EASTERN COAL FIELDS AREA.

No. 669—Wolfe County. Surface soil collected in 1912, ¼ mile southeast of Hazel Green, from a field which had been cultivated for a number of years and no fertilizers used.

No. 670—Subsoil of No. 669.

No. 671—Virgin surface soil taken near No. 669.

No. 672—Subsoil of No. 671.

No. 700—Magoffin County. Surface soil collected in 1911 on Dr. Wm. Howard's farm on Howard Branch, ¼ mile from the Magoffin-

Floyd county line, from a field which had been cultivated about 4 years and no fertilizer used. Crops were usually 20 to 25 bushels corn per acre.

No. 701—Subsoil of No. 700.

No. 702—Johnson County. Surface soil collected in 1911 on the Picklesimer farm, 40 rods southwest of Volga Post-office on Big Mud Lick. The land had been cultivated 75 years and no fertilizers used. When new, the land will average 35 bushels of corn and then produced 25 bushels per acre.

No. 703—Subsoil of No. 702.

No. 704—Johnson County. Surface soil collected in 1911 on Wiley Price's farm, 2 miles above Denver on Acre's Creek, from a field which had been cultivated for 7 years and no fertilizer used. It usually produced from 30 to 35 bushels of wheat per acre.

No. 705—Subsoil of No. 704.

No. 763—Johnson County. Surface soil collected in 1911, ¼ mile east of Flat Gap, from a pasture which had been cultivated several years before but no fertilizers used. It usually produced about 25 bushels of corn per acre. This may be classed as a virgin soil.

No. 764—Subsoil of No. 763.

No. 706—Floyd County. Surface soil collected in 1911, 1½ miles below mouth of Beaver Creek and ½ mile west of Big Sandy River. This is a virgin soil and typical of the virgin hills in the Big Sandy country.

No. 707—Perry County. Surface soil collected in 1911, on the farm of S. M. Holliday, 2 miles above Stacy Post-office, on Troublesome Creek and near the mouth of Tom's Branch. First year of cultivation and had a fine crop of corn growing on it. The land had not been plowed or broken; expected 40 bushels per acre.

No. 708—Subsoil of No. 707.

No. 709—Perry County. Surface soil collected in 1911 on the farm of W. K. Jamison, 1½ miles west of Big Creek and 1½ miles south of North Fork of Kentucky River. It had been cultivated 15 or 20 years and no fertilizers used, and produced 20 to 30 bushels of corn per acre.

No. 710—Subsoil of No. 709.

No. 715—Lawrence County. Surface soil collected in 1911 on the farm of Ernest Shannon, 3 miles west of Louisa and 20 rods north of the Louisa-Busseyville road, from a field which had been cultivated for 60 to 75 years and no fertilizer used. It produced 20 bushels of corn per acre. This land appeared to be somewhat worn.

No. 716—Subsoil of No. 715.

No. 717—Lawrence County. Surface soil collected in 1911 on the farm of Frank Evans, 1½ miles above the mouth of Brushy Creek and a few rods above the mouth of Big Branch. This was the second year of cultivation and no fertilizers had been used.

No. 718—Subsoil of No. 717.

No. 731—Pike County. Surface soil collected in 1911 on Hurricane Creek, 2½ miles from the Louisa fork of the Big Sandy River. It had been cultivated only 1 or 2 years and no fertilizers used.

No. 732—Subsoil of No. 731.

No. 733—Pike County. Surface soil collected in 1911 on the farm of Dr. O. K. Bond on John Creek and 1½ miles above the mouth of Coon Creek. It had been cultivated 50 years or longer and no fertilizer used.

No. 734—Subsoil of No. 733.

## SULPHUR AND PHOSPHORUS IN SOILS OF EASTERN COAL FIELDS AREA.

| No. | County | Virgin Surface Soil Pounds per Acre Sulphur | Virgin Surface Soil Pounds per Acre Phosphorus | Cultivated Surface Soil Pounds per Acre Sulphur | Cultivated Surface Soil Pounds per Acre Phosphorus |
|---|---|---|---|---|---|
| 669-72 | Wolfe | 580 | 1,580 | 440 | 860 |
| 700-1 | Magoffin | ..... | ..... | 320 | 860 |
| 702-3 | Johnson | ..... | ..... | 520 | 740 |
| 704-5 | Johnson | ..... | ..... | 300 | 1,100 |
| 763-4 | Johnson | 680 | 800 | ..... | ..... |
| 706 | Floyd | 620 | 1,660 | ..... | ..... |
| 707-10 | Perry | 820 | 1,480 | 380 | 1,040 |
| 715-18 | Lawrence | 320 | 700 | 180 | 560 |
| 731-4 | Pike | 560 | 1,800 | 460 | 2,060 |
| Average | | 598 | 1,337 | 371 | 1,031 |

| No. | County | Virgin Subsoil Pounds per Acre Sulphur | Virgin Subsoil Pounds per Acre Phosphorus | Cultivated Subsoil Pounds per Acre Sulphur | Cultivated Subsoil Pounds per Acre Phosphorus |
|---|---|---|---|---|---|
| 669-72 | Wolfe | 660 | 1,120 | 200 | 620 |
| 700-1 | Magoffin | ..... | ..... | 200 | 660 |
| 702-3 | Johnson | ..... | ..... | 240 | 620 |
| 704-5 | Johnson | ..... | ..... | 300 | 960 |
| 763-4 | Johnson | 180 | 500 | ..... | ..... |
| 707-10 | Perry | 380 | 1,360 | 140 | 700 |
| 715-18 | Lawrence | 160 | 540 | 160 | 520 |
| 731-4 | Pike | 460 | 1,300 | 300 | 2,120 |
| Average | | 368 | 964 | 220 | 886 |

## ST. LOUIS-CHESTER AREA.

No. 681—Lyon County. Surface soil collected in 1907 on the farm of W. Hodges, 2 miles south of Dycusburg and east of the Kuttawa road, from a field which had been cultivated for 50 years and no fertilizers used. It produced about 1000 pounds of tobacco and 35 bushels of corn per acre.

No. 682—Subsoil of No. 681.

No. 683—Metcalfe County. Surface soil collected in 1907 on Crutcher Eubank's farm, ½ mile northeast of Edmonton and 100

yards south of residence of Stewart Coffey, from a field which had been cultivated for 50 years and no fertilizers used. It produced about 10 bushels of corn per acre.

No. 684—Subsoil of No. 683.

No. 685—Adair County. Surface virgin soil collected in 1907 on the farm of John Gilpin, about 50 yards northwest of the residence and 500 yards west of the forks of the road from Gradyville to Nell and Edmonton. The virgin soil usually produces about 25 to 30 bushels of corn per acre.

No. 759—Lincoln County. Surface virgin soil collected in 1907 on the farm of Waller Hulett, 2½ miles west of Eubanks, from an old orchard just after it had been plowed for the first time. The virgin soil will produce about 6 to 8 barrels of corn per acre.

No. 760—Surface soil collected at the same time near No. 759, from an old cultivated field and no fertilizers used. This land would not produce scarcely anything. The virgin soil is easily exhausted.

No. 806—Warren County. Surface virgin soil collected in 1913 on the farm of Mr. Alderson, 1 mile west of Bowling Green from a thicket.

No. 807—Subsoil of No. 806.

No. 808—Surface soil collected at the same time and a few rods from No. 806, from a field which had been cultivated for 60 years and no fertilizers used. Corn and wheat had usually been raised and produced about 20 bushels of corn and 15 bushels of wheat per acre.

No. 809—Subsoil of No. 808.

No. 813—Metcalfe County. Virgin soil, first 18 inches, collected in 1913 on the farm of David W. Eubanks, 1 mile southwest of Wisdom and near the Barren county line, from an old fence row, which had never been cultivated.

No. 814—Cultivated soil, first 18 inches, collected at the same time and from the cultivated area of the same field from which No. 813 was taken. The field had been cultivated for 62 years and only

a little stable manure and no commercial fertilizers used. Classed as rather poor soil. The late crops have been corn and grass and used for pasture. It produced about 15 to 20 bushels of corn and 700 to 800 pounds of tobacco per acre. Mr. Eubanks had lived on this land for 62 years and the above was its true history.

No. 815. Metcalfe County. Virgin soil, first 18 inches, collected in 1913 on the farm of Crutcher Eubank, ½ mile northeast of Edmonton, from an old fence row which had never been cultivated.

No. 816—Cultivated soil, first 18 inches, collected at the same time and from the cultivated area of the same field from which No. 815 was taken. It had been cultivated for 15 to 20 years but it was not known whether commercial fertilizers had been used. Corn and oats were usually grown. It is classed as a rather poor soil and produced about 15 bushels of corn per acre the previous year.

## SULPHUR AND PHOSPHORUS IN SOILS OF ST. LOUIS-CHESTER AREA.

| No. | County | Virgin Surface Soil Pounds per Acre | | Cultivated Surface Soil Pounds per Acre | |
|---|---|---|---|---|---|
| | | Sulphur | Phosphorus | Sulphur | Phosphorus |
| 681-2 | Lyon | ..... | ..... | 440 | 880 |
| 683-4 | Metcalfe | ..... | ..... | 200 | 420 |
| 685 | Adair | 220 | 520 | ..... | ..... |
| 759-60 | Lincoln | 720 | 1,200 | 480 | 300 |
| 806-9 | Warren | 600 | 640 | 400 | 420 |
| Average | | 513 | 787 | 380 | 505 |

| No. | County | Virgin Subsoil Pounds per Acre | | Cultivated Subsoil Pounds per Acre | |
|---|---|---|---|---|---|
| | | Sulphur | Phosphorus | Sulphur | Phosphorus |
| 681-2 | Lyon | ..... | ..... | 140 | 720 |
| 683-4 | Metcalfe | ..... | ..... | 620 | 400 |
| 806-9 | Warren | 1,080 | 680 | 680 | 440 |
| Average | | 1,080 | 680 | 480 | 520 |
| 813-4 | Metcalfe | 440* | 620* | 360* | 380* |
| 815-6 | Metcalfe | 240* | 360* | 340* | 380* |

*In first 18 inches.

## CINCINNATIAN AREA.

No. 757—Henry County. Surface soil collected in 1908, on the farm of Thomas Goff near Jericho Station and about 1½ miles northwest of Harrod's Creek. The field had been cultivated for 50 years and no fertilizers used. The field was worn and Mr. Goff stated that the land had been exhausted by poor farm practice.

No. 758—Henry County. Surface virgin soil collected at the same time from a woodland on the Goff farm. This sample was taken close to No. 757 and was the same character of soil.

Nos. 757-8 are of the sand stone types which are not as good as the soils derived from limestone in the same geological area.

No. 769—Washington County. Surface virgin soil collected in 1902 on the farm of J. K. Walls, near Springfield, from a woodland. A very dark, almost black soil.

No. 770—Surface soil collected at the same time from a cultivated field on the Walls farm. Dark brown soil but lighter in color than No. 769.

No. 771—Surface soil collected at the same time from an old cultivated field on the Walls farm. Lighter in color than No. 770.

No. 772—Surface soil collected at the same time from a very old cultivated field on the Walls farm. Lighter in color than No. 771.

No. 773—Mason County. Surface soil collected in 1893 on the farm of Wm. Luttrell, near Helena Station, from a field that was cleared of timber in 1831 and subjected to continuous crop rotation until the time of collection and never having been in grass longer than 2 years. Soil lighter in color than Nos. 774 and 775.

No. 775—Surface soil collected at the same time from a field on the Luttrell farm that was cleared of timber in 1860 and followed by continuous crop rotation until the time of collection.

No. 774—Surface soil collected at the same time from a field on the Luttrell farm that was cleared of timber in 1884 and subjected to continuous crop rotation of tobacco, wheat, clover and corn until the time of collection.

Mr. Luttrell stated that these samples of soil represent geologically, the soil of the tobacco belt of Mason County, a territory about 8 by 11 miles in area, extending from the Fleming county line on the south to the river hills overlooking Maysville and from a line about 1 mile east of the Maysville and Mt. Sterling road to a line about 1 mile west of the Maysville and Lexington road.

### SULPHUR AND PHOSPHORUS IN SOILS OF CINCINNATIAN AREA.

| | | Virgin Surface Soil Pounds per Acre | | Cultivated Surface Soil Pounds per Acre | |
|---|---|---|---|---|---|
| No. | County | Sulphur | Phosphorus | Sulphur | Phosphorus |
| 757-8 | Henry | 520 | 1,000 | 280 | 740 |
| 769-70 | Washington | 1,240 | 2,840 | 720 | 3,040 |
| 771 | Washington | ..... | ..... | 460 | 1,980 |
| 772 | Washington | ..... | ..... | 460 | 1,660 |
| 773 | Mason | ..... | ..... | 640 | 3,480 |
| 775 | Mason | ..... | ..... | 720 | 3,080 |
| 774 | Mason | ..... | ..... | 780 | 4,080 |
| | Average | 880 | 1,920 | 580 | 2,580 |

### WESTERN COAL FIELDS AREA.

No. 692—Webster County. Surface virgin soil collected in 1910 in Deer Creek bottom, 2 miles northwest of Mt. Pleasant church, north of Deer Creek, and 1½ miles southeast of Ortiz. Green River bottom land.

No. 693—Subsoil of No. 692.

No. 694—Webster County. Surface soil collected in 1910 on the Burton farm, 1¼ miles south of Roland Ferry and 2¼ miles northeast of Onton, from a field which had been cultivated for 20 to 30 years and no fertilizers used. It produced 60 to 75 bushels of corn; 30 bushels of wheat and 2 tons of hay per acre. Green River bottom land.

No. 695—Subsoil of No. 694.

No. 821—Henderson County. Surface soil collected in 1913 on the farm of Rev. E. M. McCollum, 6 miles southwest of Hend-

erson, from a field which had been cultivated 50 years or longer and no fertilizers used. It had been in corn, wheat, grass, etc. The land washes and the humus is easily exhausted. Average yield after 5 years cultivation, was 20 to 30 bushels of corn and 5 to 15 bushels of wheat.

No. 822—Subsoil of No. 821.

No. 823—Henderson County. Surface virgin soil collected in 1913 from near same location as No. 821.

No. 824—Subsoil of No. 823.

No. 841—Muhlenburg County. Surface virgin soil collected in 1913, about 2½ miles southwest of Greenville from a woodland which joins No. 843. The crop yields on the virgin soil are 50 bushels of corn; 1,700 pounds of tobacco without manure; 30 bushels of wheat and 3 tons of pea hay per acre.

No. 842—Subsoil of No. 841.

No. 843—Muhlenburg County. Surface soil collected in 1913 on the farm of Henry Lovell, about 2½ miles southwest of Greenville on the Depoy Road. The sample was taken from an area which now forms the Station experimental field and joins No. 841. This field has been cultivated for 40 years and some commercial fertilizer and stable manure used. Since 1906, corn, wheat and peas were raised and the peas used for a hog pasture. It produced 30 bushels of corn; 900 pounds of tobacco with the addition of manure; 12 bushels of wheat and 1 ton of pea hay per acre.

No. 844—Subsoil of No. 843.

## SULPHUR AND PHOSPHORUS IN SOILS OF WESTERN COAL FIELDS AREA.

| | | Virgin Surface Soil Pounds per Acre | | Cultivated Surface Soil Pounds per Acre | |
|---|---|---|---|---|---|
| No. | County | Sulphur | Phosphorus | Sulphur | Phosphorus |
| 692-5 | Webster | 560 | 1,040 | 360 | 840 |
| 821-4 | Henderson | 620 | 1,020 | 460 | 860 |
| 841-4 | Muhlenburg | 500 | 660 | 420 | 660 |
| Average | | 560 | 907 | 413 | 787 |

| No. | County | Virgin Subsoil Pounds per Acre Sulphur | Virgin Subsoil Pounds per Acre Phosphorus | Cultivated Subsoil Pounds per Acre Sulphur | Cultivated Subsoil Pounds per Acre Phosphorus |
|---|---|---|---|---|---|
| 692-5 | Webster | 360 | 1,020 | 320 | 660 |
| 821-4 | Henderson | 300 | 740 | 320 | 940 |
| 841-4 | Muhlenburg | 400 | 600 | 300 | 560 |
| Average | | 353 | 787 | 313 | 720 |

## KEOKUK-WAVERLY AREA.

No. 686—Adair County. Surface soil collected in 1907 on the farm of C. O. Keltner, 1¼ miles southwest of Gradyville and northeast of the home of Kurt Kellner on opposite side of road. The field had been cultivated for 50 years and no fertilizers used. It produced about 25 to 30 bushels of corn per acre.

No. 723—Adair County. Surface virgin soil collected in 1908 on the Ellice farm just over the east county line and near the Pellyton church. Only recently cultivated and might be classed as virgin soil. No fertilizers had been used, and produced 5 to 8 barrels of corn and ½ to 2 tons of hay per acre.

No. 724—Subsoil, 12″-18″ of No. 723.

No. 725—Adair County. Surface soil collected in 1908 on the farm of Steve Good from the bottom land of west fork of Casey Creek. Map 9-16. The field had been cultivated for 50 to 75 years and commercial fertilizers used. It produced 3 to 6 barrels of corn and 4 to 10 bushels of wheat per acre. Very poor land.

No. 726—Subsoil, 12″-18″ of No. 725.

No. 688—Rockcastle County. Surface soil collected in 1910 on the farm of W. D. Cummins, 40 rods east of Quail, from a field which had been cultivated for 50 years and commercial fertilizers used. It produced about 25 bushels of corn and 7 to 8 bushels of wheat per acre.

No. 689—Subsoil of No. 688.

No. 690—Rockcastle County. Surface virgin soil collected in 1910, 1½ miles east of mouth of Gum Sulphur.

No. 691—Subsoil of No. 690.

No. 696—Green County. Surface soil collected in 1908, from an old cultivated field at forks of road about 3 miles north of Greensburg, Ky. Map 30-18.

No. 697—Subsoil of No. 696.

No. 698—Green County. Surface virgin soil collected in 1908, from a beech woods about 0.4 miles nearer Greensburg than No. 696.

No. 699—Subsoil of No. 698.

### SULPHUR AND PHOSPHORUS IN SOILS OF KEOKUK-WAVERLY AREA.

| | | Virgin Surface Soil Pounds per Acre | | Cultivated Surface Soil Pounds per Acre | |
|---|---|---|---|---|---|
| No. | County | Sulphur | Phosphorus | Sulphur | Phosphorus |
| 686 | Adair | ..... | ..... | 280 | 620 |
| 723-6 | Adair | 300 | 360 | 520 | 600 |
| 688-91 | Rockcastle | 180 | 600 | 240 | 400 |
| 696-9 | Green | 600 | 660 | 360 | 600 |
| Average | | 360 | 540 | 350 | 555 |

| | | Virgin Subsoil Pounds per Acre | | Cultivated Subsoil Pounds per Acre | |
|---|---|---|---|---|---|
| No. | County | Sulphur | Phosphorus | Sulphur | Phosphorus |
| 723-6 | Adair | 100 | 340 | 320 | 420 |
| 688-91 | Rockcastle | 80 | 520 | 40 | 220 |
| 696-9 | Green | 460 | 520 | 140 | 520 |
| Average | | 213 | 460 | 167 | 387 |

### QUATERNARY AREA.

No. 719—Graves County. Surface soil collected in 1913 on the farm of Boone Easley, 1½ miles northeast of Lynnville, from a field which had been cultivated for 40 years and no fertilizers used. The field had been in corn or tobacco every year, except 5, for the last 40 years. It did not yield very good at the time of collection and produced about 20 bushels of corn and 300 pounds of tobacco per acre.

No. 720—Subsoil of No. 719.

No. 721—Surface virgin soil collected at the same time and from an old fence row which surrounds the field from which No. 719 was taken. This ground had never been cultivated.

No. 722—Subsoil of No. 721.

No. 845—McCracken County. Surface virgin soil collected in 1913 near No. 847 from a woodland. The virgin soil produces about 30 bushels of corn; 16 bushels of wheat; 1½ to 2 tons of cow peas and 1,000 pounds of tobacco without manure.

No. 846—Subsoil of No. 845.

No. 847—McCracken County. Surface soil collected in 1913 on the farms of Messrs. E. Futrell and Alcock at Lone Oak, about 3 miles southwest of Paducah. A part of this land has been cultivated for 15 years and the remainder for about 30 years and the whole now forms the Station experimental field. No commercial fertilizers have been used but some stable manure was applied in former years. A portion of the field had been in grass for the last six years and the remainder in cow peas, grass and pasture for the last five, except 1910 and 1912, in which wheat and corn were grown. It produced about 15 bushels of corn; 8 bushels of wheat; 1 ton of cow peas and 750 pounds of tobacco with manure. No system of crop rotation has been used.

No. 848—Subsoil of No. 847.

## SULPHUR AND PHOSPHORUS IN SOILS OF QUATERNARY AREA.

| | | Virgin Surface Soil Pounds per Acre | | Cultivated Surface Soil Pounds per Acre | |
|---|---|---|---|---|---|
| No. | County | Sulphur | Phosphorus | Sulphur | Phosphorus |
| 719-22 | Graves | 680 | 1,220 | 240 | 860 |
| 845-8 | McCracken | 420 | 620 | 400 | 760 |
| Average | | 550 | 920 | 320 | 810 |

| | | Virgin Subsoil Pounds per Acre | | Cultivated Subsoil Pounds per Acre | |
|---|---|---|---|---|---|
| No. | County | Sulphur | Phosphorus | Sulphur | Phosphorus |
| 719-22 | Graves | 200 | 880 | 60 | 740 |
| 845-8 | McCracken | 260 | 640 | 260 | 780 |
| Average | | 230 | 760 | 160 | 760 |

## TRENTON AREA.

No. 749—Clark County. Surface soil collected in 1904 on the farm of Stanley Prewitt, near Tebbs Station on the C. & O. Ry., from a cultivated field on the Combs Ferry road opposite the residence of John Battaile. During the previous 9 years, the field had been cultivated in a 3 year rotation of tobacco, wheat or rye and clover and before that time probably in small grains and clover. The land had always produced good crops.

No. 750—Subsoil of No. 749.

No. 751—Surface soil collected at the same time from a five acre area of the same field from which No. 749 was taken. The field was in tobacco and in this particular area, the crop was practically a failure and this could not be accounted for from the chemical analysis of the other plant food present.

No. 752—Subsoil of No. 751.

No. 753—Surface virgin soil collected at the same time on the Prewitt farm, from an old fence row on the Boone's Ferry road near the residence of Mr. Steele on the south, and W. Y. Jones on the west. This land had not been plowed for a good many years.

No. 754—Subsoil of No. 753.

No. 755—Fayette County. Surface soil collected in 1906 on the farm of Dr. J. H. Parker, from a field where the tobacco had failed that year.

No. 756—Fayette County. Surface soil collected in 1906 on the farm of Dr. E. M. Norwood, from an old pasture on the west of the north part of Dr. Parker's field. Same character of soil as No. 755. It was in tobacco and growing well. Formerly cultivated but had been in blue grass for many years. Classed as a virgin soil.

No. 765—Woodford County. Surface virgin soil collected in 1904 on the farm of Paul Lansing, formerly the Withrow farm, about 2 miles southeast of Midway, Ky., on South Elkhorn Creek and near Weisenberger's mill road. The sample was taken from the second woodland, northeast of the residence.

No. 766—Subsoil of No. 765.

No. 767—Woodford County. Surface soil collected at the same time on the Lansing farm, from a timothy field west of the residence. This field had produced good crops and although it had been in continuous cultivation for several years, it had formerly been a feed lot and pasture and no doubt still shows the effect of manure accumulations.

No. 768—Subsoil of No. 767.

No. 837—Madison County. Surface virgin soil collected in 1913 on the farm of J. W. Herndon, 4 miles north of Berea and on the west side of the Berea-Kingston road. The sample was taken near an old fence row which had never been cultivated on the north side of an old burying ground and on the south side of a small branch, about 250 yards south of barn, at Mr. Herndon's home.

No. 838—Subsoil, 6″-15″ of No. 837.

No. 839—Surface soil collected at the same time on the Herndon farm, from a field within 75 feet southwest of the burying ground and close by No. 837. This land had been cultivated for 45 years and no fertilizers used. It had been cultivated in a rotation of corn, wheat, meadow and pasture in irregular succession. The crops usually expected were 25 to 30 bushels of corn; 8 to 10 bushels of wheat and ¾ ton of hay per acre.

No. 840—Subsoil, 6″-15″ of No. 839.

## SULPHUR AND PHOSPHORUS IN SOILS OF TRENTON AREA.

| No. | County | Virgin Surface Soil Pounds per Acre | | Cultivated Surface Soil Pounds per Acre | |
|---|---|---|---|---|---|
| | | Sulphur | Phosphorus | Sulphur | Phosphorus |
| 749, 50, 3, 4 | Clark | 920 | 4,240 | 900 | 11,660 |
| 751-2 | Clark | ..... | ..... | 900 | 15,320 |
| 755-6 | Fayette | 720 | 3,800 | 760 | 3,500 |
| 765-8 | Woodford | 740 | 12,100 | 700 | 5,460 |
| 837-40 | Madison | 880 | 2,060 | 360 | 1,360 |
| Average | | 815 | 5,550 | 724 | 7,460 |

| No. | County | Virgin Subsoil Pounds per Acre Sulphur | Virgin Subsoil Pounds per Acre Phosphorus | Cultivated Subsoil Pounds per Acre Sulphur | Cultivated Subsoil Pounds per Acre Phosphorus |
|---|---|---|---|---|---|
| 749, 50, 3, 4 | Clark | 560 | 3,440 | 660 | 9,320 |
| 751-2 | Clark | ..... | ..... | 740 | 12,180 |
| 765-8 | Woodford | 700 | 12,440 | 640 | 6,600 |
| 837-40 | Madison | 500 | 1,700 | 220 | 860 |
| Average | | 587 | 5,860 | 560 | 7,240 |

## DEVONIAN AREA.

No. 727—Clark County. Surface soil collected in 1904 near Indian Fields on the L. & E. Railway, from a cultivated field in the Indian Old Fields section which consists of a remarkable level area of rich black soil.

No. 728—Surface virgin soil collected at the same time and from the same field as No. 727, from a fence row that had never been cultivated.

No. 761—Marion County. Surface soil collected in 1909 on the farm of L. S. Pence, from an old field which borders Rolling Fork River, at a point two miles up the river from where Marion, Nelson and Larue counties join. The field had been constantly cultivated for 70 years and no fertilizers used. No rotation was practiced and corn had generally been grown.

No. 762—Surface virgin soil collected at the same time from a woodland which borders No. 761. This land had never been cultivated and the soil of No. 761 was originally like the woodland soil.

No. 833—Madison County. Surface virgin soil collected in 1913 on the farm of Mark Settle, northwest of Big Hill, from an old fence row along the Berea and Big Hill road, at a point about 75 to 100 yards west of the bridge in front of Isaac Burns' residence.

No. 834—Subsoil, 6″-15″ of No. 833.

No. 835—Surface soil collected at the same time and near No. 833, from a field which had been cultivated for over 50 years and no fertilizers used. The rotation had been corn, oats, hay and pasture in irregular succession. The soil was worn and much in need

of humus. It produced about 10 to 15 bushels of corn; 8 to 10 bushels of oats and ½ ton of hay per acre.

No. 836—Subsoil, 6″-15″ of No. 835.

## SULPHUR AND PHOSPHORUS IN SOILS OF DEVONIAN AREA.

| No. | County | Virgin Surface Soil Pounds per Acre Sulphur | Virgin Surface Soil Pounds per Acre Phosphorus | Cultivated Surface Soil Pounds per Acre Sulphur | Cultivated Surface Soil Pounds per Acre Phosphorus |
|---|---|---|---|---|---|
| 727-8 | Clark | 1,420 | 3,980 | 1,080 | 3,300 |
| 761-2 | Marion | 640 | 1,440 | 460 | 1,240 |
| 833-6 | Madison | 1,020 | 740 | 240 | 520 |
| Average | | 1,027 | 2,053 | 593 | 1,687 |

| No. | County | Virgin Subsoil Pounds per Acre Sulphur | Virgin Subsoil Pounds per Acre Phosphorus | Cultivated Subsoil Pounds per Acre Sulphur | Cultivated Subsoil Pounds per Acre Phosphorus |
|---|---|---|---|---|---|
| 833-6 | Madison | 220 | 320 | 180 | 320 |
| Average | | 220 | 320 | 180 | 320 |

## SILURIAN AREA.

No. 817—Jefferson County. Surface virgin soil collected in 1913 from the Fair Grounds woods at Fern Creek, Ky., and so far as known had never been in cultivation.

No. 818—Subsoil of No. 817.

No. 819—Surface soil collected in 1913 on the farm worked by Morris Stout adjoining the Fair Grounds woods from which No. 817 was taken. The field had been in oats the previous year but had been practically abandoned recently. It had been cultivated for many years and only small amounts of stable manure and no commercial fertilizers had been used. The land produced light crops and loses humus easily.

No. 820—Subsoil of No. 819.

No. 829—Madison County. Surface virgin soil collected in 1913 on the farm of Lathe Moore, 1 mile northwest of Berea and about 75 feet of west side of L. & N. right of way from an old line

fence row which forms the south boundary of the Berea College brick yard. This land had never been cultivated.

No. 830—Subsoil, 6″-15″ of No. 829.

No. 831—Surface soil collected at the same time on the Moore farm within 50 feet of the west side of the right of way of L. & N. Ry. and just west of the old Berea College brick yard and close to No. 829. The sample was taken from an old field which had been cultivated for 55 years or longer and no fertilizer used. It was badly depleted of humus. The land had been rotated in corn, wheat or oats, meadow and pasture in irregular succession. The crops usually expected were 15 to 20 bushels of corn; 6 to 8 bushels of wheat; 10 to 15 bushels of oats and ½ ton of hay per acre.

No. 832—Subsoil, 6″-15″ of No. 831.

### SULPHUR AND PHOSPHORUS IN SOILS OF SILURIAN AREA.

| | | Virgin Surface Soil Pounds per Acre | | Cultivated Surface Soil Pounds per Acre | |
|---|---|---|---|---|---|
| No. | County | Sulphur | Phosphorus | Sulphur | Phosphorus |
| 817-20 | Jefferson | 700 | 980 | 380 | 840 |
| 829-32 | Madison | 820 | 1,180 | 580 | 920 |
| Average | | 760 | 1,080 | 480 | 880 |

| | | Virgin Subsoil Pounds per Acre | | Cultivated Subsoil Pounds per Acre | |
|---|---|---|---|---|---|
| No. | County | Sulphur | Phosphorus | Sulphur | Phosphorus |
| 817-20 | Jefferson | 340 | 700 | 320 | 660 |
| 829-32 | Madison | 520 | 900 | 420 | 880 |
| Average | | 430 | 800 | 370 | 770 |

### RIVER ALLUVIAL AREA.

No. 676—Daviess County. Surface soil collected in 1910 on the farm of S. Hagan, 1 mile east of Burks City and 4 miles south of Stanley, from a field which had been cultivated for 25 years and no fertilizers used. It produced about 50 bushels of corn; 20 bushels of wheat; 1,200 pounds of tobacco and 1½ tons of clover and hay per acre.

No. 677—Surface virgin soil collected in 1910 on the Hagan farm from a woodland pasture.

No. 678—Daviess County. Surface soil collected in 1912 on the farm of S. Hagan, 1 mile east of Burks City, 9 miles west of Owensboro, and 3 miles south of Stanley, from a field which had been cultivated for 30 years and no fertilizers used. It produced about 50 bushels of corn; 1,200 pounds of tobacco; 25 bushels of wheat and 1 ton of timothy per acre.

No. 679—Surface soil collected in 1912 on the same farm as No. 678, from a cultivated field, the soil of which was of a peaty character and overflows three or four times a year, otherwise, it is the same as No. 678.

No. 680—Surface virgin soil collected in 1912 on the same farm as No. 678, and was about the same character of soil.

No. 711—Jefferson County. Surface virgin soil collected in 1912 on the farm of M. V. Joyes, 10 miles southwest of Louisville, 2 miles west of the interurban and 1 mile east of the Ohio river. This is Ohio river bottom land and the sample was taken from the northwest part of the farm.

No. 712—Subsoil of No. 711.

No. 713—Surface soil collected in 1912 on the Joyes farm from a field at the back part of the farm about 150 yards from the road leading to the Ohio river. It had been cultivated for 60 to 75 years and no fertilizers used. It produced about 25 to 30 bushels of corn and 8 to 12 bushels of wheat per acre.

No. 714—Subsoil of No. 713.

No. 825—Henderson County. Surface soil collected in 1913 on the farm of C. E. Harness, 12 miles west of Henderson, from a field which had been cultivated for 50 years and no fertilizers used. It was considered very good land. Corn, wheat, clover and tobacco have been the usual crops and produced about 60 to 80 bushels of corn and 2 tons of red clover hay per acre.

No. 826—Subsoil of No. 825.

No. 827—Surface virgin soil collected at the same time on the Harness farm and near No. 825.

No. 828—Subsoil of No. 827.

## SULPHUR AND PHOSPHORUS IN SOILS OF RIVER ALLUVIAL AREA.

| No. | County | Virgin Surface Soil Pounds per Acre Sulphur | Virgin Surface Soil Pounds per Acre Phosphorus | Cultivated Surface Soil Pounds per Acre Sulphur | Cultivated Surface Soil Pounds per Acre Phosphorus |
|---|---|---|---|---|---|
| 676-7 | Daviess | 740 | 1,840 | 840 | 1,620 |
| 678, 680 | Daviess | 460 | 1,820 | 560 | 1,360 |
| 679 | Daviess | ..... | ..... | *1,260 | *1,880 |
| 711-14 | Jefferson | 540 | 1,760 | 580 | 1,340 |
| 825-8 | Henderson | 700 | 1,480 | 620 | 1,400 |
| Average | | 610 | 1,725 | 650 | 1,430 |

| No. | County | Virgin Subsoil Pounds per Acre Sulphur | Virgin Subsoil Pounds per Acre Phosphorus | Cultivated Subsoil Pounds per Acre Sulphur | Cultivated Subsoil Pounds per Acre Phosphorus |
|---|---|---|---|---|---|
| 711-14 | Jefferson | 740 | 1,400 | 440 | 1,520 |
| 825-8 | Henderson | 660 | 1,180 | 460 | 1,260 |
| Average | | 700 | 1,290 | 450 | 1,390 |

In the following tables, the average amounts of sulphur and phosphorus in the soils of the different areas have been arranged so as to show the actual losses of each element caused by cultivation. Although the number of samples worked upon was limited in certain areas, the average amounts of phosphorus found agree fairly well with the general average of other analyses made by the Station and generally used as representing these areas.

The fact that some of the cultivated soils in certain areas contain considerably larger amounts of phosphorus than the corresponding virgin soils, is probably due to the frequent occurrence of phosphates in streaks and pockets. Some of the soils were abnormal in this respect which of course, from the limited number work-

* Omitted from the average.

ed upon, materially affected the averages, especially in the Cincinnatian and Trenton areas.

In the Keokuk-Waverly area, commercial fertilizers had been used which may explain why both the sulphur and phosphorus content has been maintained in this area.

The results obtained on some of the cultivated soils from the other areas are also probably due to the fact that barnyard manure or commercial fertilizers had been used in former years for as stated before, it was impossible in several instances to obtain a very accurate history of the soil since it had been in cultivation.

The Station averages were obtained from the analyses of a much larger number of samples, some of which perhaps were virgin soils, but a large majority had been in cultivation. The average amounts of potassium obtained in the same manner and the approximate number of square miles in each area are included.

## AVERAGE NUMBER OF POUNDS PER ACRE OF SULPHUR AND PHOSPHORUS IN THE VIRGIN AND CULTIVATED SURFACE SOILS OF THE GEOLOGICAL AREAS OF KENTUCKY AND LOSS DUE TO CULTIVATION

| Area | Virgin | | Cultivated | | Per Cent Loss Due to Cultivation | |
|---|---|---|---|---|---|---|
| | Sulphur | Phosphorus | Sulphur | Phosphorus | Sulphur | Phosphorus |
| Eastern Coal Fields | 598 | 1,337 | 371 | 1,031 | 38 | 23 |
| St. Louis-Chester | 513 | 787 | 380 | 505 | 26 | 36 |
| Cincinnatian | 880 | 1,920 | 580 | 2,580 | 34 | 34* |
| Western Coal Fields | 560 | 907 | 413 | 787 | 26 | 13 |
| Keokuk-Waverly | 360 | 540 | 350 | 555 | 3 | 3* |
| Quaternary | 550 | 920 | 320 | 810 | 42 | 12 |
| Trenton | 815 | 5,550 | 724 | 7,460 | 11 | 34* |
| Devonian | 1,027 | 2,053 | 593 | 1,687 | 42 | 18 |
| Silurian | 760 | 1,080 | 480 | 880 | 37 | 19 |
| River Alluvial | 610 | 1,725 | 650 | 1,430 | 7* | 17 |

* Increase.

## AVERAGE NUMBER OF POUNDS PER ACRE OF SULPHUR AND PHOSPHORUS IN THE VIRGIN AND CULTIVATED SUBSOILS OF THE GEOLOGICAL AREAS OF KENTUCKY AND LOSS DUE TO CULTIVATION.

| Area | Virgin | | Cultivated | | Per Cent Loss Due to Cultivation | |
|---|---|---|---|---|---|---|
| | Sulphur | Phosphorus | Sulphur | Phosphorus | Sulphur | Phosphorus |
| Eastern Coal Fields | 368 | 964 | 220 | 886 | 40 | 8 |
| St. Louis-Chester | 1,080 | 680 | 480 | 520 | 56 | 24 |
| Cincinnatian | ..... | ..... | ..... | ..... | ..... | ..... |
| Western Coal Fields | 353 | 787 | 313 | 720 | 11 | 9 |
| Keokuk-Waverly | 213 | 460 | 167 | 387 | 22 | 16 |
| Quaternary | 230 | 760 | 160 | 760 | 30 | 0 |
| Trenton | 587 | 5,860 | 560 | 7,240 | 5 | 24* |
| Devonian | 220 | 320 | 180 | 320 | 18 | 0 |
| Silurian | 430 | 800 | 370 | 770 | 14 | 4 |
| River Alluvial | 700 | 1,290 | 450 | 1,390 | 36 | 8* |

## AVERAGE NUMBER OF POUNDS PER ACRE OF PHOSPHORUS AND POTASSIUM IN THE CULTIVATED SURFACE SOILS OF THE GEOLOGICAL AREAS OF KENTUCKY ACCORDING TO STATION ANALYSES.

| Area | Approximate Number Square Miles† | Phosphorus | Potassium |
|---|---|---|---|
| Eastern Coal Fields | 10,000 | 700 | 25,000 |
| St. Louis-Chester | 8,000 | 800 | 25,000 |
| Cincinnatian | 7,900 | 2,000 | 35,000 |
| Western Coal Fields | 4,500 | 700 | 26,000 |
| Keokuk-Waverly | 4,400 | 550 | 21,000 |
| Quaternary | 2,460 | 850 | 29,000 |
| Trenton | 1,200 | 5,000 | 30,000 |
| Devonian | 900 | ..... | ..... |
| Silurian | 875 | ..... | ..... |
| River Alluvial | 1,048 | ..... | ..... |

* Increase.

† Taken from Preliminary Geological Map of Kentucky made by J. B. Hoeing, C. E., in 1907.

## GENERAL DISCUSSION.

In a majority of the soils, there has been a considerable loss of sulphur from cultivation and if all the samples had been collected for this work, the differences would undoubtedly have been greater, since in practically all cases where the samples were so taken, large differences between the sulphur content of the virgin and cultivated soils were found. The reason of this is, that their history was better known and as the virgin and cultivated samples were taken very close together, they were of the same character.

The counties in which the samples were collected for this purpose were Wolfe, Graves, Warren, Henderson and Madison and also Nos. 813 to 820 from Metcalfe and Jefferson. Altogether there were forty samples from these counties and among this number, only one from Metcalfe, contained more sulphur in the cultivated than in the virgin soil and this was probably due to the use of commercial fertilizers as the phosphorus was also slightly higher. In the remainder, the amounts of sulphur and phosphorus in the virgin surface and subsoils were larger than in the corresponding samples from the cultivated areas and in nearly every case, the surface soils in both the virgin and cultivated areas contained more of these elements than their respective subsoils.

In most of the soils from the other counties, a greater or less depletion of the sulphur has taken place from cultivation. In the River Alluvial area, the cultivated surface soils usually contained more and their subsoils less sulphur than the corresponding virgin samples. The Alluvial soils are so changeable in character due to overflows, that they will vary greatly in short distances from each other. The results on the only samples that were collected for this work from this area, namely those from Henderson county, however, showed considerably more sulphur in the virgin than in the cultivated soil.

As a rule, we find from the above, that a large majority of the soils contain much less sulphur than phosphorus while the amounts removed by the average crop, although in some cases somewhat less, still compare very favorably with the phosphorus. Again it might be mentioned that some crops contain considerably larger amounts of sulphur than phosphorus. It is probably safe to assume that nearly all of the general farm crops contain more sulphur than

phosphorus in proportion to each element contained in our average soil.

If the above is true, then we must admit that sulphur should be ranked along with phosphorus, potassium and nitrogen as one of the chief or limiting elements and indeed so far as the amounts of each contained in the soils of the entire state are concerned, there is undoubtedly less sulphur than any of the other three elements.

When we consider permanent soil fertility, we generally concede that the nitrogen is a variable constituent and that the nitrogen content of the soil can be maintained from that in the air, provided leguminous crops are grown and plowed under.

In this state, the potassium content of practically all of the soils is large, and by turning under green crops, a sufficient amount of potassium can more than likely be rendered available by the organic acids of the decaying vegetable material, to furnish the amounts required by crops.

The phosphorus content of many of our soils outside of those in certain areas, is generally low and undoubtedly applications of phosphate rock or phosphorus in other forms will prove beneficial.

The only element remaining of the four enumerated above, is sulphur and the only possibility of the sulphur content being maintained, other than by the addition of materials containing it, is through the rain water. The amount of sulphur brought down by the average annual rainfall to an acre surface is about 7.4 pounds according to late determinations made at the Rothamstead Station in England which has made the longest observations. As England burns large amounts of soft coal, it is presumed that this amount exceeds the average in this country which is not so densely populated.

Hart and Peterson, in their work mentioned above, have also found in Wisconsin that 4.3 pounds of sulphur per acre were brought down in their rainfall for 5 months and from these data, they estimate that the annual amount would be from 6.8 to 7.2 pounds per acre.

If no losses of sulphur occurred in soils other than the amounts removed by crops, the quantity supplied by the rain together with that in the soil would be ample for all future needs. However, the annual loss by drainage undoubtedly exceeds the amount sup-

plied by the rain and consequently the soil is being constantly depleted of this element, as the results in the foregoing show.

Hall,[17] in his discussion of the losses by drainage from the Rothamstead experimental fields, states that the annual drainage from the unmanured plots removes about 20 pounds of sulphur per acre, while in the manured plots it ranges from 34 to 88 pounds annually per acre.

It is evident from the above that the loss by drainage is about treble the amount brought down in the rain but of course this will vary in different soils and localities. It is safe to assume that in this state, the loss by drainage probably exceeds and undoubtedly equals the amount derived from the rain, since most of our drainage waters contain considerable quantities of sulphates judging from the amounts found in our spring and well waters. The fact that more sulphur than phosphorus or potassium is lost through drainage, is in harmony with what has been proven in regard to these three elements, for it has been found that the phosphorus in phosphates and potassium in its salts are largely retained or fixed when they are added to the soil, while sulphates are readily lost by leaching and the analysis of the drainage waters from the Rothamstead Station plots shows this to be the case.*

The problem of having a permanent supply of phosphorus in our soils for the needs of future crops has become a serious one in our own and other states. It seems from the above that the sulphur supply is just as serious a problem, or more so, for if the average crop removes nearly as much sulphur as phosphorus, while the average soil contains considerably less, and furthermore is losing larger amounts in the drainage, then it is only a matter of time before the soil will show the effect in its smaller crop production.

The only means we have to replenish this loss is by repeated applications of materials that contain sulphur, and these are farm manure, calcium sulphate or gypsum, commercial fertilizers such as acid phosphates or superphosphates, potassium sulphate, ammon-

* A recent analysis of a spring water on the Kentucky Station farm during a prolonged drought showed this water to contain these elements in the following amounts:

| | | | | |
|---|---|---|---|---|
| Calcium | 48.96 | parts | per | million |
| Magnesium | 4.49 | " | " | " |
| Sodium | 4.23 | " | " | " |
| Sulphur | 3.04 | " | " | " |
| Potassium | .47 | " | " | " |
| Phosphorus | .39 | " | " | " |

ium sulphate and finally the element itself, but it is preferable that experimental field trials should be made with this material before it can be recommended as a fertilizer.

Field trials with sulphur are highly desirable to determine its effect on the soil, for if found satisfactory, it has an advantage in cost for the element could probably be supplied cheaper in this material than in any other form.

Without attaching any importance to the fact, we have always practiced adding combined sulphur in many of our fertilizers and it may be that the beneficial results in some cases derived from the use of acid phosphate which contains calcium sulphate, over ground rock phosphate or other untreated phosphates, can be explained as partly due to the sulphate in the acid phosphate which contains from 80 to 120 pounds of sulphur per ton. Other forms in which sulphur has been unconsciously added are potassium sulphate, which contains about 360 pounds per ton; ammonium sulphate, about 400 pounds per ton, and gypsum or land plaster which has about 360 pounds per ton.

Applications of gypsum were formely recommended and sometimes used in this state as a soil stimulant but it was not supposed to furnish any plant food. One of its functions, as has been proven, is to liberate potassium from silicates to form potassium sulphate, the sulphur probably being furnished by the gypsum. In addition to the above good effect, gypsum probably supplies sulphur as a plant food.

The superior results obtained by the use of potassium sulphate over the chloride on certain crops, such as tobacco, etc., may also be partly due to the sulphur.

The writer has tried some pot experiments on the effect of adding flowers of sulphur to the Graves county soil referred to in the tables and afterwards growing Yellow Pryor tobacco in the same and has obtained some very interesting results which will be published in a future article. This soil was very poor and had a bad physical condition and it was found that sulphur applied at the rate of 100 and 500 pounds per acre in conjunction with the other plant food elements, together with calcium carbonate, gave a gain of 10 per cent and 24 per cent respectively in the green weights, but when used alone, no increase was obtained. This was probably due to the fact that this soil needed other elements of plant food.

It was also proven that calcium sulphate in the same manner gave a decided gain and furthermore it was found that the sulphur was rapidly oxidized to sulphate.

It is the writer's intention to continue the pot experiments and probably field trials with sulphur in various forms on other plants in the near future.

## SUMMARY.

1. Different investigators have found that flowers of sulphur, when added to the soil, has given decided increases in the yields of certain crops such as potatoes, beans, peas, onions, beets, celery, parsnips, asparagus, rutabagas, mangolds, barley and rye. Others have shown that sulphur in certain instances seems to improve the bacterial flora of the soil and that sulphur is rapidly converted into sulphates. The writer has also found that tobacco, under certain conditions, was materially benefited by applications of sulphur and gypsum and that sulphur was rapidly oxidized to sulphate in the soil.

2. It has also been found by other workers that applications of sulphates were beneficial in crops having a high percentage of albuminoids and that the feeding value of these crops are thereby improved.

3. Hart and Peterson have found that the amount of sulphur removed by crops is considerable, being equal in the case of average crops of cereal grains and straws to about two-thirds of the phosphorus removed by these crops; the grasses of mixed meadow hay remove quite as much sulphur as phosphorus, while the legume hays may approach and in the case of alfalfa, even exceed in this respect. Members of the Cruciferae, as the cabbage and turnip, are heavy sulphur using crops and may remove two to three times as much sulphur as phosphorus. They have also shown that soils cropped for 50 to 60 years and unmanured have lost on the average 40 per cent of the sulphur originally present by comparison with the virgin soil.

4. The writer has worked upon representative samples of soils from every geological area in this state and has found that in almost

all cases, constant cultivation without manuring shows a loss of sulphur, and in some cases very large when compared with the corresponding virgin soil. The same results were obtained with the subsoils.

5. There is a considerable variation in the sulphur content of the soils from the different areas and even in the same area, both in the virgin and cultivated surface and subsoils. As a rule, however, the better agricultural areas show the higher sulphur content as they do of phosphorus, showing a concordance between the sulphur and phosphorus and the agricultural value.

6. The virgin and cultivated surface soils generally contain more sulphur than their corresponding subsoils.

7. The total phosphorus was also determined in the samples and while there are large differences in some of the soils from the same area, the phosphorus content was much higher than the sulphur in nearly every sample used in the work.

8. More sulphur is probably lost through drainage than is brought down in the rainfall and to maintain the sulphur content, it is necessary to add some material containing it to the soil. This can be done by repeated applications of manure or some of the commercial fertilizers such as acid phosphate or superphosphate, which contains calcium sulphate or by the use of potassium or ammonium sulphate. Sulphur can also be supplied by calcium sulphate (gypsum) or land plaster as it is sometimes called. This substance was formerly more generally used as a soil stimulant but undoubtedly supplies sulphur in addition to its other good effects.

9. The facts in the foregoing being the case, it is evident that any system of permanent soil fertility without the addition of sulphur in some form or other, will doubtless prove a failure in maintaining the sulphur content of our soils.

In conclusion, the writer desires to thank the County Agents; also Dr. A. M. Peter, Prof. S. C. Jones and others who have assisted in the selection of the soils used in this work.

## REFERENCES:

1. Wis. Agr. Exper. Sta., Research Bull. No. 14.

2. Chem. Centr., 1899, ii, 487 from J. Russ Physic. Chem. Soc. 31, 471-77; Jour. Chem. Soc., (London), Vol. LXXVIII, 1900, ii, 160.

3. Jour. Agr. Sci., 1905, i, 217-29.

4. Loc. cit.

5. Jour. Agr. Prat. n. ser. 21, (1911) No. 14, pp. 427-29, abs. in Engrais 26, (1911), No. 25, pp. 684-85; Rev. Gen. Sci., 22, (1911), No. 10, pp. 392-93; Exper. Sta. Rec., 25, page 519.

6. Compt. Rend. Acad. Sci., (Paris), 154, (1912), No. 6, pp. 369-370; Exper. Sta. Rec., 27, page 27.

7. Comp. Rend. Acad. Sci., (Paris), 154, (1912), No. 8, pp. 524-26 abs. in Rev. Sci., (Paris), 50, (1912), I, No. 9, page 285; Jour. Chem. Soc., (London), (1912), Vol. CII, ii, 382; Exper. Sta. Rec., 26, page 819.

8. Compt. Rend., 1912, 155, 327-29; Jour. Chem. Soc. (London), 1912, Vol. CII, ii, 971.

9. Zhur. Opytri., Agron. (Russ. Jour. Expt. Landw.) 13, (1912) No. 6, pp. 817-22, fig. 1, abs. in Internat. Inst. Agr., (Rome), Mo. Bul. Agr., Intel. and Plant Diseases, 4, (1913), No. 3, pp. 381, 882; Exper. Sta. Rec., 28, page 726.

10. Deut. Landw. Presse., 39, (1912), No. 23, page 275; Exper. Sta. Rec., 27, page 422.

11. Prog. Agr. et. Vit., (Ed. l'est, Centri.) 33, (1912), No. 11 pp. 321-24; Exper. Sta. Rec. 27, page 422.

12. Compt. Rend., 1913, 156 pages 725-28; Jour. Chem. Soc., (London) 1913, Vol. CIV, i, 579.

13. Rev. Vit., 38, 381-9; Chem. Abs. of Amer. Chem. Soc., Vol. 7, page 529.

14. Chem. Abs. of Jour. Amer. Chem. Soc., Vol. 7, page 1071.

15. Bol. Quind. Soc. Agr. Ital., 17, 425-29; Chem. Abs., of Amer. Chem. Soc., Vol. 7, page 1254.

16. Zeitsch. Zuckerind, Bohm., 1913, 37, 441-44; Jour. Chem. Soc., (London), 1913, Vol. CIV, i, 810.

17. A. D. Hall; The Soil, page 200.

# Kentucky

# Agricultural Experiment Station

of the

## State University

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BULLETIN NO. 175

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# The Growing and Fattening of Hogs in the Dry Lot and on Forage Crops

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LEXINGTON, KENTUCKY
OCTOBER 31, 1913

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# BULLETIN NO. 175

## THE GROWING AND FATTENING OF HOGS IN THE DRY LOT AND ON FORAGE CROPS

By Edwin S. Good.

### INTRODUCTION

Kentucky is admirably adapted for the production of pork, as this State does not have the long cold winters of the North, nor the long hot summers of the South. Then, too, Kentucky grows large crops of corn and other cereals which can be used in swine-feeding operations. Abundant forage crops for grazing can be grown in almost any part of the State.

Kentucky raises about 2,500,000 hogs yearly, and if only $1.00 per head can be saved in the feeding of these animals, it would mean in the aggregate the saving of a large sum annually to the farmers of this State.

There are some stock raisers who question whether it is profitable to feed high-priced corn to hogs, and, as a result, when corn is high they sell their hogs including the breeding stock. The rise in price of corn may be only temporary. People who follow such a practice never make money in the hog business, for, having sold their brood sows, they are generally in the market for breeding stock when hogs are high in price. The men who have made the most money in the raising and feeding of hogs have remained in the business year after year. A man in this State who has built up his fortune largely in the raising, buying and feeding of hogs and mules, once said to the writer, "The raising and feeding of hogs is the poor farmer's fortune and the rich farmer's protection".

It was to throw some light on the general principles of the feeding of hogs in the dry lot, as well as on forage crops, that the experiments recorded in this bulletin were conducted.

In most of these cases, the pigs were put on experiment at, or soon after, weaning time and fed until they had reached a size and condition suitable for the market.

The breed of hogs used in these experiments has been the Berkshire, not that we consider this breed better than the others for experimental purposes, but because this breed was on the Experiment Station farm when the author of this bulletin began his investigations. Other breeds are now being introduced and will be used in connection with Berkshires in future experiments.

## The Feeding of the Sow and Pigs From Birth of Pigs to Weaning Time.

Each sow on the Experiment Station farm is bred twice a year. The day the sow farrows she is allowed no feed, but is given water to drink. For the next two or three days she is given a very light feed of ship stuff or middlings in the form of a thin slop. On the fifth day after farrowing, corn meal is introduced into the ration (feed for one day), which consists of about 1 pound of corn meal, 4 pounds of ship stuff and $\frac{1}{10}$ pound of tankage. These feeds are gradually increased, so that at the end of 10 days the ration consists of about 3 pounds of ship stuff, 3 pounds of corn meal and $\frac{1}{2}$ pound of tankage. These feeds are again increased, so that at the end of 30 days the sow is practically on a full feed, a ration of corn meal 7 pounds, ship stuff or middlings 5 pounds, and tankage 1 pound. It must be remembered, however, that the amount of feed given a sow should depend upon her size, the number of pigs she is suckling, and her ability to give milk. If the sow is overfed at first, the flow of milk may be so great that the pigs will get too much of it, which will cause scours and thumps. We aim, on the average, to give the brood sow when on full feed, about 4 per cent. of her

weight in grain per day. This is fed in the form of a rather thin slop. If skim milk is to be had, it is well to add a limited amount to this feed. Some sows are capable of giving but little milk and begin to fatten as soon as the feed is increased, hence it is necessary to reduce the feed in such cases. Such a sow does not usually produce thrifty pigs, and we sell her to the butcher. In a few instances, we have given as high as 20 pounds of grain per day to a 300-pound sow having 8 thrifty pigs, the sow being a good suckler. Part of this feed, however, was eaten by the pigs, as we make the troughs long enough so that the pigs, when old enough to do so, can eat with the sow. We wean the pigs when they are from 2 to 2½ months of age. For 2 or 3 days before the pigs are weaned, the feed given the sow is much reduced so as to dry up the milk secretion. The pigs are taken from the sow at once, and but little feed given to her for several days. By this method the udders of the sow are not damaged from being gorged with milk when the pigs are weaned.

From the time the pigs are weaned until put on experiment, they are given the same mixture as that fed to the sow, and the feed limited so that they always have a keen appetite. They are fed twice a day.

If at any time we had reason to believe that our pigs were infected with worms, we gave them the following mixture:

| | |
|---|---|
| Santonin | 2½ grains. |
| Areca nut | 1 dram. |
| Calomel | 1 grain. |
| Sodium bicarbonate | 1 dram. |

The above is a dose for a 100-pound pig, and the dosage may be increased or decreased according to the size of the animal. The pigs are starved for 12 hours previous to giving the remedy. The medicine is thoroughly stirred in a small amount of ground feed, and the dose repeated in 10 days.

## Nutrients in Feed Stuffs.

All feed stuffs contain 4 classes of nutrients in varying amounts, namely, proteins, carbohydrates, fat and ash. Protein is absolutely essential to the life of the cells of the ani-

mal and for the production of bone and muscle. Carbohydrates, of which starch and sugar are examples, are used by the body for the production of heat, energy and fat. The fat found in the different feed stuffs may be utilized by the animal body for the production of heat and energy, or with little change it may be deposited in the tissues as fat. Ash is not only essential for the building up of the bones of the body, but is present in varying proportions in every tissue and fluid of the body. It is self evident that the young growing animal needs more of the muscle and bone-building material than does an animal which has practically attained its growth, and hence requires more protein and ash in proportion to its weight than does an older animal. Animals that have practically received their growth and are ready to be made fat, can use larger amounts of the feeds rich in carbohydrates and fat, because it is from such nutrients that fat is mostly formed. Such animals, however, need some protein in their feed.

## Corn.

Corn is king of cereals. The annual crop in the United States is generally estimated to be worth $1,500,000,000.00. Corn in this country enters more largely into the feeding of swine than any other cereal. Corn is rich in carbohydrates, consequently is one of the best feeds for the production of fat. Corn, however, has its limitations as an efficient feed for the growing of young animals if fed in connection with no other grain or with a forage crop, on account of the small amount of protein and ash which it contains. Important light has recently been thrown upon the nature of the protein content of corn. The protein in a kernel of corn is made up of the following proteins: zein, 58 per cent., globulins, albumins and proteoses together, 6 per cent., and maize glutelin, 36 per cent. Osborne and Mendel[1] found that in the feeding of rats on a ration free of any protein, with the exception of zein, they made no growth—in fact, lost weight. It looks

[1]. Science. N. S. Vol. 37, No. 944, Jan. 31, 1913. "The Nutritive Value of the Proteins of Maize."

quite conclusive from the results of this experiment, that the protein "zein" does not fulfil the function of a true protein, and, as a consequence, a little over half of the protein content of corn is of no value to the animal. Corn contains about 10 per cent. protein, and if half of this amount has no food value, this grain must be considered as very deficient in this material.

Corn, as has been pointed out by Forbes, Snyder and Burnett[1], is also very deficient in ash.

Dietrich[2] found that young pigs fed corn alone, gained but 20 pounds per head in 6 months, which coincides closely with the results obtained by us in the feeding of young pigs, as indicated in Lot 1 of Experiment 1, tabulated on page 318 of this bulletin. It is our experience that the older the pigs before being put on a sole ration of corn, the larger and cheaper are the gains secured. This can readily be seen by comparing the results of Lot 1, p. 318; Lot 1, p. 327; Lot 1, p. 330.

There is no reason, however, why corn should not make up a part of the feed of a young pig, provided that feeds rich in protein are given with it. Most of the experiments described in this bulletin give the results of supplementing corn with different feeds and with forage crops in the growing and fattening of swine.

Our experiments have been conducted along two distinct lines of feeding, namely: *Part I, the growing and fattening of hogs in the dry lot; Part II, the growing and fattening of hogs on forage crops.*

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1. H. Snyder, Minnesota Exp. Sta. Bul. 26; E. B. Forbes, Missouri Exp. Sta. Bul. 81; E. A. Burnett, Nebraska Exp. Sta. Bul. 107,
2. Circular No. 126, Illinois Exp. Sta., p. 11.

# PART I.

## The Growing and Fattening of Hogs in the Dry Lot.

By "dry lot feeding" is meant the feeding of grain to pigs in a lot devoid of any forage crop.

### Shelter and Dry Lots Used in These Experiments.

Each dry lot used in these experiments contains exactly one-tenth of an acre. The troughs for feeding purposes are at one end of the lot and the inclosed sheds for shelter are situated at the other end of the lot. The trough is so constructed that no pig can gain access to the feed until all the feed is put into the trough. The trough is also divided into sections, the partitions reaching within 6 inches of the bottom of the trough so as to prevent crowding and pushing while the pigs are eating. The free space below the partitions allows an equal distribution of the feed. The sheds are large enough to give all of the pigs plenty of room, and are inclosed during the late fall and winter months, with the exception of an opening at one side large enough for the pigs to enter. They are kept dry, well bedded and free from vermin.

### Feeding.

The pigs used in all of the experiments were fed grain twice a day. The feeding was done at 7 o'clock in the forenoon and at 4 o'clock in the afternoon. The kind of grain fed these different lots is indicated under the specifications of each experiment. All the grain fed, unless otherwise indicated, was finely ground. During the first two years of our experimental work, the hogs were allowed free access to the following mixture.

| | |
|---|---|
| Slack | 2 bushels |
| Air-slaked lime | 2 quarts |
| Salt | 2 pounds |
| Wood ashes | 1 bushel |
| Copperas (Iron sulphate) | 1¼ pounds |

The copperas was dissolved in warm water, poured over the mass and all thoroughly stirred together. We came to the conclusion that the pigs ate too much of this mixture and thus lessened their capacity for the consumption of grain. Thereafter the pigs were allowed a moderate amount of this mixture three times a week. At first, all the salt allowed the hogs was obtained from the mixture. When the amount of coal mixture was reduced, salt was added and stirred into the feed at the rate of $\frac{1}{3}$ ounce daily, per hundred pounds weight of hog. The pigs had access to water at all times.

## Experiment 1.

This experiment, the results of which are tabulated in Table 1, was conducted to compare the efficiency of corn alone and corn supplemented by feeds containing more protein and ash, in the growing and fattening of young pigs. These pigs were fed in dry lots. Being fed through the hot summer months, not as good results were obtained as if this experiment could have been carried on for a longer period during the spring or fall. At the beginning, these pigs were divided into lots as equally as possible, so as to eliminate individuality and sex. In addition to the grain given, all lots of pigs were allowed the coal mixture ad libitum.

Table 1, page 318, gives a synopsis of the feeds fed and results obtained in this experiment.

## Experiment 1, Table 1.

Experiment began Jan. 22, 1908 and closed in Lot 1, Aug. 5, 1908, and in Lots 2, 3, and 4, Sept. 1, 1908.

| | Lot 1. Corn meal, alone. | Lot 2. Corn meal, Middlings, Oil meal, Tankage. | Lot 3. Corn meal 1 part, Ship stuff 1 part. | Lot 4. Corn meal 1 part, Middlings, 1 part. |
|---|---|---|---|---|
| No. of pigs in experiment | 4 | 4 | 10 | 10 |
| Days on experiment | 196 | 223 | 223 | 223 |
| Av. first weight, lbs. | 39 | 40 | 38 | 39 |
| Av. final weight, lbs. | 64 | 303 | 224 | 217 |
| Av. gain per pig, lbs. | 25 | 263 | 186 | 178 |
| Daily gain per pig, lbs. | .127 | 1.178 | .834 | .798 |
| Total lbs. grain fed[1] | 1525 | 4768 | 9802 | 9081 |
| Av. grain eaten per pig daily, lbs. | 1.945 | 5.346 | 4.395 | 4.072 |
| Lbs. grain per 100 lbs. gain | 1525 | 453 | 526 | 510 |
| Cost[2] of 100 lbs. gain | $17.85 | $5.93 | $6.65 | $6.56 |
| Lbs. gain per bu. (56 lbs.) grain | 3.67 | 12.36 | 10.66 | 10.98 |
| Cost of 1 bu. (56 lbs.) grain | $0.655 | $0.733 | $0.707 | $0.721 |
| Amt. realized per bu. (56 lbs.) grain, pork at $7.00 | $0.256 | $0.865 | $0.746 | $0.768 |
| Amt. realized per bu. (56 lbs.) grain, pork at $8.00 | $0.293 | $0.988 | $0.852 | $0.878 |

[1]Tankage included in Lot 2.
[2]Based on the following prices of feeds:
Corn 60 cents per bu., plus $2.00 per ton for grinding=$23.42 a ton.
Middlings, $28.00 per ton.
Ship stuff, $27.00 per ton.
Oil meal, $40.00 per ton.
Tankage, $47.00 per ton.

The feed eaten by Lot 1, was 1525 lbs. corn meal in 196 days; by Lot 2, corn meal 1972 lbs., middlings 2773 lbs., oil meal 17.3 lbs., tankage 6.25 lbs.; Lot 3, corn meal 4756 lbs., ship stuff 5046 lbs.; Lot 4, corn meal 4435 lbs., middlings 4646 lbs.

It was soon quite noticeable that the 4 pigs receiving corn meal alone were not gaining like the pigs in the other lots. As the experiment progressed, their frames remained small, and in appearance they were lank and the hair staring. On August 5th, after having been fed 196 days, they weighed but 64 pounds, a gain of only 25 pounds per pig. Compare Plate

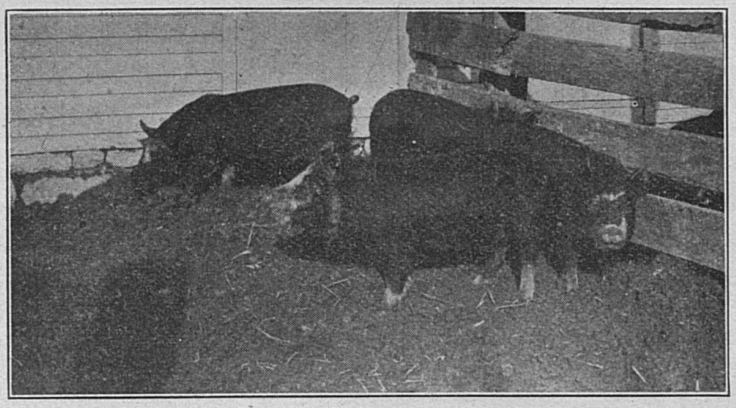


PLATE 1.—Pigs of Lot 1, Experiment 1, at the beginning of the experiment. Average weight at beginning of test 39 pounds.

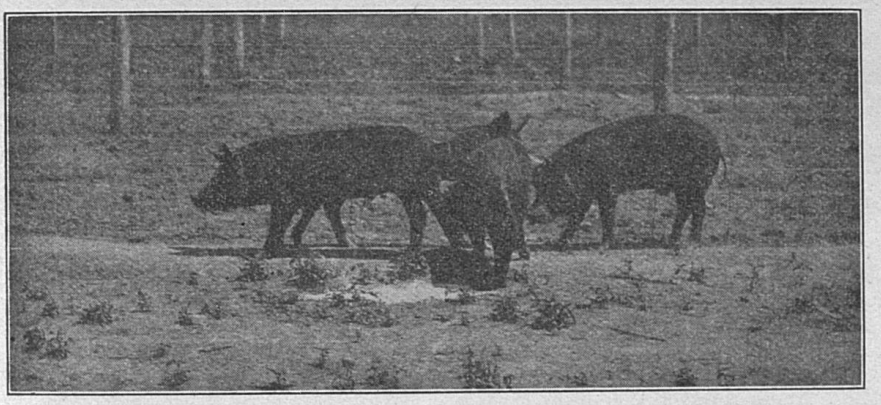


PLATE 2.—Pigs of Lot 1, Experiment 1, as they looked after being fed 196 days in the dry lot on corn meal alone. Average weight at this time 64 pounds. See page 318.



PLATE 3.—Pigs of Lot 1, Experiment 1, as they looked after being fed 155 days on a balanced ration. Average weight at this time 276 pounds. See pages 318, 320, and 321.

1 with Plate 2, page 319. The appetite of these pigs at that time was very poor and their general condition indicated that they would not have lived much longer on this ration. The question then arose as to whether these pigs were permanently stunted or whether they could still be made to grow and fatten on a more balanced ration. On August 5th, therefore, we discontinued the feeding of corn to this lot of pigs, and ship stuff containing all the middlings was substituted. The results obtained between August 5, 1908, and January 7, 1909, we shall designate as the second experiment with this lot of pigs.

## Table 2.

Second experiment with Lot 1.

Experiment began Aug. 5, 1908, and closed Jan. 7, 1909.

| | |
|---|---|
| No. of pigs in experiment | 4 |
| Days on experiment | 155 |
| Av. first weight, lbs. | 64 |
| Av. final weight, lbs. | 276 |
| Av. gain per pig, lbs. | 212 |
| Daily gain per pig, lbs. | 1.368 |
| Total lbs. grain fed | 3607 |
| Av. grain eaten per pig daily, lbs. | 5.817 |
| Lbs. grain per 100 lbs. gain | 425 |
| Cost[1] of 100 lbs. gain | $5.31 |
| Lbs. gain per bu. (56 lbs.) grain | 13.17 |
| Cost of 1 bu. (56 lbs.) grain | $0.684 |
| Amt. realized per bu. (56 lbs.) grain, pork at $7.00 | $0.921 |
| Amt. realized per bu. (56 lbs.) grain, pork at $8.00 | $1.053 |

[1]Based on the following prices of feeds:
Corn, 60 cts. per bu., plus $2.00 per ton for grinding=$23.42 per ton.
Ship stuff, $27.00 per ton.
Green alfalfa, $3.00 per ton.
Alfalfa hay, $12.00 per ton.

The above lot ate 2576 lbs. corn meal, 1031 lbs. ship stuff, 434 lbs. green alfalfa, 63 lbs. alfalfa hay.

At first, these pigs had no appetite even for the ship stuff, and each pig would eat only 1 pound of this feed per day. Their appetite gradually increased, however, and 20 days after the second experiment was begun, each pig was eating at the rate of 4 pounds of ship stuff per day. Thirty

days after the beginning of the second experiment with this lot, green alfalfa was added to the ration. This alfalfa was cut daily, weighed and fed to the hogs in a deep trough. At first they ate this green alfalfa at the rate of 1 pound per pig per day, but their appetite became keener for this feed, and they were soon eating at the rate of 2 pounds daily. On November 13th, the alfalfa was killed by freezing, and alfalfa hay of good quality was substituted. The 4 pigs ate at the rate of 3 pounds of alfalfa hay per day. The feeding of hay was discontinued on December 3d. On September 22nd, 47 days after the beginning of the second experiment, corn meal was introduced into the ration. The 4 pigs received at this time 2 pounds of corn meal, 16 pounds of ship stuff and 4 pounds of green alfalfa. The corn meal was slowly increased and the ship stuff slowly decreased, so that on December 3d the pigs were getting at the rate of 34 pounds of corn meal and 4 pounds of ship stuff per day. The next day the ship stuff was eliminated and the pigs fed until the end of the experiment (33 days) on corn meal alone. The pigs weighed at the end of the experiment, 276 pounds per head. See Plate 3, page 319. In other words, these same pigs that made a gain of only 25 pounds per head in 196 days when fed corn meal alone, made a gain of 212 pounds per head in the next 155 days when given a ration containing considerable protein and then finished on corn meal alone.

The results of the first experiment with this lot of young pigs showed conclusively that corn alone is a poor feed for young pigs, because it is deficient in muscle and bone-building material. The second experiment with this lot of pigs demonstrates the value of feeds containing considerable protein and ash, such as ship stuff containing all the middlings, and green alfalfa, in the growing of young pigs in the dry lot. It also demonstrates that young pigs fed corn alone in the dry lot, although apparently permanently stunted by the feeding of corn alone, can be made to grow and fatten on a properly balanced ration.

LOT 2, TABLE 1.—The 4 pigs in this lot were given nearly a standard ration during the growing and fattening periods.

These 4 pigs started on a mixture of 6 pounds of middlings and 1/10 pound of tankage. These feeds were gradually increased, so that at the end of 40 days this lot was receiving 12 pounds of middlings and 7/10 of a pound of tankage per day. The tankage on hand having been exhausted at this time, oil meal was substituted. At the end of 75 days, corn meal was introduced into the ration and the oil meal discontinued. On this date the 4 pigs weighed 438 pounds and were receiving 2 pounds of corn meal and 16 pounds of middlings per day. From this time on, the corn meal was slowly increased and the middlings decreased, so that at the end of 195 days from the beginning of the experiment, the corn meal amounted to 16 pounds and the middlings to 13 pounds per day. At this time, the middlings was withdrawn from the ration entirely, and the pigs finished on corn meal alone. When the pigs in this lot were first fed corn meal alone, they ate at the rate of 28 pounds per day, which feed was gradually increased, so that at the end of the experiment this lot was receiving 40 pounds of corn meal per day. Considering that these pigs were but 2½ months of age at the beginning of the experiment, that they were fed in the dry lot during a very warm summer, and that they averaged 303 pounds at 10 months of age, the ration and the method used proved very satisfactory. See Plate 4. As corn has been high in price during the past few years, the results obtained with this lot indicate that middlings, or a good grade of ship stuff (ship stuff with all the middlings of the wheat), can be more profitably used in swine-feeding operations, especially in the feeding of young pigs in the dry lot.

LOT 3, TABLE 1.—This lot was given corn meal and ship stuff, half and half, during the entire experiment. This method is quite often followed in swine-feeding operations. The results obtained, as compared with Lot 2, show that these pigs did not receive sufficient protein to make the most economical gains, and that the method employed in feeding Lot 2 was more efficient than that used with Lot 3. See Plate 5.

LOT 4, TABLE 1.—This lot was given corn meal and mid-

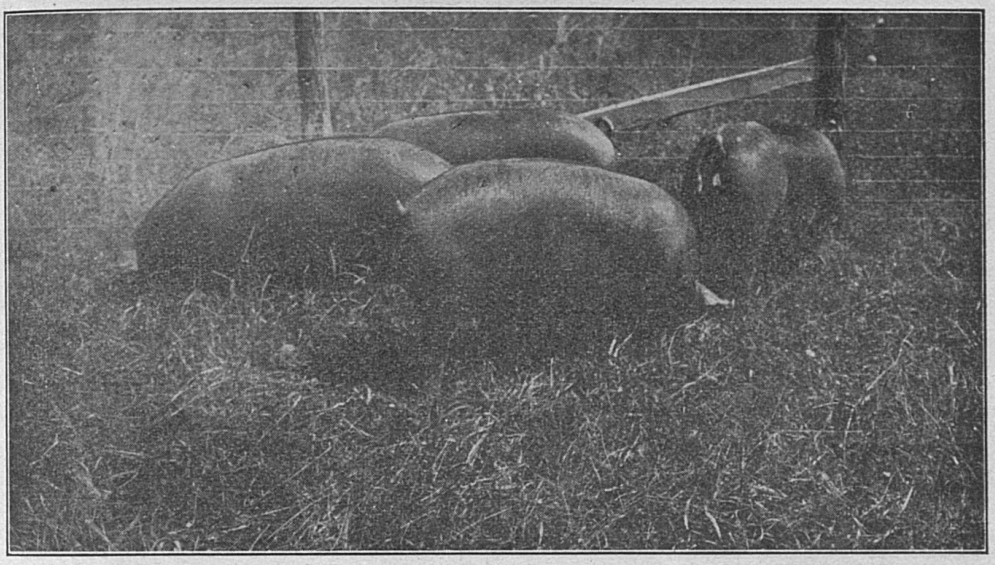


PLATE 4.—Lot 2, Experiment 1. Fed a balanced ration. Average weight at the beginning of the test 40 pounds. Fed 223 days. Average weight at end of test 303 pounds. See pages 317, 318, 321, and 322.

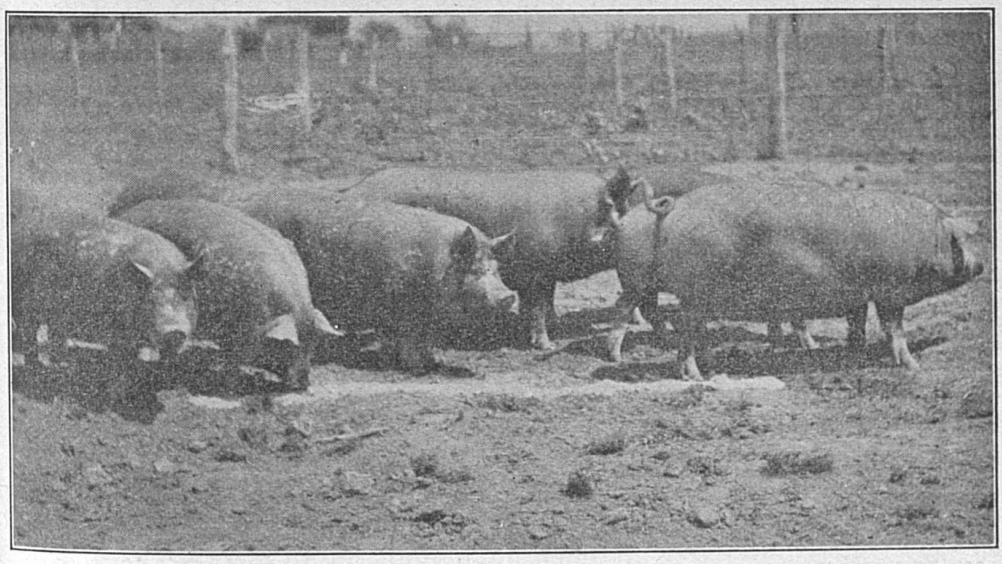


PLATE 5.—Lot 3, Experiment 1. Fed corn meal and ship stuff, half and half. Average weight at the beginning of the test 38 pounds. Fed 223 days. Average weight at the end of test 224 pounds. See pages 317, 318, and 322.

dlings, half and half, to compare their efficiency with corn meal and ship stuff, as used with Lot 3. See Plate 6. The results are somewhat surprising, as we thought the lot receiving corn and middlings would do better than the lot receiving corn and ship stuff. The ship stuff used in these experiments contained all the middlings, hence, was of good quality. We have seen some ship stuffs that consisted mostly of bran, and which therefore, were inferior to a good grade of middlings or ship stuff for swine feeding operations. We do not, of course, consider the results of this one experiment of comparing ship stuff and middlings as conclusive.

### Experiment 2. The Feeding of Runts.

We often hear the expression, "Might as well kill the runt, as it will not be an economical producer." It was to test the truth of this assertion that 9 runts were put on an experiment from January 22, 1908, to September 1, 1908. A number of these pigs were runts from birth, and others were more or less runted by older pigs stealing a part of the mother's milk, which is often the case when a number of brood sows are allowed to run together in the same lot. These pigs averaged but 18 pounds per head at 2½ months of age when they were put on the experiment. It must be understood that these pigs were not runted from any disease or by being affected with worms, but were healthy when put on the test. After being fed 223 days, these pigs averaged 182 pounds per head, making an average daily gain of .735 pound per pig, and ranged in weight from 106 pounds, weight of the smallest pig, to 206 pounds, the weight of the largest pig in the lot. See Plate 7. This lot of runts was fed quite similarly to Lot 2, Table 1, with the exception that a little more protein was given in the early part of the feeding period, and they were not finished on corn meal alone, but on equal parts of corn meal and middlings. These 9 runts ate 4013 pounds of middlings, 1995 pounds of corn meal, 160 pounds of tankage and 93 pounds of oil meal. It required 4.24 pounds of grain for one pound of gain. Each

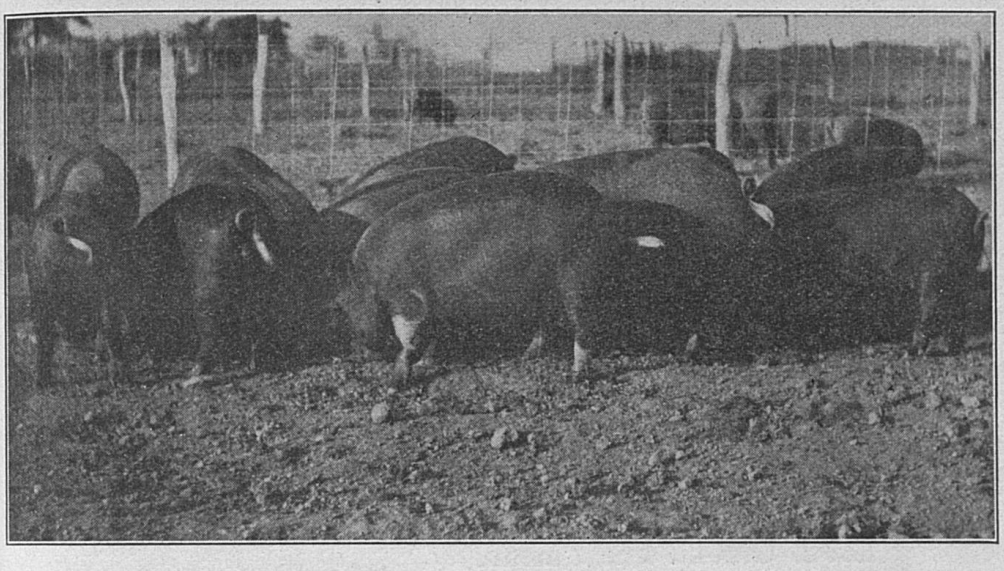


PLATE 6.—Lot 4, Experiment 1. Fed corn meal and middlings, half and half. Average weight at beginning of experiment 39 pounds. Fed 223 days. Average weight at end of test 217 pounds. See pages 317, 318, and 322.

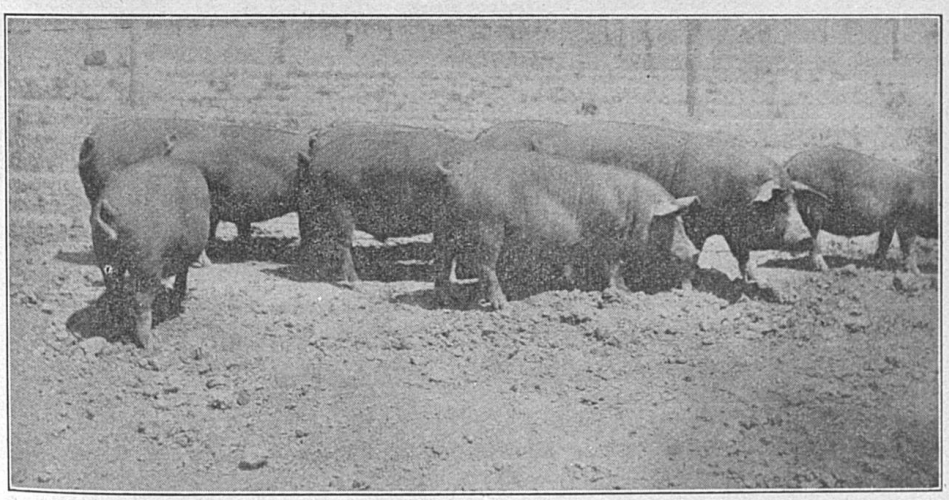


PLATE 7.—Runts as finished. Fed a balanced ration. Average weight at beginning of test 18 pounds. Fed 223 days. Average weight at end of test 182 pounds. See page 324.

bushel of grain fed these runts cost 76 cents and produced 13.20 pounds of pork. It can thus be seen that these runts were economical producers of pork. The greatest drawback in the feeding of runts, however, is their slow maturing qualities, as compared with normal pigs. At the time the pigs in Lots 2, 3, and 4, of Experiment 1, were large enough to be marketed, these runts were too small to be sold. When the experiment was concluded, the runts actually sold for 50 cents per cwt. less than the hogs in Lots 2, 3, and 4, Experiment 1.

### Experiment 3.

Five lots of pigs, ranging from 2 to 6 pigs in a lot, were fed on the following rations:

Lot 1. Corn meal alone.
Lot 2. Ground wheat alone.
Lot 3. Corn meal, 7 parts; soybean[1] meal, 1 part.
Lot 4. Corn meal, 7 parts; digester tankage,[2] 1 part.
Lot 5. Corn meal, green alfalfa and alfalfa hay.

The object of this experiment was to determine the rapidity and economy of gains in the feeding of corn meal alone to pigs of the age and weight later indicated; to determine the efficiency of ground wheat as a feed for young growing pigs; and to compare the results of supplementing corn meal with either soybean meal, tankage or alfalfa.

Lot 1 was fed all the corn meal, and Lot 2 all the ground wheat they would eat twice a day without waste. Lot 3 received, approximately, corn meal 7 parts and soybean meal 1 part by weight; while Lot 4 was given, approximately, corn meal 7 parts and Swift's digester tankage 1 part by weight, the object being to make a direct comparison of soybean meal and tankage as supplements to corn in swine-

[1]The soybean (grain) contains the following digestible nutrients: crude protein, 29.6 per cent.; carbohydrates, 22.3 per cent.; fat, 14.4 per cent. It can thus be seen that this grain is rich in protein and fat. Methods of growing the soybean are given in Bul. 161, Kentucky Exp. Sta., by Roberts and Kinney.

[2]Tankage is a by-product of the packing houses and contains about 48 per cent. of digestible protein and 12 per cent. of fat. It can be seen that this is a very concentrated feed, as far as these nutrients are concerned.

feeding operations. The corn in Lot 5 was supplemented with fresh alfalfa and alfalfa hay. The fresh alfalfa was cut daily, weighed and fed in a trough. The fresh alfalfa was fed until November 20th, when it was killed by frost. After this time alfalfa hay of good quality was substituted.

## Experiment 3, Table 3.

Experiment began Sept. 25, 1908, and closed Jan. 28, 1909 (125 days).

| | Lot 1 Corn meal. | Lot 2 Ground wheat. | Lot 3 Corn meal 7 parts, Soybean meal 1 part. | Lot 4 Corn meal 7 parts, Tankage 1 part. | Lot 5 Corn meal, Green alfalfa, Alfalfa hay. |
|---|---|---|---|---|---|
| No. of pigs in experiment | 3 | 2 | 6 | 6 | 5 |
| Days on experiment | 125 | 125 | 125 | 125 | 125 |
| Av. first weight, lbs. | 64 | 61 | 63 | 62 | 62 |
| Av. final weight, lbs. | 150 | 182 | 202 | 221 | 204 |
| Av. gain per pig, lbs. | 86 | 121 | 139 | 159 | 142 |
| Daily gain per pig, lbs. | .688 | .968 | 1.11 | 1.272 | 1.13 |
| Total lbs. grain fed[1] | 1411 | 1140 | 3257 | 3465 | 3076 |
| Av. grain eaten per pig daily, lbs. | 3.76 | 4.56 | 4.34 | 4.62 | 4.92 |
| Lbs. grain per 100 lbs. gain | 546 | 471 | 391 | 363 | 433 |
| Cost[2] of 100 lbs. gain | $6.39 | $8.72 | $4.79 | $4.80 | $5.30 |
| Lbs. gain per bu. (56 lbs.) grain | 10.24 | 11.89 | 14.33 | 15.38 | 12.92 |
| Cost[3] of 56 lbs. of feed | $0.655 | $1.00 | $0.687 | $0.740 | $0.58 |
| Amt. realized per bu. (56 lbs.) feed, pork at $7.00 | $0.717 | $0.832 | $1.00 | $1.076 | $0.90 |
| Amt. realized per bu. (56 lbs.) feed, pork at $8.00 | $0.82 | $0.95 | $1.14 | $1.23 | $1.03 |

[1]Tankage included in Lot 4.
[2]Based on the following prices of feeds:
Corn, 60 cents per bu., plus $2.00 per ton for grinding=$23.42 per ton.
Ground wheat, $1.00 per bu.
Soybean meal, $32.00 per ton.
Tankage (Swift's), $47.00 per ton.
Green alfalfa, $3 00 per ton.
Alfalfa hay, $12.00 per ton.
[3]Alfalfa included.

The feed eaten by Lot 1, was 1411 lbs. corn meal; Lot 2, 1140 lbs. ground wheat; Lot 3, 2829 lbs. corn meal and 428

lbs. soybean meal; Lot 4, 3021 lbs. corn meal and 444 lbs. tankage; Lot 5, 3076 lbs. corn meal, 376 lbs. green alfalfa, and 178 lbs. alfalfa hay.

The pigs were 3½ months of age at the beginning of the experiment. From the time they were weaned until the experiment was begun they had the run of a blue grass pasture with a small amount of grain. They were all in good growing, thrifty condition when the experiment began. If there was any difference in the individuality in any of the lots, it was in favor of Lot 1, which received corn meal alone. The pigs in all these lots were at first fed a limited amount of grain which was gradually increased so that at the end of 30 days they were practically on a full feed. The pigs in all the lots were so fed that all the feed was cleaned up at each feeding, thereby insuring a sharp appetite for the next feed. From our experiments in feeding soybeans to pigs, we find it best to begin with a limited amount, until the pigs have acquired a taste for the beans. All the feeds were fed in the form of a rather thin slop.

A study of Table 3 is practically explanatory as to the results obtained. The results of feeding corn alone are considerably better in this experiment than was the case of Lot 1 in Experiment 1. We must remember, however, that the pigs in the former experiment were but 2½ months of age, while these pigs were 3½ months of age. The results obtained in this instance, however, are not satisfactory and demonstrate the incompleteness of corn alone to make satisfactory gains when fed to young pigs.

Ground wheat fed to pigs, of the age and size indicated in Table 3, was found to produce 40 per cent. larger gains in the same length of time than did corn meal alone. When pigs have attained some size before being finished for market, corn and wheat are generally considered of equal value, as far as rapidity of gains is concerned. Figuring pork at $8.00 per cwt., the wheat fed Lot 2 brought 95 cents per bushel.

The lot receiving corn meal 7 parts and tankage 1 part, made 84 per cent. better gains than did the lot receiving

corn meal alone, and the cost of gain was $1.60 less per hundred pounds. The experiment also shows that in this instance (Lot 3) soybean meal was only 12½ per cent. less efficient, pound for pound, than was digester tankage in supplementing corn, as far as gains were concerned, and illustrates what an efficient supplement to corn soybeans are in the feeding of swine. The soybean is a supplement which can be grown on the farm.

A lot of smaller pigs, not tabulated in this bulletin, averaging 45 pounds at the beginning of the test, and receiving corn meal 7 parts and soybean meal one part, did even slightly better than the lot receiving corn meal and soybean meal, tabulated in this bulletin, making a little over 16 pounds of pork for every 56 pounds of grain fed.

It was surprising to note the beneficial effect of adding some green alfalfa to a ration of corn meal, as noted in the experiment with Lot 5, Table 3. When the green alfalfa was no longer obtainable because of frosts, alfalfa hay of good quality was substituted. Alfalfa is not only valuable as a supplement to corn in the feeding of the pig, but, no doubt, aids in toning the appetite of the animal. The pigs in this lot ate on the average 1.16 pounds of grain more per pig per day than did the lot receiving corn alone, and made 65 per cent. larger gains per pig per day at a cost of $1.09 less per hundred pounds of gain. Valuing pork at $8.00 per cwt., a bushel of corn fed this lot was worth 21 cents more than was a bushel of corn fed the lot receiving corn alone.

## Experiment 4.

This experiment was begun November 8, 1911, and was conducted in order to test the efficiency of corn alone in finishing hogs that had attained considerable size, as compared with a similar lot of hogs receiving corn meal 10 parts and soybean meal 1 part by weight, and with a third lot receiving corn meal 14 parts and Swift's tankage 1 part by weight. Previous to this experiment, these pigs had been allowed the run of a 2-acre matured field of rye. This rye had become

pretty ripe and had shelled badly, and, as a consequence, a good deal had fallen to the ground and was not secured by the pigs. A small amount of corn was fed daily to the pigs at this time. The pigs were then turned on a field of young green rye and given about half a ration of corn until they were put on this experiment. The hogs, as they went on the experiment, were well-grown but not fat.

## Experiment 4, Table 4.

Experiment began Nov. 8, 1911, and closed Jan. 3, 1912 (56 days).

| | Lot 1. Corn meal. | Lot 2. Corn meal 10 parts, Soybean meal 1 part. | Lot 3. Corn meal 14 parts, Tankage 1 part. |
|---|---|---|---|
| No. of pigs in experiment | 10 | 10 | 10 |
| Days on experiment | 56 | 56 | 56 |
| Av. first weight, lbs. | 143 | 143 | 147 |
| Av. final weight, lbs. | 219 | 227 | 240 |
| Av. gain per pig, lbs. | 76 | 84 | 93 |
| Daily gain per pig, lbs. | 1.357 | 1.50 | 1.66 |
| Total lbs. grain fed[1] | 3778 | 3773 | 3780 |
| Av. grain eaten per pig daily, lbs. | 6.74 | 6.73 | 6.75 |
| Lbs. grain per 100 lbs. gain | 497 | 449 | 406 |
| Cost[2] of 100 lbs. gain | $5.82 | $5.43 | $5.07 |
| Lbs. gain per bu. (56 lbs.) grain | 11.26 | 12.46 | 13.77 |
| Cost of 1 bu. (56 lbs.) grain | $0.655 | $0.677 | $0.688 |
| Amt. realized per bu. (56 lbs.) grain, pork at $7.00 | $0.788 | $0.872 | $0.963 |
| Amt. realized per bu. (56 lbs.) grain, pork at $8.00 | $0.90 | $1.00 | $1.10 |

[1]Tankage included in Lot 3.
[2]Based on the following prices of feeds:
Corn, 60 cents per bu., plus $2.00 per ton for grinding=$23.42 per ton.
Soybean meal, $32.00 per ton.
Tankage, $47.00 per ton.

The feed eaten by Lot 1, was 3778 lbs. corn meal; Lot 2, 3430 lbs. corn meal and 343 lbs. soybean meal; Lot 3, 3528 lbs. corn meal and 252 lbs. tankage.

Hogs of this size and age, provided the size is represented

by bone and muscle and not fat, can usually be finished profitably on corn alone. However, in most instances, it is even better to add some nitrogenous supplement to the ration, as can be seen from the results of this experiment as indicated in Table 4. The proportion of corn to the supplement, however, can be considerably greater than where young pigs are fed. Lot 2, in this experiment, received corn meal 10 parts and soybean meal 1 part, made 10 per cent. better gains with a saving of a little over ½ pound of grain for every pound of gain made, and at a cost of 39 cents per hundred pounds of gain less, than did Lot 1 receiving corn meal alone. The ration of corn meal 14 parts and Swift's tankage 1 part, as can be seen by Table 4, produced 10 per cent. larger gains than did the ration of corn meal 10 parts and soybeans 1 part. The profit was also somewhat greater in Lot 3 than in Lot 2. Table 4 also shows that both Lots 2 and 3 made considerably better gains than did Lot 1. The profits, too, were much better, for, figuring pork at $8.00 per cwt., the grain fed Lot 2 netted 10 cents, and Lot 3, 20 cents, more per bushel than did the grain fed Lot 1.

# PART II.

## The Growing and Fattening of Hogs on Forage Crops.

### Pasture For Hogs.

To make the production of pork most profitable in all its phases, the feeder should provide pasture for his hogs whenever possible, for the following reasons: (1) fresh green pasture exerts a beneficial influence on the health of the hog, besides the nutrients actually obtained from such pasture; (2) pigs while grazing obtain considerable exercise which is essential to good gains and health, especially in the development of young pigs; (3) cheaper gains can be made on pasture than in the dry lot; (4) the manure, which is rich in fertilizing constituents, is distributed on the land and thus greatly aids in maintaining the fertility of the soil.

Professor George Roberts, Agronomist of the Kentucky Experiment Station, has figured that the fertilizing constituents of a bushel of corn amount to 25 cents.* The writer wrote to Dr. H. S. Grindley, Professor of Animal Chemistry, Department of Animal Husbandry, University of Illinois, asking for information relative to the fertilizing constituents eliminated by animals. Dr. Grindley kindly gave the following information:

> "We have made a number of experiments with mature animals, especially swine and cattle, to determine the amount of fertilizing constituents eliminated in the urine and feces. On mature animals our results average for pigs, approximately 90 per cent. of the ingested nitrogen and about 95 per cent. of the ingested phosphorus. As yet we have not calculated our results for potassium. In the case of three-year-old steers, we have found that practically all of the phosphorus is recovered in the excreta and that on the average 88 to 90 per cent. of the nitrogen is recovered. Of course, in growing animals the percentage of the nitrogen and phosphorus

*Kentucky Exp. Sta. Circular, "Soil Fertility."

recovered in the excreta would not be as large as that recovered from mature animals.

"In my opinion your estimate of 80 per cent. of the fertilizing constituents eliminated by the pig is rather low if anything. I would be inclined to estimate it as 85 per cent. for the entire life of the pig."

On the estimates of Professor Roberts and Doctor Grindley, 21.25 cents' worth of fertilizing constituents would be eliminated by the hog for every bushel of corn eaten—a matter worthy of serious consideration by the farmer, and one that should be taken into account in figuring the profits from the feeding of swine, provided the manure is returned to the land.

It is difficult to save any manure from the hog running in a dry lot, unless he is closely confined. We have heard of a farm being greatly depleted in fertility by following the method of raising corn year after year, feeding it to hogs in the dry lot, and not returning the manure to the land.

We must remember in the grazing of the pig that he has a small stomach, and, as a consequence, is not as capable of digesting grasses and other forms of roughage as is the cow or the sheep, which has four stomachs and re-chews its feed in the form of a cud. On watching a pig grazing on a field of young rye, we notice that he chews and swallows the rye—in fact, he relishes the young tender plants; but let such plants arrive at some height and we observe that after chewing the same for a little time he spits the material out of his mouth. This is because the plants have become tough—in other words, the percentage of crude fiber, the indigestible part of the plant for the pig, increases rapidly as the plants get larger. A reference to Table 5 shows that when rye is 5 inches high it contains but 1.99 per cent. of crude fiber, but when it reaches a height of 27 inches, the fiber is 4.2 per cent. This is one of the principal reasons why green rye, green oats, green wheat or green barley should be pastured by the pig before the plants attain much height. We turn our pigs on such pastures when the plants arrive at a height of about 6 to 8 inches, and take them off when the plants

reach such a height that the pigs begin to spit the chewed material from their mouths. Usually, after the plants measure 15 inches in height, they are not relished by the pig. It is well to keep enough hogs on the pasture to keep it well pastured down.

Some four years ago the writer was discussing with the late Director, Dr. M. A. Scovell, the good results obtained in the feeding of corn meal alone to pigs running on young rye, and was not able to account for these results, taking into consideration the small amount of protein in green rye, as given in the analyses in text books*. Dr. Scovell called our attention to the fact that grasses when young and short contain much more protein than when they arrive at some height; and that a number of years previous to the conversation, he and the Chief Chemist of the Station, Dr. Alfred M. Peter, had conducted some analyses along this line. In view of the facts stated by Dr. Scovell, the writer gathered grasses and legumes of various heights, and analyses of same were kindly made by Professor H. D. Spears, Chemist of the Feed Department of this Station. Some of the grasses were being used in grazing experiments with young pigs, while other plants, including young legumes, were analyzed for comparative purposes. See Table 5.

*No statements are usually given as to the height of plants when analyzed, but, no doubt, plants fairly well matured are usually used for this purpose.

## TABLE 5.

### The Average Composition of a Number of Forage Crops Common to Kentucky.*

| Name. | Height when analyzed. | In the Fresh Material. | | | | | |
|---|---|---|---|---|---|---|---|
| | | Water. | Crude fiber. | Protein. | Carbo-hydrates. | Fat. | Ash. |
| Rye (green) | 5 inches | 81.90 | 1.99 | 6.50 | 6.54 | 0.90 | 2.17 |
| Rye (green) | 27 " | 82.82 | 4.20 | 2.72 | 8.02 | 0.65 | 1.59 |
| Wheat (green) | 5 " | 75.80 | 3.90 | 6.54 | 10.07 | 0.69 | 3.00 |
| Wheat (green) | 24 " | 78.24 | 5.96 | 2.31 | 11.09 | 0.65 | 1.75 |
| Oats (green) | 8 " | 86.96 | 1.71 | 4.90 | 4.00 | 0.83 | 1.60 |
| Alfalfa (green) | 8 " | 84.35 | 2.87 | 4.71 | 5.59 | 0.55 | 1.93 |
| Red Clover (green) | 11 " | 81.25 | 2.64 | 4.31 | 9.20 | 0.59 | 2.01 |
| White Clover (green) | 6 " | 82.69 | 2.27 | 4.46 | 5.24 | 0.57 | 4.77 |
| Soybeans (green) | 12 " | 80.69 | 4.33 | 3.12 | 9.21 | 0.52 | 2.13 |
| Cowpeas (green) | 12 " | 85.50 | 2.47 | 2.97 | 6.55 | 0.53 | 1.98 |
| Blue Grass | 7 " | 82.52 | 3.90 | 4.66 | 5.88 | 1.32 | 1.72 |

*These analyses were kindly made for the writer by Professor H. D. Spears, Chemist of the Feed Department of this Station.

Green rye, oats and wheat are generally classified as carbonaceous roughages, but, by reference to Table 5, it is shown that when green rye, green wheat, and green oats are analyzed when young, they contain more protein, according to our analyses, than do the legumes, and, hence, at this age should be classified as nitrogenous roughages. These young plants also contain considerable ash. In other words, from the results of these analyses and from our experiments as well, we are strongly inclined to believe that about as good results can be obtained from the grazing of young wheat, barley, rye and oats as can be obtained from the grazing of any of the legumes, such as clover or alfalfa. The fact that young oats, barley, wheat and rye are such good grazing crops and that they are green when the clovers are killed by frosts, makes them ideal plants to provide for the pig during the late fall, winter and early spring. By a judicious system of rotation of forage crops on the farm, pigs can be kept on pasture, in this State, during most of the time that they are being grown and fattened.

### Experiment 5. Young Pigs on Pasture Without Grain.

It is never profitable to run young pigs on pasture without grain. We turned 2 pigs weighing 63 pounds each, on young rye on March 19, 1910, kept them on the same without grain for 42 days, and they did not maintain their weight—in fact they lost 5 pounds in that time. On May 13, 1911, 4 thrifty shotes, weighing 82 pounds each, were turned on a pasture consisting of young fresh clover and blue grass without grain. There was considerably more red clover in this pasture than blue grass. On July 4th, these pigs averaged 90 pounds per head, or made a gain of only 8 pounds in 53 days. In this instance, the pigs did a little better than maintain their original weight. The above results indicate that it does not pay to run young pigs on pasture without grain. Our experience has been, however, that full-grown, thin brood sows not suckling pigs, will take on flesh while running on a good pasture, with plenty of shade and pure

water to drink. The reason for this is that mature hogs have secured their growth, and having large, matured digestive capacities, can handle larger amounts of coarse feed to better advantage than younger hogs.

### Experiment 6.

The first experiment of running pigs on pasture was conducted during the late winter and early spring months. The rye that year measured 5 inches high when the pigs were turned on it. Having a few shotes on hand that had been farrowed late in the previous fall, it was determined to divide them into lots and run them on the young rye. This experiment was conducted to get an estimate of the economy of running young pigs on young rye at that time of the year. Not intending to publish the results, not much attention was given to the division of pigs into lots. One litter of 3 pigs, averaging 74 pounds per head, was turned on young rye and fed corn alone. These pigs were turned on rye February 20, 1909, and taken off May 22, 1909 (91 days). They ate 1226 pounds of corn meal, and made an average daily gain of 1.363 pounds per pig, at a cost of, considering grain only, 3.84 cents per pound. They made 17.04 pounds of pork per bushel of corn. A brood of 10 pigs, averaging 52 pounds per head, was turned on another field of young rye for the same length of time and fed a mixture of corn meal, oil meal, cottonseed meal and ship stuff. The amount eaten by this lot in 91 days was 2016 pounds of corn meal, 20 pounds of oil meal, 402 pounds of cottonseed meal and 704 pounds of ship stuff. This second lot of pigs averaged 1 pound of gain per pig per day on 3.45 pounds of grain for every pound of gain. They made 16.22 pounds of pork for every 56 pounds of grain, at a cost of 70.5 cents.[1] The cost of each pound (cost of pasture not included) was 4.34 cents. Valuing pork at $8.00

[1]Based on the following prices of feeds:
Corn meal, 60 cents per bu., plus $2.00 per ton for grinding=$23.42 per ton.
Oil meal, $40.00 per ton.
Cottonseed meal, $30.00 per ton.
Ship stuff, $27.00 per ton.

per hundred, each 56 pounds of ration fed was worth $1.30. Lot 3, a litter of 6 pigs, averaging 86 pounds per head, was also turned on young rye on February 20, 1909, for the same length of time as the other lots, and given a ration of corn meal, oil meal and ship stuff. The lot ate during the 91 days on experiment, 1593 pounds of corn meal, 364 pounds of oil meal, and 650 pounds of ship stuff. This lot of pigs averaged 1.30 pounds of gain per pig per day on 3.65 pounds of grain per pound of gain. They made 15.34 pounds of gain for every 56 pounds of ration at a cost of 74.5 cents. Not valuing the pasture, each pound of gain cost 4.85 cents. Valuing pork at $8.00 per hundred, each 56 pounds of ration as fed was worth $1.22.

The writer does not wish to be understood, from this single experiment, that for the most rapid and economical gains it is not necessary to add a nitrogenous supplement to corn in the feeding of young pigs running on young rye, during the spring, summer and fall months. Much more experimental data will be needed to determine that point. However, the writer must admit that he was surprised at the good results obtained from the lot receiving corn alone.

The pigs in all the lots were given all the grain twice a day that they would clean up and still have a keen appetite for the next feed. The amount of cottonseed meal fed Lot 2 had no apparent injurious effect on any of the pigs. It has been demonstrated, however, that larger amounts of cottonseed meal can be fed to pigs while running on pasture without injurious effects than if the pigs were given the same amount of this feed in a dry lot.[1]

## Experiment 7.

Table 6 shows the results of an experiment of running young pigs on rye during the winter and spring months. In Lot 1, corn meal alone was used as a grain ration, while in Lot 2, approximately 6 parts of corn meal and 1 part of soybean meal were fed.

[1]Texas Exp. Sta. Bul. 78, by F. R. Marshall.

## Experiment 7, Table 6

Experiment began Nov. 30, 1909, and closed May 4, 1910.

| | Lot 1. Corn meal, Rye pasture. | Lot 2. Corn meal 6 parts, Soybean meal 1 part, Rye pasture. |
|---|---|---|
| No. of pigs in experiment | 5 | 4 |
| Days on experiment | 155 | 155 |
| Av. first weight, lbs. | 47 | 49 |
| Av. final weight, lbs. | 168 | 201 |
| Av. gain per pig, lbs. | 121 | 152 |
| Daily gain per pig, lbs. | .780 | .980 |
| Total lbs. grain fed | 2489 | 2220 |
| Av. grain eaten per pig daily, lbs. | 3.21 | 3.58 |
| Lbs. grain per 100 lbs. gain | 411 | 365 |
| Cost[1] of 100 lbs. gain | $4.82 | $4.49 |
| Lbs. gain per bu. (56 lbs.) grain | 13.61 | 15.34 |
| Cost of 1 bu. (56 lbs.) grain | $0.655 | $0.689 |
| Amt. realized per bu. (56 lbs.) grain, pork at $7.00 | $0.953 | $1.073 |
| Amt. realized per bu. (56 lbs.) grain, pork at $8.00 | $1.089 | $1.22 |

[1]Based on the following prices of feeds:
Corn, 60 cents per bu. plus $2.00 per ton for grinding=$23.42 per ton.
Soybean meal, $32.00 per ton.

The grain eaten by Lot 1, was 2489 pounds of corn meal, and by Lot 2, 1908 pounds of corn meal and 312 pounds of soybean meal.

This experiment was begun November 30, 1909, and continued until May 4, 1910. Our notes show that there was considerable cold weather and snow for Kentucky during the winter of 1909 and 1910. The pigs used in this test had just been weaned. They were given all the grain they would eat without waste, twice a day. Sufficient warm water was added to the ration to make quite a thin slop. Our experience has been that young pigs will not drink a sufficient amount of water in the winter time to make maximum gains. By the above method we were able to get the pigs to take

considerable water twice a day. Considering the time these pigs were fed, the results were excellent and show that the winter feeding of young pigs in this State can be made very profitable. Lot 1, receiving corn meal alone, made an average daily gain of .780 pound per pig. It took 4.11 pounds of corn meal for each pound of gain. Not considering the value of the pasture, each 100 pounds of gain cost $4.82. These pigs gained 13.61 pounds for each bushel of corn fed. Valuing pork at $8.00 per cwt., each bushel of corn fed these pigs netted $1.08. The beneficial effects of rye pasture for young pigs, even during the winter months, can be readily noted by comparing the results obtained in this lot with Lot 1 of Experiment 1 given on page 318, of this bulletin. Lot 2, of this experiment, receiving corn meal and soybean meal in the proportions indicated, made better gains than the lot receiving corn meal alone. There are a number of days during the winter months when rye is covered with snow, and, as corn meal alone does not contain sufficient protein to make maximum gains, it should be supplemented at such times with some feed rich in protein. Lot 2, receiving corn supplemented with soybean meal, as can be seen from Table 6, weighed 201 pounds at the end of the experiment, making a gain of nearly a pound per pig per day on 3.65 pounds of grain. The cost of each pound of gain was 4.49 cents. The gain made per 56 pounds of grain was 15.34 pounds. Valuing pork at $8.00 per cwt., each 56 pounds of ration fed Lot 2 was worth $1.22.

### Experiment 8.

This experiment was conducted to determine what gains and economy of gain could be secured by running young pigs on clover pasture until it was killed by frost, and then upon a fresh pasture of young rye. The grain used was corn meal alone. The pigs in this instance were given all the corn meal, in the form of a rather thin slop, that they would eat twice a day without waste. It was the aim at all times to keep these pigs just a little hungry for grain, although on the whole, it might be said that they received a full grain



PLATE 8—Lot 2, Experiment 8. Hogs grown and fattened on corn meal and allowed the run of a clover and rye pasture. This lot averaged 66 pounds at beginning of test. Fed 124 days. Average weight at end of test 215 pounds. See pages 340, 342, and 343.

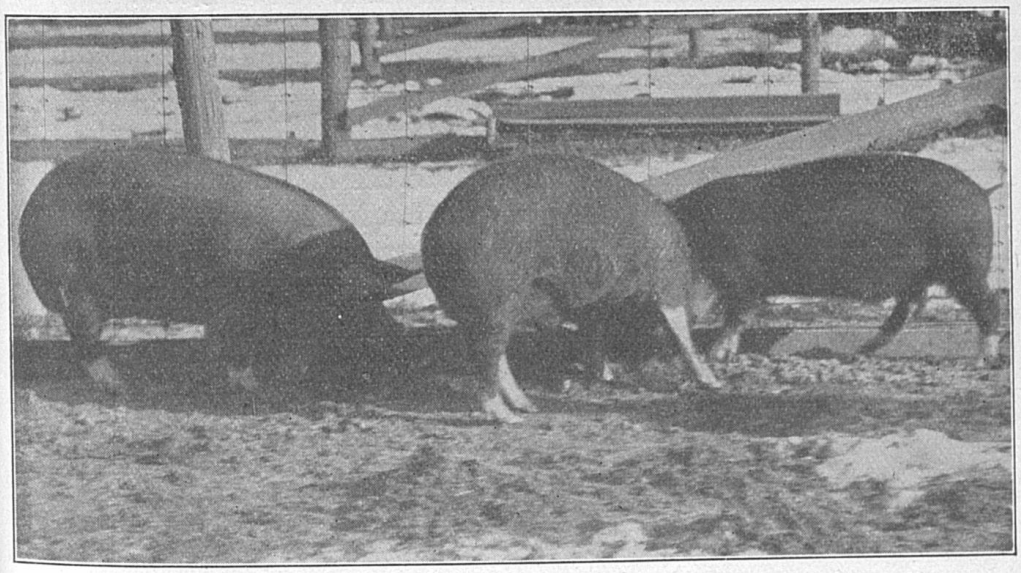


PLATE 9—Lot 1, Experiment 8. Hogs grown and fattened on corn meal alone in the dry lot. These pigs averaged 64 pounds at the beginning of experiment. Fed 125 days. Average weight at end of test, 150 pounds. See pages 342 and 343.

ration. The clover had been cut some little time before these pigs were turned on the field. The young clover was 9 inches high when the experiment began, September 10, 1910, hence was tender and palatable. These pigs were also given the slack coal mixture ad libitum, as mentioned on page 316. The pigs ran on the clover pasture until November 5th, or for a period of 56 days. At this time the clover was killed by frost. The young rye on which this lot of pigs was then pastured, measured 8 inches high. The pigs ran on this rye until the end of the experiment, January 12th, or for a period of 68 days. See Plate 8.

For comparison, the writer has inserted in Table 7, the statistics of Lot 1 of Table 3. The two tests were conducted at practically the same time, as far as seasons were concerned, though in different years. The age and previous feedings of these two lots of pigs before they were put on experiment were practically the same. Lot 1 was fed one day longer than was Lot 2. We believe that these two tests give a very good comparison of the results that can be expected with two lots of pigs similarly fed. See Plate 9.

Lot 1, consisting of 3 pigs, ate 1411 pounds of corn meal, and Lot 2, consisting of 7 pigs, ate 3987 pounds of corn meal.

Not counting the cost of pasture, each pound of gain cost 43 per cent. more by feeding the pigs corn meal alone in the dry lot, than by feeding corn meal to the lot of pigs running on pasture. Each pig on pasture ate a little over 10 bushels of corn meal, and, if each bushel of corn meal which passed through the animal was worth 21.25 cents as a fertilizer, or $2.12 per pig, the manure alone would in a large part pay for the rent of land and for the grain sown.

## Experiment 8, Table 7.

Experiment began Sept. 10, 1910, and closed Jan. 12, 1911.

| | Lot 1. Corn meal, fed in dry lot. | Lot 2. Corn meal, Clover pasture, Rye pasture. |
|---|---|---|
| No. of pigs in experiment | 3 | 7 |
| Days on experiment | 125 | 124 |
| Av. first weight, lbs. | 64 | 66 |
| Av. final weight, lbs. | 150 | 215 |
| Av. gain per pig, lbs. | 86 | 149 |
| Daily gain per pig, lbs. | .688 | 1.202 |
| Total lbs. grain fed | 1411 | 3987 |
| Av. grain eaten per pig daily, lbs. | 3.76 | 4.59 |
| Lbs. grain per 100 lbs. gain | 546 | 382 |
| Cost[1] of 100 lbs. gain | $6.39 | $4.47 |
| Lbs. gain per bu. (56 lbs.) grain | 10.24 | 14.65 |
| Cost of 1 bu. (56 lbs.) grain | $0.655 | $0.655 |
| Amt. realized per bu. (56 lbs.) grain, pork at $7.00. | $0.717 | $1.026 |
| Amt. realized per bu. (56 lbs.) grain, pork at $8.00. | $0.819 | $1.172 |

[1]Corn, 60 cents per bu., plus $2.00 per ton for grinding=$23.42 per ton.

It will be noted in this experiment that the lot on pasture receiving corn meal made 73 per cent. larger gains per pig than did the lot receiving corn meal alone in the dry lot. The use of pasture also increased the appetite of these pigs, for they ate 22 per cent. more grain per pig daily than did the lot receiving corn in the dry lot.

## Experiment 9.

This experiment was conducted to determine the rapidity and economy of gains from feeding one lot of pigs corn meal while running on a rye pasture during the winter months; from the feeding of a nitrogenous supplement with corn meal to pigs running on rye; and from the feeding of pigs in the dry lot with corn meal and a nitrogenous supplement. In a general way, this experiment was conducted to compare results with those of a similar experiment in grazing hogs in the winter time, namely, Experiment 7. The pigs were

divided into 3 lots as equally as possible to eliminate sex and individuality. All were similarly housed. All lots were given all the grain they would clean up twice a day without waste. The feed was mixed with sufficient warm water just before it was fed to make a thin slop. Table 8 gives the results of this experiment.

## Experiment 9, Table 8.

Experiment began Nov. 12, 1910, and closed April 8, 1911.

| | Lot 1. Corn meal, Rye pasture. | Lot 2. Corn meal 10 parts, Tankage 1 part, Rye pasture. | Lot 3. Corn meal 10 parts, Tankage 1 part, Dry lot. |
|---|---|---|---|
| No. of pigs in experiment | 7 | 7 | 8 |
| Days on experiment | 147 | 147 | 147 |
| Av. first weight, lbs. | 49 | 48 | 47 |
| Av. final weight, lbs. | 174 | 214 | 198 |
| Av. gain per pig, lbs. | 125 | 166 | 151 |
| Daily gain per pig, lbs. | .850 | 1.129 | 1.027 |
| Total lbs. grain fed | 4211 | 4378 | 4829 |
| Av. grain[1] eaten per pig daily, lbs. | 4.092 | 4.255 | 4.106 |
| Lbs. grain per 100 lbs. gain | 480 | 376 | 399 |
| Cost[2] of 100 lbs. gain | $5.62 | $4.80 | $5.08 |
| Lbs. gain per bu. (56 lbs.) grain | 11.64 | 14.86 | 14.03 |
| Cost of 1 bu. (56 lbs.) grain | $0.655 | $0.715 | $0.715 |
| Amt. realized per bu. (56 lbs.) grain, pork at $7.00 | $0.815 | $1.04 | $0.982 |
| Amt. realized per bu. (56 lbs.) grain, pork at $8.00 | $0.931 | $1.188 | $1.122 |

[1]Tankage included in Lot 3.
[2]Based on the following prices of feeds:
Corn, 60 cents per bu., plus $2.00 per ton for grinding=$23.42 per ton.
Tankage (Swift's), $47.00 per ton.

The grain eaten by Lot 1, was 4211 pounds of corn meal; Lot 2, 3980 pounds of corn meal and 398 pounds of tankage; Lot 3, 4390 pounds of corn meal and 439 pounds of tankage.

This experiment again plainly demonstrates the economy of adding a nitrogenous supplement to corn meal while pigs are running on pasture during the winter months. We must

not forget, however, that the pigs on pasture and receiving corn meal alone, made profitable gains and by April 8th, had arrived at a weight by which they could have soon been finished for the market. Making a comparison of the gains made by the pigs in this experiment receiving corn meal alone, with the pigs noted in Experiment 1, page 318, receiving corn meal alone and running in a dry lot, brings our attention again to the benefits of supplementing corn with rye pasture in the feeding of young pigs.

There is not as much difference in either the rapidity or the economy of gains between Lot 2, obtaining corn meal and tankage and running on rye pasture, and Lot 3, receiving the same ration and kept in the dry lot. We thought the difference would be more favorable to the pigs having the run of the rye field. It must be remembered, however, that these pigs were fed during the winter months and that a part of the time the rye was covered with snow. We must also consider that the manure made from Lot 2 was distributed in the field where it would do more good than if it were left in a small dry lot. The pigs in Lot 2 ate 78 bushels of grain which we estimate to be worth $16.57 in the form of manure. Lot 2, getting the nitrogenous supplement in addition to corn meal, made 32 per cent. better gains than Lot 1 on pasture receiving corn meal alone, and these gains were put on at nearly a cent a pound cheaper.

## Experiment 10.

This experiment was conducted to compare the rapidity and economy of gains from feeding corn meal alone and corn meal and a nitrogenous supplement to young pigs running on young rye during the late spring.

## Experiment 10, Table 9.

Experiment began March 19, 1910, and closed May 6, 1910.

| | Lot 1. Corn meal, Rye pasture. | Lot 2. Corn meal 6 parts, Soybean meal 1 part, Rye pasture. |
|---|---|---|
| No. of pigs in experiment | 3 | 15 |
| Days on experiment | 48 | 48 |
| Av. first weight, lbs. | 51 | 51 |
| Av. final weight, lbs. | 79 | 82 |
| Av. gain per pig, lbs. | 28 | 31 |
| Daily gain per pig, lbs. | .583 | .645 |
| Total lbs. grain fed | 252 | 1366 |
| Av. grain eaten per pig daily, lbs. | 1.75 | 1.89 |
| Lbs. grain per 100 lbs. gain | 300 | 293.76 |
| Cost[1] of 100 lbs. gain | $3.51 | $3.61 |
| Lbs. gain per bu. (56 lbs.) grain | 18.66 | 19.06 |
| Cost of 1 bu. (56 lbs.) grain | $0.655 | $0.689 |
| Amt. realized per bu. (56 lbs.) grain, pork at $7.00 | $1.30 | $1.33 |
| Amt. realized per bu. (56 lbs.) grain, pork at $8.00 | $1.49 | $1.52 |

[1]Based on the following prices of feeds:
Corn, 60 cents per bu., plus $2.00 per ton for grinding=$23.42 per ton.
Soybean meal, $32.00 per ton.

The grain eaten by Lot 1, was 252 pounds of corn meal; Lot 2, 1172 pounds of corn meal and 194 pounds of soybean meal.

These pigs were all thrifty. Lot 2, receiving soybean meal in addition to the corn meal, made slightly better gains per pig per day and ate a little more feed than did Lot 1, receiving corn meal alone. The rye was shorter than usual at the time of year when these pigs were turned on this pasture on account of severe freezes in February and lack of rain in March. The shorter the rye, the more protein it contains; hence, it was an excellent supplement to the corn meal. The rye had arrived at a considerable height, however, before the experiment was closed. Though the pigs receiving corn meal alone did not make quite as large gains

as the lot of pigs receiving the supplement in the form of soybeans, they did make nearly as economical gains. Had the rye attained much more height, the protein contained in the same would have been greatly reduced, in which instance the pigs getting corn meal alone would not have received sufficient protein and ash to make good gains. This would not have been the case with the lot receiving the soybeans in addition to the corn.

Both of the lots receiving grain while on the rye pasture made, as can be seen from Table 9, very profitable gains, making 18.66 and 19.06 pounds of gain for every 56 pounds of grain fed, and each bushel of grain as fed netted practically $1.50, figuring pork at $8.00 per hundredweight. There is no time in the raising of a pig when grain can be more profitably fed than when he is young and running on good pasture.

### Experiment 11.

On May 7, 1910, the pigs in the previous experiment, namely, the 3 pigs running on young rye and receiving corn meal, together with the 15 pigs running on young rye and receiving corn meal and soybean meal, were turned on an acre field of young oats. The oats at the time were 8 inches high. Five bushels of oats had been sown on this acre so the field was well sodded over. The ration given these pigs was corn meal 9 parts by weight, and soybean meal 1 part. We endeavored throughout this test to give the pigs about a three-quarters grain ration, so as to keep them somewhat hungry, and by this method make them consume more pasture. On June 18th, these 18 pigs were turned on a fresh acre of oats 8 inches high. This lot had also been heavily seeded. For about a week previous to turning these pigs in this field, the first acre of oats had been quite closely grazed. The pigs were alternated every 2 or 3 weeks between these two fields of young oats. By this method the acre not pastured had time to renew its growth to considerable extent before the pigs were again turned on it. The abundant rains experienced at this time greatly aided in developing the

growth of the oats in the interim. It was said by some that Kentucky had more rain at this time of the year than in any year since 1875. These 18 pigs were alternated between these 2 fields until July 23rd, when they were turned on an acre of succotash. The succotash planted June 22nd, was composed of 2 bushels of oats, 1 pound of rape, 30 pounds of cowpeas, 30 pounds of soybeans, and 2 pecks of corn. At the time the pigs were turned on this field, the oats measured 12 inches, the cowpeas 12 inches, the rape 9 inches, and the corn about 2 feet. Our observation was that the pigs ate the soybeans much more greedily than they did the cowpeas. Many of the rape plants were left untouched. By August 6th, the succotash was nearly eaten. The grain ration at this point was increased rapidly to a full feed so as to finish the pigs for the market.

These pigs were fed twice a day and the feed given in the form of a slop. Fresh water was provided at all times. On March 19th, these pigs averaged 51 pounds and received at the rate of 1.4 pounds of grain per pig per day. On May 7th, they averaged 81 pounds and were receiving at the rate of 2.42 pounds of grain per day. On June 18th, the pigs averaged 124 pounds and were receiving at the rate of 3.33 pounds of grain per pig per day. On July 16th, the pigs averaged 155 pounds and were receiving 4.27 pounds of grain per head per day. On August 6th (the time the succotash was getting somewhat short), these pigs averaged 184 pounds and were receiving at the rate of 5.2 pounds of feed per pig daily. From this time on, the feed was increased so that at the end of the feeding period, September 2nd, they averaged 221 pounds, and received on that day 7.44 pounds of grain per pig. The ratio of soybeans to corn meal was decreased during the last three weeks to about 1 to 15, so as to firm the pork. The hogs were sold to Sim and Jonas Weil of Lexington, on September 2nd, at an average weight of 221 pounds, for $8.50 per cwt., and were pronounced to be in excellent finish by these buyers. See Plate 10.



PLATE 10—Experiment 11. Hogs fed corn meal 9 parts, soybean meal 1 part, and run on a succession of forage crops, namely, rye, oats, and succotash. Average weight at the beginning of test 51 pounds. Fed 166 days. Average final weight, 222 pounds. See pages 347, 348, 350, and 351.

## Experiment 11, Table 10.

Experiment began March 19, 1910, and closed Sept. 1, 1910.

| | Corn meal 9 parts, Soybean meal 1 part, Rye pasture, Oat pasture, Succotash. |
|---|---|
| No. of pigs in experiment | 18 |
| Days on experiment | 166 |
| Av. first weight, lbs. | 51 |
| Av. final weight, lbs. | 222 |
| Av. gain per pig, lbs. | 171 |
| Daily gain per pig, lbs. | 1.03 |
| Total lbs. grain fed | 10,456 |
| Av. grain eaten per pig daily, lbs. | 3.50 |
| Lbs. grain per 100 lbs. gain | 340 |
| Cost[1] of 100 lbs. gain | $4.12 |
| Lbs. gain per bu. (56 lbs.) grain | 16.47 |
| Cost of 1 bu. (56 lbs.) grain | $0.679 |
| Amt. realized per bu. (56 lbs.) grain, pork at $7.00 | $1.15 |
| Amt. realized per bu. (56 lbs.) grain, pork at $8.00 | $1.31 |

[1]Considering grain only, and based on the following prices:
Corn, 60 cents per bu., plus $2.00 per ton for grinding=$23.42 per ton.
Soybean meal, $32.00 per ton.

As stated before, the pigs in Lots 1 and 2 of Experiment 10, were turned together on the 7th of May, and grazed on oats and succotash. In computing Table 10, the grain fed Lots 1 and 2, of Experiment 10, was added to the grain fed these pigs after they were turned together. The data thus given in Table 10, cover from March 19th to September 1, 1910, inclusive, and show the good results that can be obtained by feeding grain to young pigs on a succession of forage crops, such as young rye, early in the spring, followed by young oats, and finished on succotash.

By referring to Table 10, it can be seen that the pigs made a little over a pound of gain per day on 3.4 pounds of grain, and that 16.47 pounds of pork were produced for every bushel of grain eaten. Valuing pork at $8.00 per cwt., each bushel of grain fed was worth $1.31.

These 18 pigs ate during the experiment 9413 pounds of corn meal and 1043 pounds of soybean meal. One acre of young rye, 2 acres of young oats and 1 acre of succotash were used for pasturing the pigs. Charging the amount of corn these pigs ate at the rate of 60 cents per bushel, plus $2.00 per ton for grinding, and soybean meal at the rate of $32.00 per ton, and crediting the pigs at $8.50 per cwt., the price they actually brought in the field, each acre of pasture used netted $33.68. These pigs ate 186.7 bushels (56 lbs. per bu.) of grain, which, estimating the grain to be worth 21.25 cents per bushel as fertilizer as it passes the pig, would amount to $39.67; in other words, each acre of pasture received nearly ten dollars' worth of fertilization from the manure made by these pigs, which would in a large measure pay for the rent of land and the seed sown.

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## CONCLUSIONS.

### Part 1. The Growing and Fattening of Hogs in the Dry Lot.

1. Corn lacks in protein and ash, nutrients essential for the production of bone and muscle, but excels in those nutrients essential for the production of heat, energy and fat, as may be seen from the fact that in one of these experiments pigs averaging 39 pounds at the beginning and fed corn meal alone in the dry lot, gained but 25 pounds per head in 196 days, at a cost of 17.8 cents per pound gain, whereas, the same pigs were made to gain 212 pounds per head in the next 155 days by supplementing the corn meal with ship stuff, green alfalfa and alfalfa hay, at a cost of 5.3 cents per pound gain.

It was found that pigs averaging 40 pounds at the beginning of a test gained 263 pounds per head in 223 days, at a cost of 5.9 cents per pound gain, by the feeding of middlings with a small amount of tankage and oil meal for the first 75 days, at the end of which time corn meal was introduced into the ration, and the oil meal and tankage discon-

tinued. The corn meal was gradually increased and the middlings gradually decreased, so that at the end of 195 days from the beginning of the experiment the proportions of these two feeds were about half and half, and for the remainder of the experiment (4 weeks) corn meal alone was fed.

Two lots of pigs, averaging 38 and 39 pounds at the beginning of the test, the one lot receiving corn meal and ship stuff (ship stuff with all the middlings), half and half, and the other lot receiving corn meal and middlings, half and half, gained respectively 186 and 178 pounds in 223 days, at a cost of 6.6 and 6.5 cents per pound gain, thus indicating that these two feeds are of about equal value in the supplementing of corn in pork production.

Pigs weighing 64 pounds at the beginning and fed corn meal for 125 days, made an average gain of 86 pounds, at a cost of 6.39 cents per pound gain; while pigs of similar weight, receiving corn meal supplemented with green alfalfa and alfalfa hay, and fed for the same length of time, gained 142 pounds per head, at a cost of 5.3 cents per pound gain. Two other lots of pigs, averaging 63 and 62 pounds at the beginning, the one being fed corn meal 7 parts and soybean meal 1 part, and the other receiving corn meal 7 parts and digester tankage 1 part, gained, respectively 139 and 159 pounds per head in 125 days, at a cost of 4.7 and 4.8 cents per pound of gain.

Hogs weighing 143 pounds at the beginning, and fed corn meal alone, gained 76 pounds per head in 56 days, at a cost of 5.8 cents per pound gain, while a similar lot as to weight gained 84 pounds per head in the same length of time, at a cost of 5.4 cents per pound of gain, by receiving a ration of corn meal 10 parts and soybean meal 1 part. Still another lot, similar in weight at the start, gained 93 pounds in 56 days, by receiving a ration of corn meal 14 parts and digester tankage 1 part, at a cost of 5 cents per pound of gain.

By comparing the lot averaging 39 pounds at the begin-

ning and receiving corn [meal alone; the lot averaging 64 pounds at the beginning, and receiving corn meal alone; and the lot averaging 143 pounds at the beginning, and receiving corn meal alone, it is noted that corn meal alone becomes a more balanced and economical feed for a hog as he matures. However, it is also noted in the comparative experiments that it is profitable to supplement corn with a nitrogenous supplement, even after the pig arrives at considerable weight. In these tests it is shown that green alfalfa, alfalfa hay and soybeans are excellent supplements to corn in the production of pork, and are feeds that can be grown on the farm. In our experience so far, however, hogs eat but little alfalfa hay, unless they have previously acquired a taste for alfalfa by having been fed green alfalfa. Soybean culls were used largely in our tests.

2. The average gain made per bushel (56 pounds) by all lots of hogs receiving corn meal alone in these dry lot experiments, was 8.3 pounds. Estimating the pork produced at $8.00 per hundredweight, 67 cents per bushel was realized on the amount of corn consumed, while the average cost of a bushel of corn meal was 65.5 cents. The average number of pounds of gain made per bushel (56 pounds) by the lots receiving a nitrogenous supplement in addition to the corn meal, was 12.92 pounds. Estimating the pork produced at $8.00 per hundredweight, the grain fed realized $1.03 per bushel, while the average cost of the feeds fed was 69.7 cents per bushel.

3. Runts fed a balanced ration made economical, but small gains. The greatest drawback in the feeding of runts proved to be their slow growing qualities.

4. Ground wheat, used as a sole ration for pigs averaging 61 pounds, and fed 125 days, produced 40 per cent. larger gains than corn meal alone fed to a similar lot.

**Part II. The Growing and Fattening of Hogs on Forage Crops.**

1. The young growing cereals, such as rye, oats, barley and wheat, were found to contain much more protein and ash and less crude fiber than the same cereals that had arrived

at some height; hence, the young growing plants are much better as forage crops for hogs than the more mature plants. From our analyses, young green rye, barley, wheat and oats should be classified as nitrogenous instead of carbonaceous roughages. These pastures should be grazed by hogs when the plants measure between 6 and 15 inches in height.

2. There is no time that grain can be so profitably fed to a hog as when he is young and running on pasture. Under such conditions, we have been able to secure, at times, 18 pounds of gain for each bushel of grain fed. On the other hand, our experience is that young pigs running on forage crops without grain scarcely maintain their weight.

3. During the spring, summer and early fall months, from one-half to three-fourths of a full feed of grain was fed to hogs running on pasture. This was done so that more pasture would be eaten by the pigs than if a full ration were given. During the late fall, winter and early spring, when the pastures were short, nearly a full ration of grain was fed.

4. Corn meal should be supplemented with soybeans, tankage, middlings or with some other nitrogenous supplement when fed to pigs running on young rye or barley during the winter months. Thus, pigs averaging 47 pounds on November 30th, averaged 168 pounds by May 4th (155 days), on a grain ration of corn meal alone and the run of a rye pasture, a gain of 13.61 pounds for every bushel of corn meal consumed; while a similar lot of pigs, running on rye during the same time and fed a grain ration of corn meal 6 parts and soybean meal 1 part, averaged 201 pounds at the end of the test, a gain of 15.34 pounds per bushel of grain. Valuing pork at $8.00 per hundredweight, the grain as fed the lot receiving corn meal alone, realized $1.08 per bushel, and cost 65.5 cents per bushel. while the grain fed the lot receiving corn meal and soybean meal, realized $1.22 per bushel and cost 68.9 cents per bushel. Also, pigs averaging 49 pounds, November 12, 1910, averaged 174 pounds, April 8, 1911 (147 days), on a grain ration of corn meal alone and the run of a rye pasture, a gain of 11.64 pounds

for each bushel of corn meal consumed; while a similar lot of pigs, running on rye during the same time and fed a grain ration of corn meal 10 parts and digester tankage 1 part, averaged 214 pounds at the end of the test, a gain of 14.86 pounds of pork per bushel of grain fed. Valuing pork at $8.00 per hundredweight, 93 cents per bushel was realized on the ration of corn meal alone, while the cost was 65.5 cents per bushel, and $1.19 per bushel was realized on the feed fed the lot receiving corn meal supplemented with tankage, while the cost of a bushel of this feed was 71.5 cents.

5. Pigs averaging 66 pounds per head, receiving corn meal alone, but allowed the run of a clover pasture, until it was killed by frost, and then turned on a pasture of young rye, averaged 215 pounds in 124 days. These pigs made a gain of 14.65 pounds of pork for every bushel of corn meal fed. Valuing pork at $8.00 per hundredweight, each bushel (56 pounds) of corn meal fed realized $1.17, and cost 65.5 cents. Pigs of the same weight fed corn meal in the dry lot averaged 150 pounds at the end of 124 days, producing only 10.24 pounds of gain per bushel of corn meal fed. The corn meal fed in this case realized but 82 cents per bushel, and cost 65.5 cents.

6. Eighteen pigs, averaging 51 pounds per head, averaged 222 pounds at the end of 166 days from receiving a ration of a mixture of corn meal 9 parts and soybean meal 1 part, and allowed a succession of forage crops, namely, 1 acre rye pasture, 2 acres oat pasture and 1 acre succotash pasture. These hogs gained 16.47 pounds for every bushel of grain consumed. Charging against these hogs the cost of the grain fed, each acre pastured was worth $33.68. This profit does not take into account the cost of the grain sown or the rent of the land. The manure produced by these pigs was, however, worth $39.67, or nearly $10.00 per acre, which would nearly pay for the seed sown and the rent of the land.

7. Each bushel of corn contains 25 cents' worth of fertilizing constituents, of which 21.25 cents' worth passes the animal in the urine and feces. This manure is all saved

when the pigs are running on forage crops, a very important factor in favor of that system of feeding pigs.

8. The average gain made per bushel (56 pounds) of grain by all the lots of hogs running on pastures, in the spring, summer, fall and winter, with the exception of Lots 1 and 2 of Table 9, page 346, which statistics were included in Table 10, was 15.02 pounds. Estimating pork at $8.00 per hundredweight, the grain fed these hogs realized $1.20 per bushel, while the average cost was 68.4 cents per bushel.

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ACKNOWLEDGMENTS.

The writer is indebted to Professor T. R. Bryant, now Head of the Extension Department of this Station, for valuable aid in carrying on the earlier experiments given in this bulletin, as well as for photographs taken. The writer is also indebted to Professor L. S. Corbett for efficient aid in compiling the statistics of experimental work conducted. We feel under special obligations to the Feed Department of this Station for the analyses of forage crops made by the Chemist of that Department, Professor H. D. Spears. Credit is also due Mr. J. B. Martin, the swine herdsman, for his careful and accurate work in carrying out instructions in the feeding of all these lots of hogs.

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NOTE—Credit should have been given on page 313, to Dr. C. H. Stange, Dean of the Veterinary School of Iowa State College, for the vermifuge formula. Dr. Stange did considerable experimental work before deducing this remedy for worms in hogs.

# Kentucky

# Agricultural Experiment Station

of the

## State University

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BULLETIN NO. 176

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I. Jack Stock of Kentucky.

II. Rearing of Mules.

III. Brood Mares for Producing Mules.

IV. Experiments in Feeding Mules.

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LEXINGTON, KENTUCKY
NOVEMBER 30, 1913

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## Notice

The Bulletins of the Station will be mailed free to any citizen of Kentucky who sends his name and address to the Director.

# BULLETIN NO. 176

## I. JACK STOCK.

By J. J. Hooper and W. S. Anderson.

### INTRODUCTION.

The remote ancestors of the Jack may be traced to the wilds of Asia and Africa. The ass was the first animal domesticated by man to carry his burdens and to transport him on his long, rough and tedious journeys. In the course of time the ass divided his labor with the horse, and now allows his progeny, the mule, to share the burdens with the horse. The important breeds of jacks are as follows:

1. The Andalusian. In the small province of southern Spain known as Andalusia there is a breed of gray jacks which are known to the commercial world as Andalusians. While the prevailing color is gray a few blacks are found among them. They are medium in size varying from 14½ to 15 hands high. The most noticeable advantage which they possess is the excellence of their legs. The bone is large, clean and strong. This breed of jacks has not been popular in America on account of the gray color, although they were the first introduced into the United States.

2. The Majorca. East of Spain in the Mediterranean Sea is a group of islands, the largest of which is Majorca. The jacks found on this island are valuable because of their black color, large body and bone, and general excellence. Most of the valuable jack stock of this island has already been exported and very few animals are now exported from that locality.

3. The Catalonian. The Catalonian is a black jack

found in the province of Catalonia which is situated in the Pyrenees mountains of Spain. This is perhaps the best breed that has been imported into America. The size of this breed ranges from 15 to 16 hands, and they are noted for their clean, flat bone. While the bone is not as large as the American breeder desires, it is flat, and of a very superior texture. Cold weather prevails in their original home and vegetation is scarce. For this reason they do exceedingly well when transplanted to the more favorable environment of our country. These jacks possess style and unsurpassed action and these valuable traits are transmitted to their mule colts.

4. THE MALTESE. The little island of Malta, situated south of Sicily, has a breed of jacks called Maltese, which are perhaps of Arabian origin. They are black and brown in color, not large, about 14 hands, with neat, but very light bone. They have slender, pointed, well set ears. These small animals show remarkable vitality, and when transplanted to a more favorable environment tend to become larger and stronger. The time has passed, however, in America when a jack as small as the Maltese can be of any value to our jack stock.

5. THE ITALIAN. This breed is found almost everywhere in Italy, and but little attention is given to their pedigrees. The Italian jacks are very small, rarely ever reaching 14 hands in height. These are the most worthless as well as the cheapest jacks to be found.

6. THE POITOU. This is an important breed found in the Poitou province in France. They have been bred with greater care than any other distinctive breed of jacks, and as a result are today the most valuable. The demand for these jacks in France is so great that but few are exported. The price ranges from $1000 to $2000. They do not thrive well when taken from their native habitat, and this makes it extremely hazardous to import them. They are noted for their rugged, sturdy form; for their size and strength. This breed is the heaviest found in Europe. The Poitou has a long, fine mane, and dark hair that is of fine texture. The

hair will, if allowed, grow to very great length. In France they are not groomed and the hair is never cut. This gives them a unique and not altogether attractive appearance.

7. THE AMERICAN. The distinctive breeds of jack stock that were early imported into America, have in the hands of American breeders, been fused into a new breed. The dis-

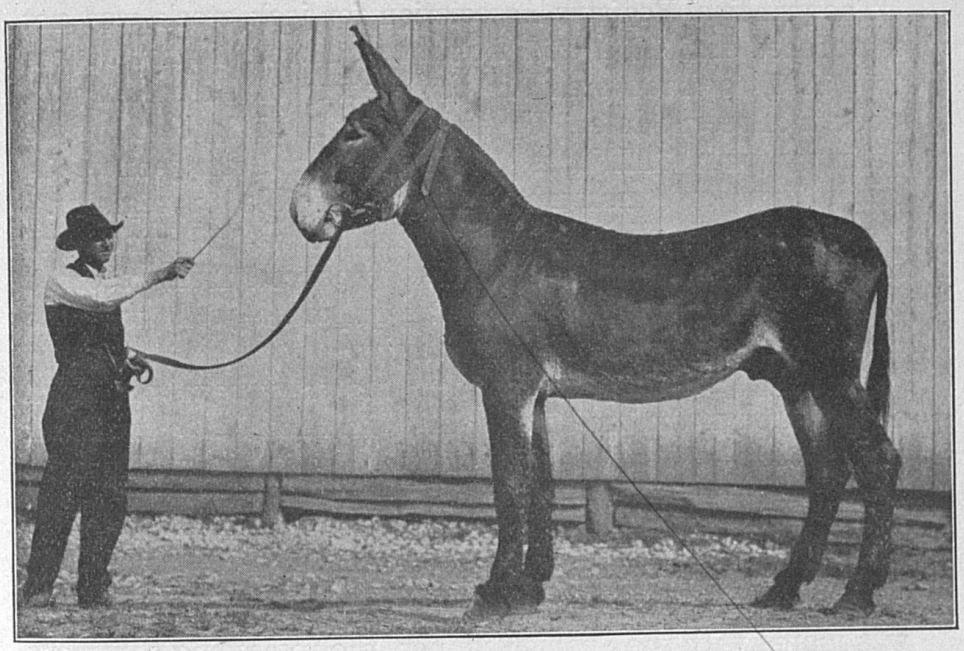


Fig. 1. A SPLENDID JACK.

Weight 1155 pounds. *Standard measurement 15 hands, 1½ inches. Six years old May 5th, 1913.

| | | | | | |
|---|---|---|---|---|---|
| Tip to tip of ears | 33 | inches | Around flank | 72 | inches |
| Width between eyes | 9 | " | " arm | 16½ | " |
| Length of face (poll to end of upper lip) | 33 | " | " knee | 16 | " |
| | | | " cannon | 9½ | " |
| Around jaw and face | 40 | " | " hock | 19 | " |
| " neck | 42 | " | " hind cannon | 10½ | " |
| " girth | 70 | " | | | |

From poll (between ears) to root of tail (total length of body) 84 inches.

This jack has won many championship ribbons in Kentucky. He was sold to his present owner for $1800. He is of splendid size and has a commanding appearance and is a sire of large mules. However, he is slightly calf-kneed and crooked in the hocks.

*Standard measure (abbreviated st. m.) only is employed in this bulletin, except when the tape measurement (commonly termed "jack measure") is specifically designated by abbreviation j. meas.

tinguished individuals who furnished most of the blood for this new breed were: Imp. Mammoth, Imp. Warrior, Imp. Moro Castle, Imp. Napoleon and Imp. Alvarado. The breeders who handled these jacks and their descendants judiciously selected and mated the best individuals. They selected for size, weight, bone, style, action, constitution and finish.

The principal Registry Association for jack stock was not established until 1888, and the first stud book did not appear until 1891, so that systematic pedigreeing of American jack stock is of recent date. Up to January 1, 1892, the only rule of entry was: "All jacks 14½ hands, and all jennets 14 hands, standard measure, shall be eligible to registry." After 1892 to be eligible, the jack had to be 15½ hands and the jennet 15 hands high, unless produced from recorded ancestry, except in the case of an imported jack, when 15 hands was set as the minimum height.

The registration of jack stock has thus been of recent date, although the use of the jack, in America, dates back to the time of General Washington. It is known that the King of Spain presented a jack and jennet to General Washington. Lafayette also sent him a jack from France. The inference would be that these animals were among the best of the two countries. It seems that the French jack was mated with the Spanish jennet, the foal being a famous jack called Compound. The name, no doubt, indicated that he was the result of a cross of two breeds. This jack, Compound, was used to produce mules, some of which sold for two hundred dollars and more each, a most fabulous price for that time.

It appears that a Mr. Leer was in the employ of General Washington at this time and on a visit to his relatives in Bourbon County, Kentucky, he told of Washington's jack stock and mules. Soon after this a small jack was secured and brought to Bourbon County, Kentucky. It attracted no little attention and comment. The story is told in this county that the people went miles just to look at the little fellow.

Henry Clay introduced the Spanish jacks into Kentucky.

The evidence seems to point to him as the importer of Don Carlos, Warrior and Ulysses. These were the very best that could be secured and soon the mules, produced by them out of Kentucky mares, became noted and were in great demand.

The exact date is not known but somewhere about 1840 a very large jack was imported to Charleston, S. C. The voyage had been a rough one and he had been swung in a ham-

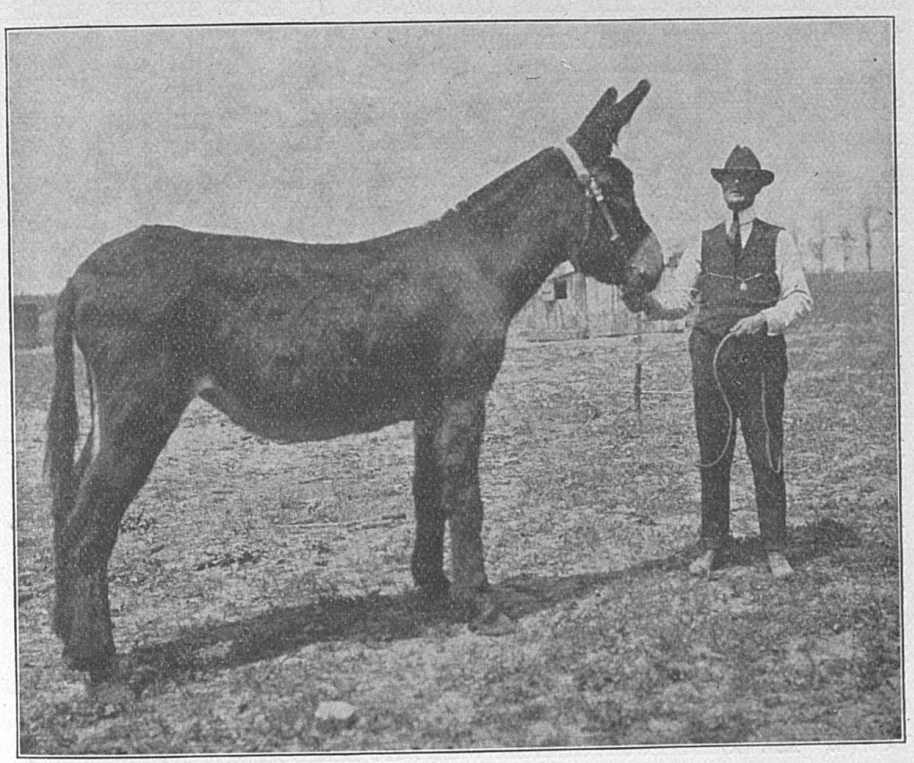


Fig. 2. A BEAUTIFUL JENNET.

Weight, 1050 pounds; height, st. m., 15 hands, 1 inch.

| | | | |
|---|---|---|---|
| Ears from tip to tip | 34 inches | Around flank | 72 inches |
| Length of head | 31½ " | " forearm | 16 " |
| Between the eyes | 9 " | " knee | 14 " |
| Around the jaw and face | 34 " | " cannon | 9 " |
| " neck | 37 " | " hock | 16 " |
| Length of body | 84 " | " hind cannon | 11 " |
| Around chest | 68 " | | |

This jennet sold for $1,000. She is the dam of the jack shown in Fig. 3, and before purchasing her the present owner made a standing offer of $1,000 for all of her jack colts at weaning time.

mock to prevent serious danger as the ship rolled in the storms. When set on shore he naturally had but little use of his legs. Young and Everette of Montgomery County, Kentucky, purchased him for much less than his value. They secured "Black" John Mason to lead him through from South Carolina to Kentucky. This he did, but the journey required six months. He would walk the jack a short distance and allow him to rest, and thus continued by slow stages, until the long journey was completed.

This jack is known as Imported Mammoth. His pedigree is a complete mystery. We have been able to find only one man, Mr. C. C. Leer, who saw this great old jack. He says he was fully 16 hands high and wonderfully well made for his day and time. Whatever may have been his pedigree he had breeding power possessed by few of his kind, and it may be profitable to dwell a little on his ability as a sire.

Henry Leer, of Bourbon County, bred a jennet to him and called the jack foal Buena Vista. This proved to be a very large animal and at this time would be considered a rough jack, but in 1853 Mr. Leer sold him to Major Blythe, of Madison County, for the sum of $3000. This jack was perhaps too large, as he was nearly 17 hands high. His value, however, shows the interest in the industry at that time, and also gives an idea of the prepotency of Imp. Mammoth.

As has been stated nothing is known of the pedigree of this wonderful old jack, but as we now understand the principles of breeding, there must have been valuable blood in his veins. He could not transmit what he himself did not possess. Buena Vista was by no means his only great son.

Had Imp. Mammoth sired only one son, and that one Maringo Mammoth, he would have justified all the confidence placed in him by Messrs. Everette and Young in bringing him at a great cost to Kentucky. Maringo Mammoth sired Black Mammoth, whom Major Knox, of Danville, Kentucky, sold to go to Tennessee, for the sum of $2500. He was also the sire of the Tennessee Maringo Mammoth which did so much to improve the Tennessee jack stock. It is estimated that this jack was worth $100,000 to Tennessee.

Imp. Mammoth was used exclusively as a jennet jack and so great was the demand for his services that his owners placed his fee at $100. This will appear all the more remarkable when it is stated that $25 is now considered a maximum fee for a jennet jack. He made nine seasons before his death. His jack colts were worth $500 at weaning time.

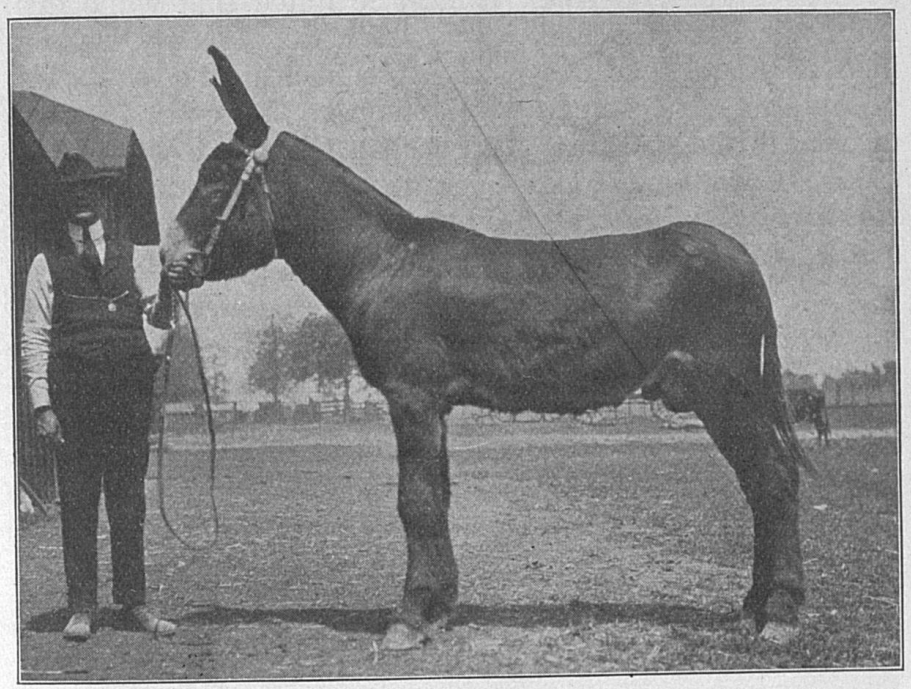


Fig. 3. A Two-Year-Old Jack.

Weight 1000 pounds; height (st. m.) 15 hands, 1½ inches.

| | | | | | |
|---|---|---|---|---|---|
| Ears from tip to tip | 35 | inches | Around knee | 17 | inches |
| Around face and jaw | 38 | " | " cannon | 9½ | " |
| Face, poll to mouth | 30 | " | " hock | 19½ | " |
| Eye to eye | 10 | " | " hind cannon | 11 | " |
| Around neck | 41½ | " | " flank | 72 | " |
| " girth | 66 | " | Length, poll to tail | 91 | " |
| " forearm | 17 | " | | | |

This two-year-old jack is of extra high class. His greatest defects are that his eyes are a trifle small and he is somewhat depressed in his back line from withers to rump. However, his ears are large and he has lots of bone in the head and jaw and he is heavily muscled in the neck, has a deep body, large knees and hocks and stands well on his legs. His sire is a large jack and he is out of the splendid jennet shown in Fig. 2. This jack sold for $1,500 to go to Mexico.

The jennets sired by Imp. Mammoth were great producers and many of the producing jennets of Kentucky, Missouri and Tennessee, today carry the blood of this old sire.

It is impossible to estimate the value of this old Imp. Mammoth to the jack stock of America. The strong characteristics of the family which he established were size, 16 hands, good bone and large feet. It must be stated that while this Mammoth family had size it was a rather ugly family, lacking in neatness and finish with perhaps too much meat on the bones of the legs. The defects were endured, however, in view of the size and strength. In Bourbon County, close to that section of Montgomery in which this famous Mammoth jack stood for service, there were brought two noted jacks, Alvarado and Moro Castle. These were imported and possessed very great excellence. The latter is said to have cost his one time Tennessee owner, Mr. Maye, $5000, the greatest amount which we can find that was ever paid for a jack. From Alvarado sprang the Yelvertons, and from both came many offspring which aided the Mammoth blood to go on producing better individuals from generation to generation. Another famous jack which added to the value of these blood lines was Leer's Napoleon by Imp. Napoleon. We have been able to learn but little of this sire who appears in so many good pedigrees. We are told by one man that he considered him the very best one of all the older jacks, including Imp. Mammoth, Alvarado and Moro Castle. Leer's Napoleon was of good size and of better style and finish than most of his contemporaries in Kentucky.

From these few jacks which have been named sprang the great jack stock which has made Kentucky, Missouri, Tennessee, and to a lesser extent, Indiana and Illinois famous as mule producing states. This nucleus of good blood in two counties of Kentucky produced splendid individuals which were sent to other parts of this commonwealth and to the other states named above. These good individuals stamped their good characteristics upon their hybrid descendants; and so the mules of these five states became world famous.

Missouri, Illinois, and Indiana have had a larger number of draft mares than has Kentucky and Tennesse. The size of these Mammoth jacks has produced with western mares a very high class mule, with weight and draft ability, but such mules are not as active as Kentucky mules produced out of lighter mares.

The tendency to coarseness which the imported jacks of early days possessed has, in the hands of American breeders, been greatly refined. This is noticeable in the winning jacks at the leading Kentucky Fairs in recent years. The prize-winning jacks of today have first of all size and weight,

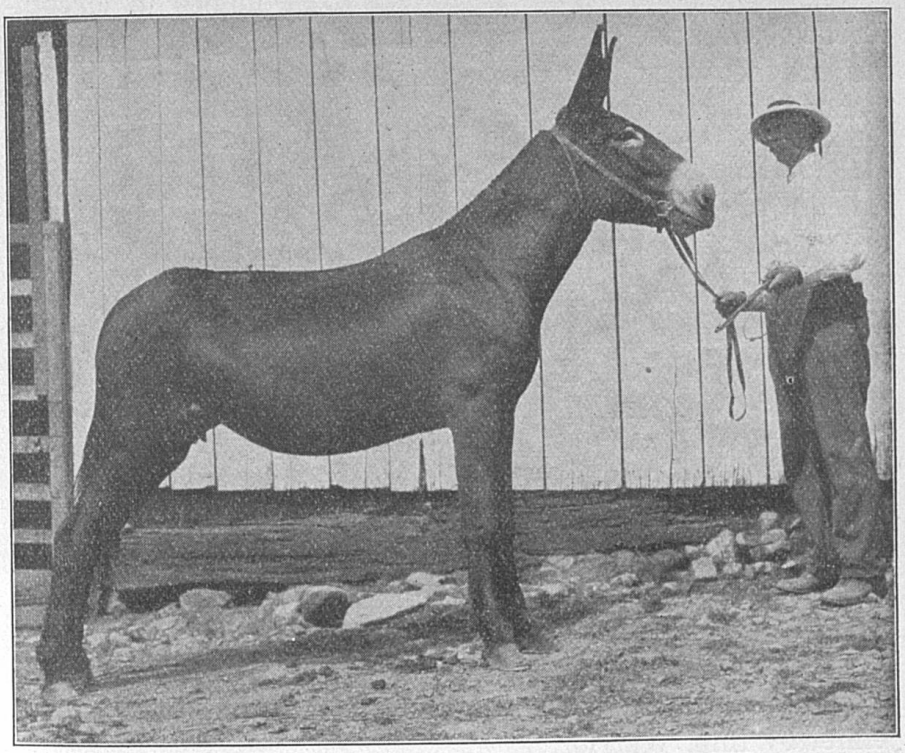


Fig. 4. A Premium Jennet.

Weight 1000 pounds; height (st. m.) 15½ hands.

| | | | |
|---|---|---|---|
| Ears from tip to tip | 32½ inches | Knee | 14 inches |
| Above knee | 12 " | Girth | 70 " |
| Below knee, cannon | 8 " | Loin | 69 " |
| Throat latch | 31 " | Length, from poll to tail | 86 " |

Jennet winner in her class at Lexington, 1913.

good legs and feet and fluted bone of desirable size. The head is long and well formed, and the ears are 33 inches or more from tip to tip. The prevailing color is black with white points. The standard height at maturity is 15 to 16 hands, weight 1050 to 1150 pounds. Girth measurement from 68 to 72 inches with loin measurement—tape drawn tight—not more than one or two inches less than girth measurement or equal to it. The cannon bone (bone below the knee) should be from 8 to 9½ inches in circumference. A jack 15 hands 3 inches high and weighing 1150 pounds, should measure not less than 9 inches below the knee and 9½ is better. The hock should be from 18 to 21 inches in circumference, while the gaskin should measure close to 16 inches and the measurement of rear cannon should approximate 10 inches in circumference.

The present perfection has been secured by sixty years of judicious selection and it shows that pedigree counts for as much in the jack as in any other animal. To show the result of this judicious selection, we give the breeding of Crouch's Independence, who died after making one season.

Crouch's Independence was sired by Big Ike; he by Big William; he by Big Light. The dam of Big Ike was by Saunders' Napoleon; he by Leer's Napoleon; he by Imp. Napoleon; and his grandam was by Everette's Mammoth, who was by Imp. Mammoth. The dam of Crouch's Independence was by Tuscarora; he by Imperial Mammoth; he by Hamilton, he by Jeff Ecton's Jack, he by Groom's Jack, he by Imp. Mammoth. The grandam of Independence, the dam of Midnight, was by Chas. Turner's Wellington; he by Lord Wellington, who was by Imp. Moro Castle. The great grandam of Independence was by Imp. Mammoth out of a jennet by Imp. Warrior.

We think one who admires a good line of breeding would consider this pedigree an unusually good one. We are told by those who knew him that his individuality was all that one would expect from such a line of ancestry. He made but one season in his three-year-old form. He was bred to 27 mares. Two late horse mule colts sold for $75 and $85

respectively; every other mule by him sold at weaning time for from $100 to $125. From the age of two years to his death he had an occasional jennet brought to him.

During the fair season of 1913 his get secured the blue at Mt. Sterling for best one-year-old jack, best two-year-old jack and sweepstake for jacks. At Lexington his get secured the blue for one-year-old jack and two-year-old jack. At the Fair of Paris, Kentucky, his offspring were awarded blue for one-year-old jack, two-year-old jack, three-year-old jack and

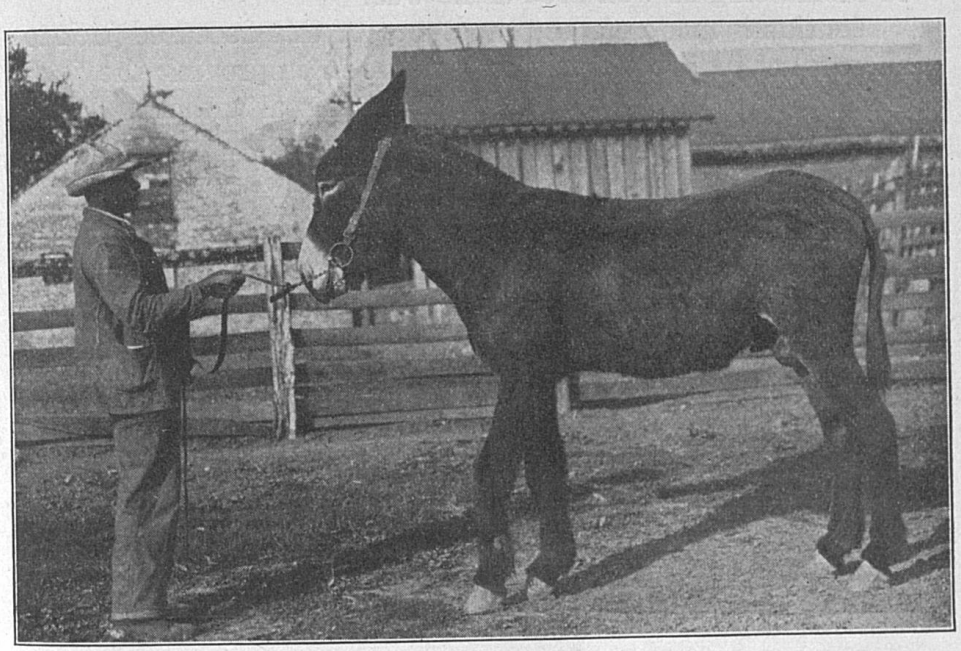


Fig. 5. A Jack of Medium Size.

Height (st. m.) 14 hands, 2 inches.

| | | | | | |
|---|---|---|---|---|---|
| Ears tip to tip | 30 | inches | Around cannon | 8 | inches |
| Width between eyes | 9 | " | " knee | 15 | " |
| Poll to end of upper lip | 30 | " | " flank | 63½ | " |
| Around neck | 38½ | " | " hock | 17 | " |
| " girth | 61½ | " | " hind cannon | 9 | " |
| " arm | 16½ | " | Length of body | 80 | " |

This is a jack of only average size, weighing 950 pounds, and standing 14 hands, 3 inches in height, according to jack measurement and 14 hands, 2 inches according to standard measurement. One unfortunate feature about this jack is that he has a dished face.

sweepstake for jacks. At the State Fair at Louisville, we saw a two-year-old jennet by him awarded the blue in her class.

We have examined and measured all the jacks sired by this prepotent sire and there is not an inferior animal among them. That which delighted us most in studying them is that they are so similar in conformation and type. One of the contributing factors to cause this is that the jennets taken to him were bred along lines similar to his own, some of them being as well bred as he was.

Mention is made of the prepotency of this deceased jack to show what judicious selection will do in improving the jack stock. The mule is spoken of as an animal without "Pride of ancestry or hope of posterity." This may have been true of the mule of the past, but the mule of the future can at least be proud of his ancestry, if in the veins of his sire and dam there runs the blood of Mammoth, Alvarado, Moro Castle, Yelverton, Dr. McCord, Independence or of other equally well bred jacks. Why should not the breeder feel proud of his achievement when he has bred a great jack like Barrytone Mammoth 2466, who sold at auction in 1910 for $3,030, or like one which recently sold in California for $4000, that was bred in Madison County, or like Monarch bred in Boyle County, who sold for $2000 to go to Missouri.

There is now no excuse for producing small, undersized mules. They will be a source of loss to the breeder. If this be true of mules, it is all the more true of jacks. There should be no place in Kentucky for the inferior, undersized jack. To secure jacks of style, finish, and size as much care must be given to their pedigrees as is given to the pedigrees of high grade horses.

The time has come in the jack industry of our State when it is doubtful if imported blood will be of advantage. It is a grave question if America does not now possess the best jack stock in the world. In foreign countries the different breeds have been kept pure. In America there has been a disregard for the purity of the separate breeds. The American breeder has been searching for a jack possessing substance, bone,

style, action, intelligence and above all else, prepotency. One who can reproduce himself when mated with similarly bred jennets, and who can sire mules of size, substance, finish and action. In this quest some have met with a good measure of success. The size of the Mammoth has been maintained, while style and finish have been added.

There can be no question that the jacks and jennets of the good strains now in Kentucky are better than were ever before produced. If some of the superior ones are retained

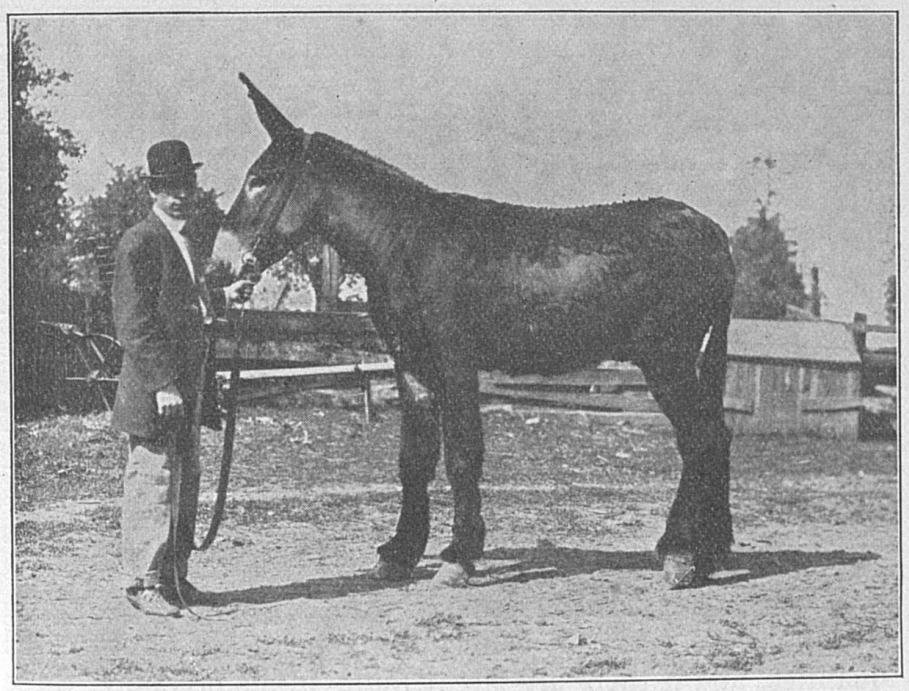


Fig. 6. A Magnificent Jack.

| | | | | | |
|---|---|---|---|---|---|
| Ears from tip to tip | 33 | inches | Around cannon | 9 | inches |
| Face and jaw | 36 | " | " hock | 20 | " |
| Neck | 40 | " | Length | 86 | " |
| Around arm | 15½ | " | Elbow to knee | 20 | " |
| " knee | 15½ | " | | | |

This Mammoth animal sold for $1,400 to go to Mexico. His weight was 1150 pounds and he measured 20 inches around the hock. His depth and length of body and extreme size are commendable. From the photograph it will be seen that he should have a larger amount of muscling in the neck and a greater length of neck would improve his looks.

in the State there is no reason why still greater improvement cannot be made in the next few years.

The stud books show which have pedigrees reaching back into worthy parentage, and those with the short or unknown pedigrees. For the future, the breeder should not be content with a short pedigreed animal, nor should it be satisfactory to know that an ancestor close up was imported. Only a comparatively few jacks which have been recently imported have improved the stock in this country, and it is a grave question now if our best families of jack stock would be benefited by crossing with imported stock. The object of importation at first was to improve the character of jack stock; now importation seems to serve but one purpose and that is a commercial one. The importer takes advantage of the current idea that an imported animal is superior to a native one and thereby secures a high price often for a mediocre individual. It is seldom now that a Kentucky jack breeder imports a jack or jennet to be used in his own stud.

Another matter should be mentioned and that is the deceptive breeding power of some good jacks whose pedigrees are short and who came from defective families. Any animal possesses, and passes on, the characteristics of his race. If there are inferior animals in his pedigree near to him, some of their inferior points are more than liable to appear in his offspring. No cross-bred animal can breed according to his personality. He can not show in the conformation of his body more than half the qualities which he carries and can transmit. So that if by chance his body shows all his good qualities, and if there are latent faults in his breeding, these are sure to appear in his descendants. It would be better to use an animal of only fair individuality in the stud who comes from a good family, than to use a superior jack from an inferior family.

### Historical Data on the Jacks and Jennets of Kentucky.

Perhaps it may be well to add some information which we have been able to secure, but which has not been previously published, concerning certain of the old jacks and jennets of Kentucky.

Diligent search has revealed but little additional information concerning the descendants of Buena Vista, that was sold to Major Blythe, of Madison County, by a Mr. Leer, of Bourbon. We have found men in Madison County who remember a Buena Vista jack owned by Dr. Tom Moberly of that County. This was evidently a son of Leer's Buena Vista. We are told that this was a very large jack, with fair finish, and a most excellent sire of mules and for this reason enjoyed a large patronage. He was at the zenith of

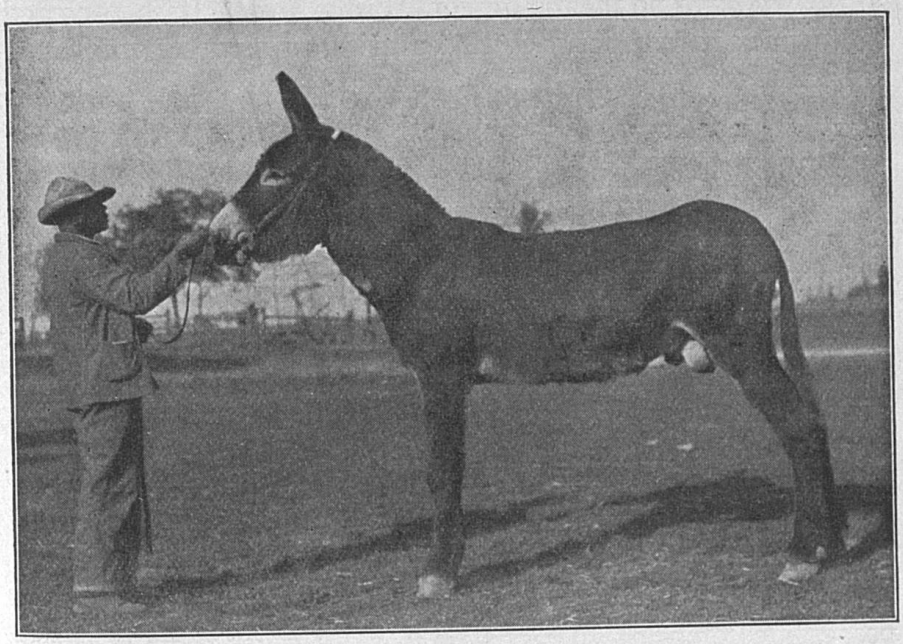


Fig. 7. A Good Two-Year-Old Jack.

his career in the stud just prior to the Civil War. However, Buena Vista was vicious in temperament, and the story is related that he once caused great fear among the slaves by crushing the head of a small colored boy who had entered his stall; and on another occasion he tossed a shoat across the paddock fence. Such ill-tempered acts as these on the part of a few of the early jacks led to the traditional belief that all of them were vicious. But it must be remarked here that by careful and judicious mating of jack stock the

temperament of the present day jack is as docile and friendly as that of the horse. But even now to keep a jack docile and kind, he must be handled kindly and gently, but firmly, each day.

The second dam of Bourbon Chief was by Patterson's Buena Vista, he by Buena Vista and he by Imp. Mammoth. Shelby Irvine, deceased, left a note stating that a Buena Vista sold for $1000. This evidently was a son of Leer's Buena Vista, and is the Patterson's Buena Vista above, but so far we have no means of confirming this. It is reported that a jack named John C. Breckinridge was by Buena Vista. If this be true, and it appears to be so, then the blood of this noted jack is to be found in some of the present day jack stock.

Governor Wood was another of the great male descendants of Imp. Mammoth through Maringo Mammoth, Royal Mammoth, Mason's Black Hawk, Peter's Black Hawk and Wood's Tip Top. Perhaps between 1885 and 1895, no jack surpassed Governor Wood in the value of his get. He himself was never defeated in the show ring, and he was a sire of consistent winners and of high priced jack and jennet colts. Perfection of style and finish, in addition to size and substance, characterized the Governor Wood family.

We have had access to the private record book of Mr. G. B. Turley, through the kindness of his two sons, John and R. E. Turley, of Richmond, Kentucky. We have in our possession copies of all his pedigrees. He has them recorded in a neat, plain hand which gives evidence of much care on his part. His first record is of a jennet foaled in 1871, Lucy Walker by name. She was sired by Blythe's Hannibal; he by Compromise; he by Tippicanoe; he by Black Hawk; he by Imp. Warrior. Hannibal's dam was by Bushes' Hannibal. His grand dam by Imp. Mammoth. His great grand dam by Imp. Warrior. The dam of Lucy Walker was by Mogul; he by Compromise; he by Tippicanoe; he by Black Hawk; he by Imp. Warrior. The dam of Mogul was Folly, perhaps the most noted jennet ever bred in Kentucky.

The pedigree in full shows the rich breeding employed

over forty years ago. In 1878 he records a jennet, Fannie Walker, who is out of this Lucy Walker and by Gate's King William; he by Robinson's Sampson; he by Black Sampson; he by Imp. Sampson. This Fannie Walker produced for him in 1884 a jack colt which he named Cleveland. His sire was Big Tom; he by Corsey; he by McGavok's jack; he by Franklin's Black Forrest.

Another pedigree copied from the herd book of Mr. Turley follows. He bred a jack which was called Big Andy. He was sired by Tom Keen.

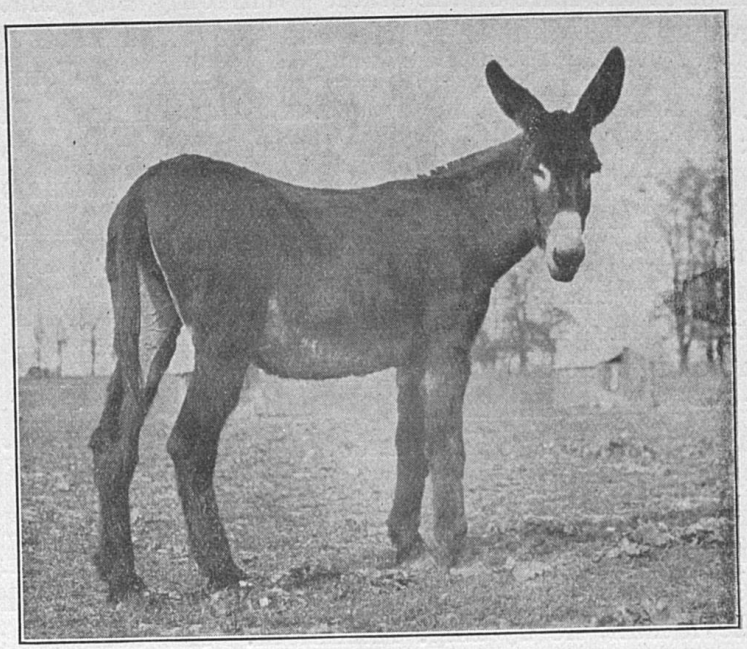


Fig. 8. A Fine Jennet.

His first dam was by Darnaby's celebrated Napoleon.
His second dam was by the Mitchel jack of Jessamine County.
His third dam was by Constitution.
His fourth dam was by Great Western.
His fifth dam was by Imp. Bertrand.
The Mitchel jack was by Bob Lee; he by Kickapoo; he by

Compromise; he by Tippicanoe; he by Black Hawk; he by Imp. Warrior.

Tom Keene was one of the famous jacks of Kentucky in more recent times. He lived during the last two decades of the previous century. He was kept for service in Boyle County in the last years of his life and died in that County. We have a copy of his stud card for 1893, when he was in the hands of Mr. W. B. Burke. The following quotation is copied from this card: "This great show jack is too well known to require an extended description, having been shown at most of the fairs of the state. Will only say that he is large, stylish, and fine. He has proven himself to be a superior breeder to both mares and jennets. Tom Keene is by Rube Billington, of whom the Collings Brothers say: 'If we had not sold him before we saw his colts we would never have done so.' He by Clark's Mammoth; he by Night's Mammoth; he by Maringo Mammoth; he by Imp. Mammoth." Rube Billington's first dam was by Black Satin; he by Philip; he by Imp. Mammoth.

Tom Keene's dam was by Col. Epsom; he by Epsom's Montgomery; he by Coal's Montgomery; he by Black Sampson; he by Imp. Mammoth. Second dam by Mogul; he by Compromise; he by Tippicanoe; he by Black Hawk; he by Imp. Warrior.

One of the famous jacks of Madison, Lincoln and Boyle Counties was Jim Porter, known as Chenault's jack. The old stock books of Walker and Watts indicate that he was by Leviathan; he by Imp. Mammoth. His dam was a gray jennet and his grand dam a Tuscarora jennet. It seems that Jim Porter and his get had a peculiar color and they were designated as "red" jacks and mules. Evidently from his dam, who was gray, he got the white and at the same time the chestnut. One or two of these "red" jacks are still living in Lincoln County.

Mr. Levi Hubble, of Shelby City, Boyle County, was one of the famous jack men forty years ago. He closed his business on account of age and the loss of his sight in 1889. At his sale in November of that year two very great jacks were

sold, Joe Blackburn for $2460, and his full brother, Brignoli, for $2340. A half-interest in the first one of these was purchased by a Lincoln County stockman and the jack was used in the stud there. These two were full brothers; their descendants are numerous; both were distinguished in the show rings and both made good in the stud.

They were sired by Third Prince; he by Second Prince; he by Imp. Prince, a Catalonian jack.

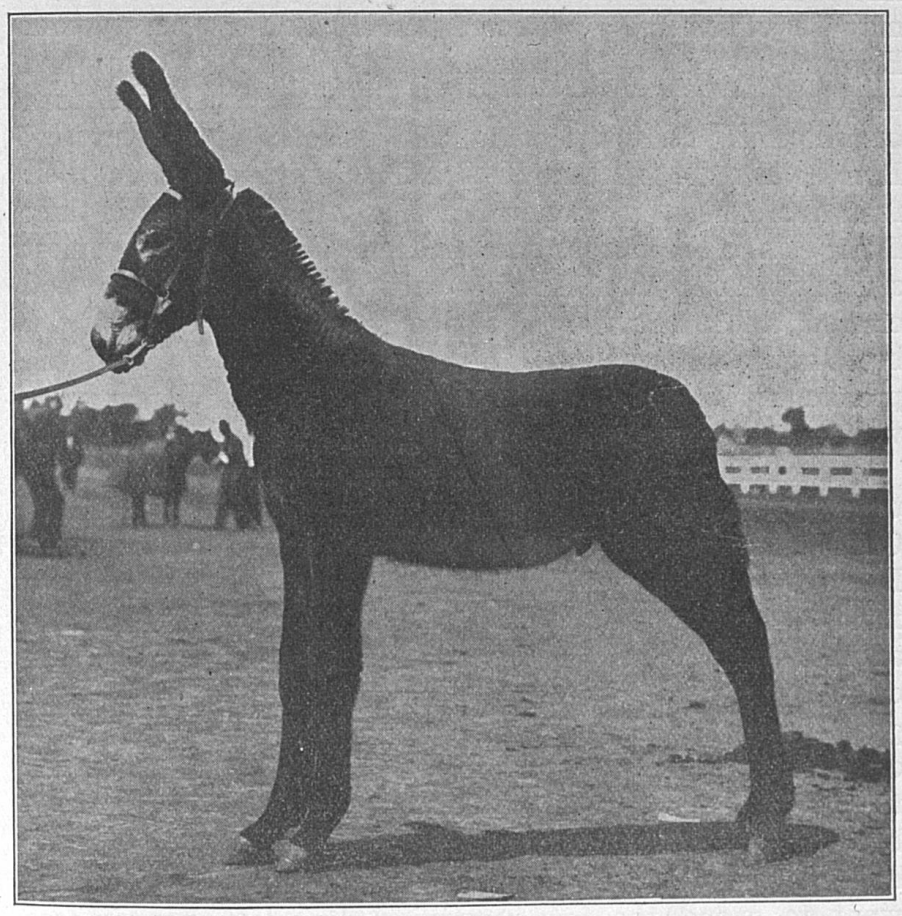


Fig. 9. A Fine Jack Colt.

This represents the highest art of Jack breeding. This colt was the outstanding individual in a class of ten colts of the same age at the Blue Grass Fair in 1913. His ears are large. He has a straight back, a deep flank, well set legs and large bone.

1st. dam Daisy, by Dixie; he by Irvine's Dixie; he by Kickapoo.

2nd. dam Nelly Gray by Lord Wellington; he by Leer's Napoleon.

3rd. dam by Jim Porter.

Mr. Hubble said that Daisy was an honor to her family and she must have been if she produced two great sons like these. The sire, Third Prince, Mr. Hubble declares was a fine premium jack which he sold to a party in California. It may be of interest to record Mr. Hubble's description of Brignoli. "He is 16 hands high, with fine weight and muscle, finer style than any of his rivals, of a beautiful dark brown color, with white points and smooth, glossy surface. Both he and the jack named Joe Blackburn stand on their feet like horses, with never a sign of a sore leg in their lives. Their breeding is the same, but Brignoli is the most successful show jack. He was exhibited sixteen times and carried off 15 premiums. His only defeat was by his full brother, Joe Blackburn. He has competed with all the premium jacks and won. This year we have challenged the world and he yet stands without a rival."

One of Kentucky's most distinguished jack breeders of the past generation was Col. I. Shelby Irvine, of Madison County. He finished his education in 1850. His father, Col. David Irvine, gave him three valuable presents on his return from school. One was a blue grass farm near Richmond, another was a jennet and the third was sound advice. He counselled: "I have never known a man who used care and good judgment in the handling of jack stock and mules, who did not make a success of farming in Kentucky." He followed the advice of his father. He did not speculate in jacks, but bred them for 52 years. On retiring in 1902 he wrote: "I have made a comfortable living from rearing jack stock and want to spend the few remaining days left to me in ease and comfort."

The jennet which his father gave him was purchased at Samuel Williams' sale for $2000. The old gentleman in memory of the extravagance named her Folly. She was

sired by Dan White's jack; he by Black Hawk; he by Imp. Warrior; The dam of Dan White's Jack was Flora, a very fine imported Maltese jennet.

At this time the greatest jack living in Kentucky was Com-

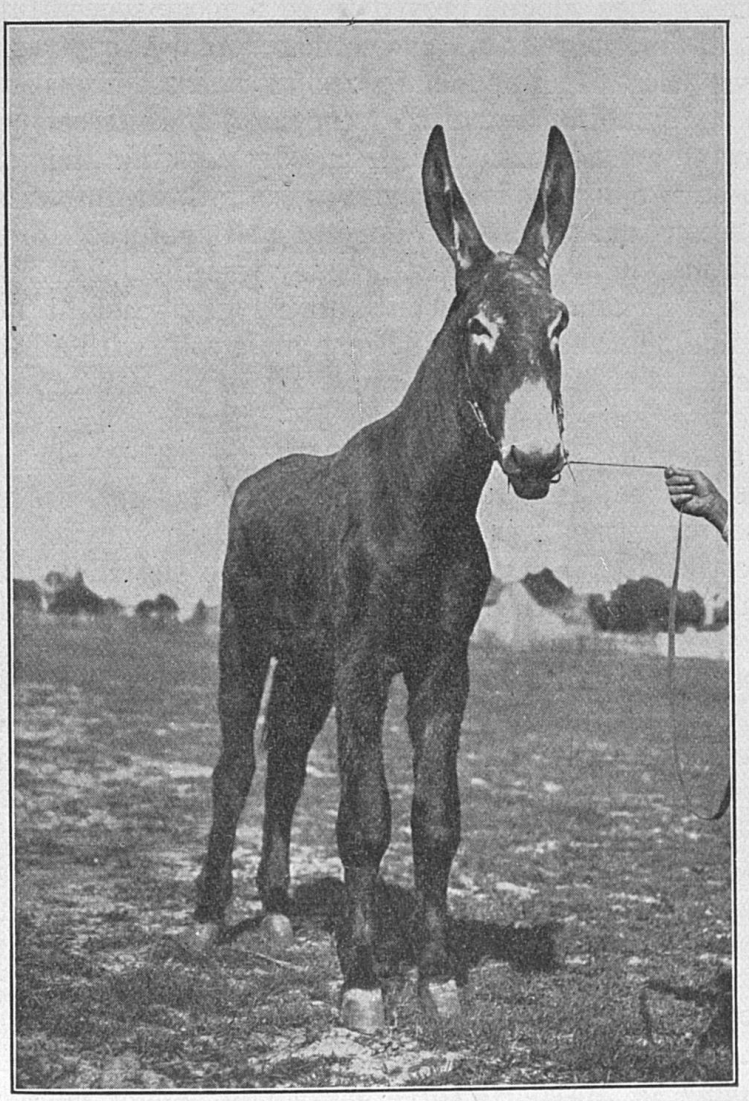


Fig. 10. FRONT VIEW OF A JACK.

This picture shows a jack possessing large ears, considerable width between the eyes, prominent eyes and large knees, but he is rather leggy and flat in the body. However, he is only 22 months old and will improve with age.

promise; he by Tippicanoe; he by Black Hawk; he by Imp. Warrior. To this distinguished sire he mated Folly, not once or twice but six times. The result of the first mating was a jack colt which matured into a jack 16½ hands high. This animal, named Mogul, proved to be a most successful show jack, at various fairs and never met defeat except as noted below. Best of all he made good as a breeder. His blood is to be found in many of the best jacks and jennets of the following generations. Mr. Irvine declares that the next colt of these two distinguished parents was just as fine as Mogul. The second one was named Corinth and matured 16 hands, 1 inch in height. The next progeny was the jack Kickapoo, who was 17 hands high. With all his great height he was "As finely finished as a handsome mule colt, with all the requirements of length, bone, style and finish. Kickapoo was a perfect jack breeder's model." He was the only jack who was able to defeat his full brother Mogul which he did a few times in sweepstake rings. What his prepotency has meant to Kentucky and to the jack interests of the nation no one can estimate. If we call Imp. Mammoth the Hambletonian of the jack stock, then Kickapoo must be classed as the George Wilkes of the same breed. In this short sketch his name appears frequently in the pedigrees of excellent animals.

In addition to these three sons, Folly produced to the embrace of Compromise three jennets as fine as herself. These became the foundation of Mr. Irvine's herd. He wrote: "I have since 1850 spared neither time, thought, trouble, nor expense, in infusing the blood of the finest jacks, both native and imported to be found in Kentucky, such as Imp. Castillian, Mammoth, Napoleon, Black Sampson, Republic and many others." On March 2, 1883, this item is to be found in the Richmond, Kentucky, Register: "Col. I. Shelby Irvine sold last week to the Leonidas Duvall Company, of Missouri, three jacks, for which he received for one four-year-old $1,200, for one three-year-old $1,100 and for one two-year-old $1,000. He also sold to J. W. Larkin, of Kansas, a yearling for $475. These animals are among the best bred in the state, and combine all the crosses

known. Their pedigrees can be traced back for forty years."

It is a very great loss to a State for a herd to be dispersed like the one which Mr. Irvine disposed of in 1902, representing the whole of his life's work. At this sale twenty-four jacks and thirty-eight jennets were sold. All went to the four quarters of the earth. They had been bred by this man of genius with definite plans for the future, but their disposal by sale caused a loss of all these plans to the breed and to the State. Most of the blood went where it must be crossed with foreign strains and the evolution wrought by a lifetime was to a great extent wasted.

There are but few breeders of our State now who are operating on an extensive scale and who are employing such

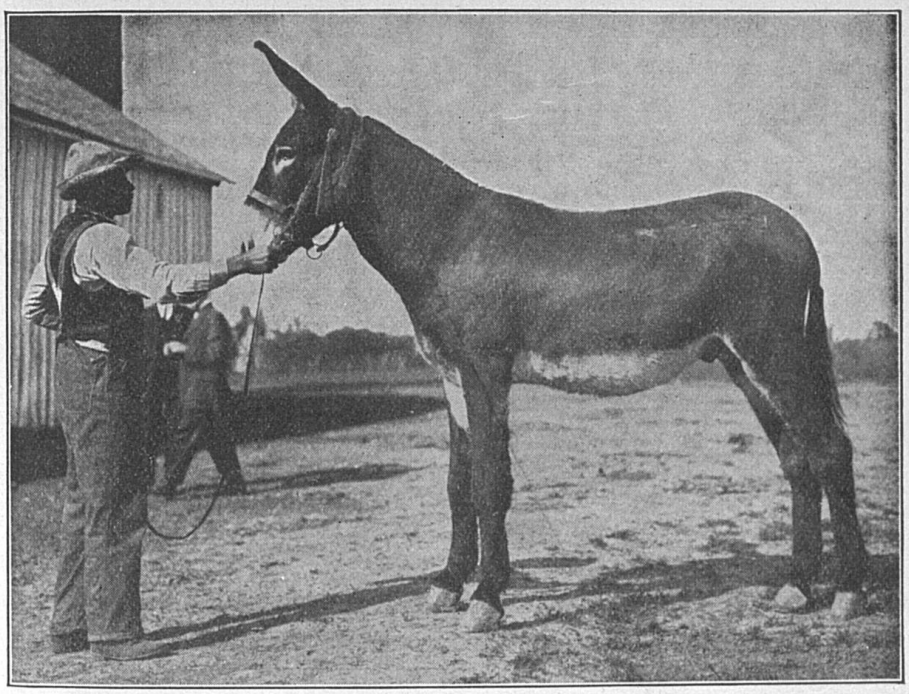


Fig. 11. A MEDIUM JACK.

This four-year-old jack is 15 hands high. He has rather a small jaw and is small in the bone below the knee Also the muscling in the arm should be much larger. His body is well proportioned He has a deep flank and his legs are straight and well set. Estimated weight 850 pounds. Especially commendable is his strong back. This animal sold for $750.

intelligent methods in their operations. At the present we have many intelligent men in the business, but most of them are operating on a small scale, and must sell many of their best individuals, which go, as a rule, to other states, and the Kentucky breeders thus lose the use of them. We can not make rapid progress in improving our jack stock as long as other states get so much of our good blood. The breeder, however, consoles himself by the long price which he secures for the pick of his herd.

The demand at present and the high prices offered for good jacks should stimulate the industry and cause more of our Kentucky farmers to engage in the breeding of jack stock.

## Remarks in Regard to the Rearing of Jacks.

The jack should be fed with a great deal of care. His likes and dislikes are very pronounced. Most of the Kentucky jack breeders use clover and alfalfa hay and sheaf oats. Occasional use is made of timothy hay but it is considered to be rather coarse and woody. During August and September a considerable quantity of green corn is fed in the roasting ear stage. The most careful feeders run this corn through a cutting box which chops it in small pieces and it is then fed in the manger. Also green sorghum is fed in a similar manner.

Bran and oats are standard feeds, while corn is used frequently, but it is considered that too much corn is heating and conducive to jack sores. It is advisable to allow the jack a paddock in which he may get considerable exercise and also some grazing. The stall in which the jack is housed should open into a paddock of one acre where he may run during the summer and winter.

Green rye, wheat or clover pasture is good for young jacks in the spring as it furnishes considerable feed and causes growth. During the different stages of the life of the jack he should be fed as follows:

RATION:—A jack under one year old should be fed two ears of corn, one quart of bran, two quarts of oats and allowed to

run in a pasture of one acre. At night he should be fed five pounds of clover hay.

YEARLING:—Four ears of corn, two and one-half quarts of oats, two and one-half quarts of bran, seven pounds of clover hay. These amounts should be fed per day.

TWO-YEAR-OLD JACKS.—One gallon of oats, two quarts

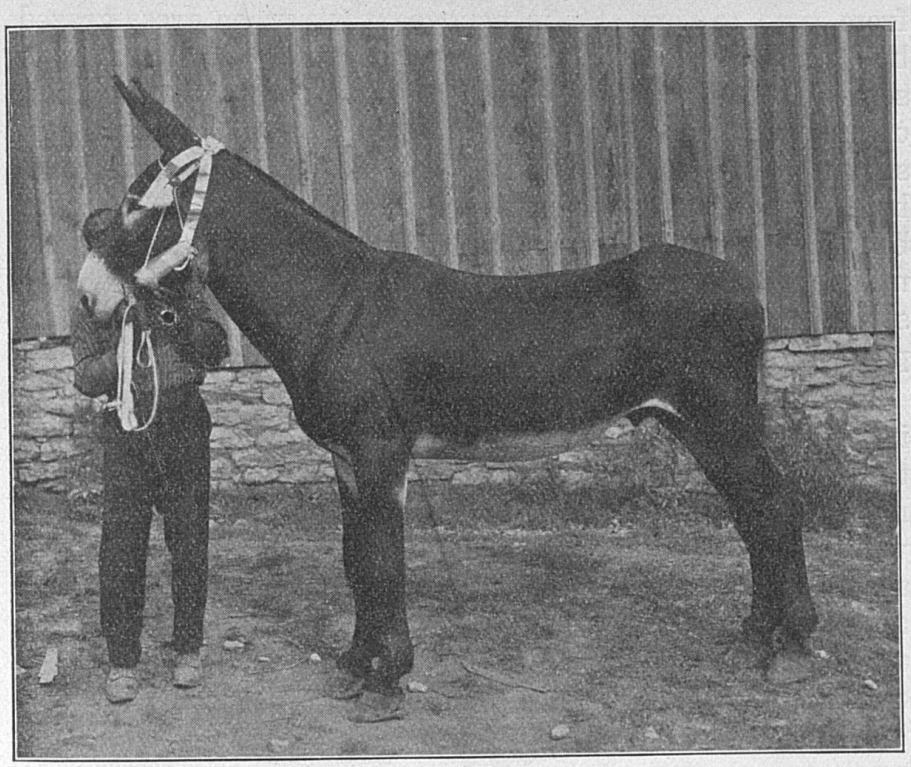


Fig. 12. A CHAMPION JACK.

This jack sags a bit in the back, is low over the loin, and is not large enough in bone, but his feet are large and of splendid texture. His fluted bone is like steel in texture.

of bran and ten pounds of clover hay, and add four ears of corn if the jack is thin in flesh.

AGED JACKS:—Aged jacks will eat about the same as two year olds. Most of the jack breeders prefer to have the feed trough placed as high as the body because feeding from the ground causes the jack to become ewe necked and leads to a general low carriage.

JACK SORES:—One of the greatest sources of annoyance in connection with handling jacks is the fact that they break out with "jack sores." It seems that these are caused by a bad condition of the blood and the heavy feeding of corn will lead to such a trouble, but even when the best method of feeding is adopted the sores will still continue to appear from time to time. It is believed that green grass grazed by the jack in his paddock cools the system and to some extent prevents the sores. These sores appear usually on the hocks and below the knees, and they come principally in summer. An excellent remedy is to dust the sores with one-half part of air slacked lime and one-half part of flour. For bad raw sores the stockman should mix verdigris and sweet milk together to form a paste which he should apply to the sore with a wooden paddle twice a day. It is said that this paste will dry up the worst sores.

The jack should be bridled and handled at least once a day in order that he may be kept in good disposition. If allowed to stay by himself and away from people he will soon become mean and stubborn, whereas if he is handled frequently he will probably be very kind and docile. Severe whipping should be avoided, as it may make the jack vicious. Also we are assured by men of long experience that the choicest hay and grain must be furnished to the jack. While he of his own accord will sometimes pick out the roughest portions of the hay yet the choicest hay and grain are furnished by the most up-to-date stockmen.

During the winter the jack pictured in Fig. 1, is fed one bundle of cut up sheaf oats at five P. M.; one-half gallon of clean, shelled oats twice per day; and every other day a quart of bran or ground barley is mixed with his feed. If he becomes constipated more bran is fed for several days. He also has a two acre pasture to run in at will.

A dealer who handles more jacks than any other man in the United States informs us that when he leads a jack from his farm to town, a distance of two miles, he very carefully protects him from rain and extreme cold. Even with the

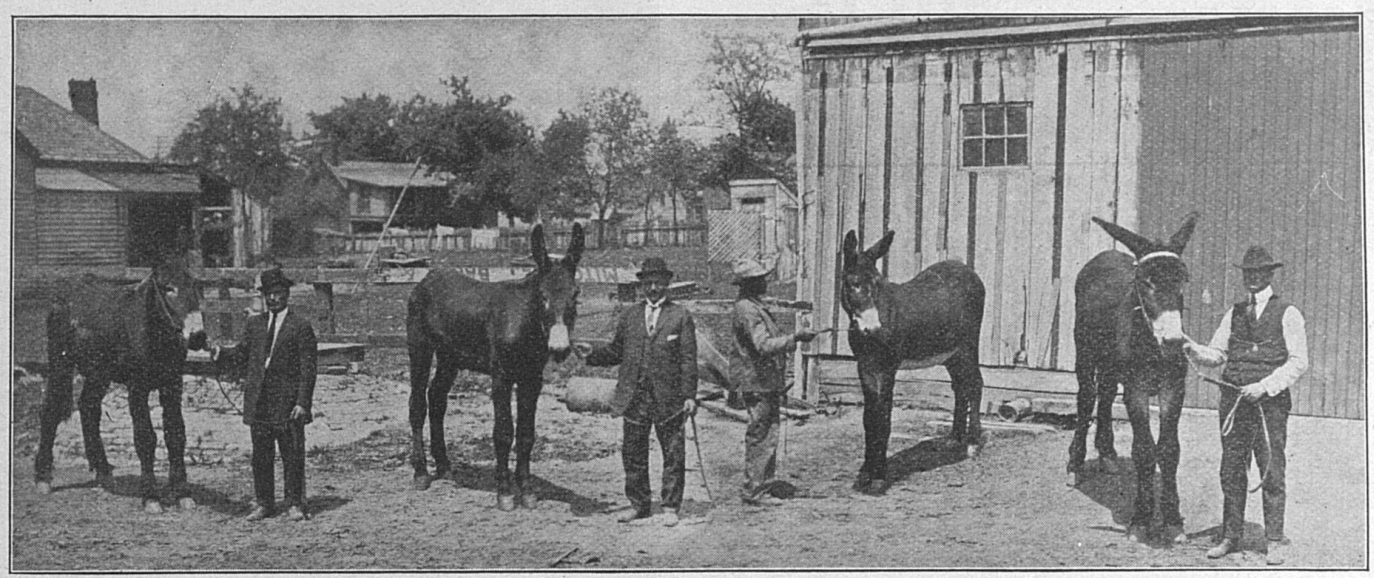


Fig. 13. A Picture of Four Jacks.

These four jacks were purchased by a Mexican stockman. Numbering from the right, the first and third jacks cost $1500 each; the one on the extreme left cost $1400, and the little jack standing in position number 2 is of medium size and cost $750. It was only after considerable intelligent searching that three jacks of this quality were secured.

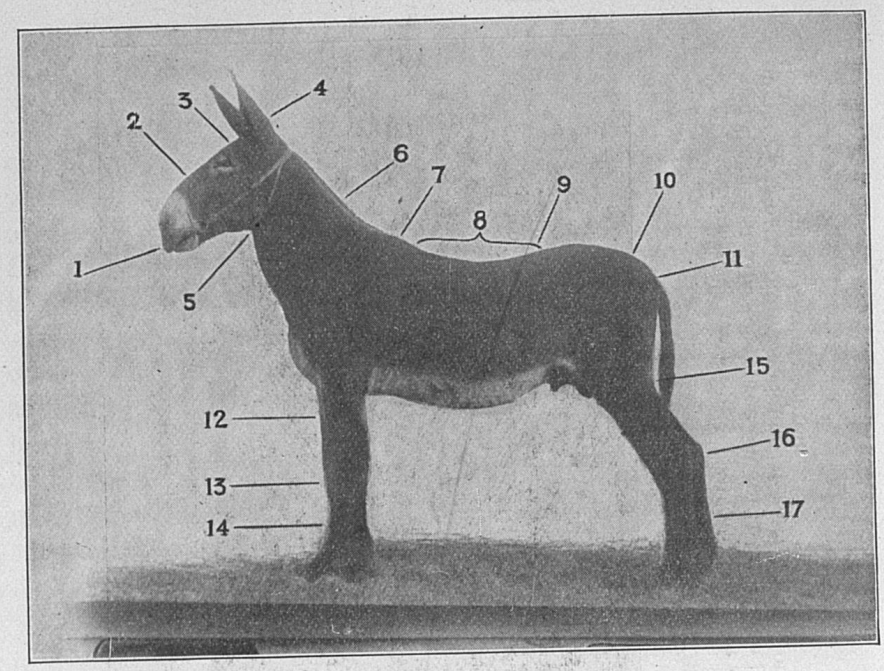



Fig. 14. A Good Jack.

(See Key to Chart below.)

Weight 1125 pounds; height, (st. m.) 15 hands, $3\frac{3}{4}$ inches.

| | | | |
|---|---|---|---|
| Ears from tip to tip | 33 inches | Length from poll to tail | $86\frac{1}{2}$ inches |
| Around face and jaw | $35\frac{1}{2}$ " | Girth | 72 " |
| Neck, throat latch | 37 " | Loin | 72 " |
| Around arm | $21\frac{1}{2}$ " | Around hoof next to hair | $16\frac{1}{2}$ " |
| Around knee | 16 " | Above hock | $16\frac{1}{2}$ " |
| Around cannon | $9\frac{1}{2}$ " | Below hock | 11 " |

Winner in class, 1912 at Louisville and the championship. Winner in class at Lexington, 1913, and the championship. Valued by owner at $3,000.

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Key to Chart of Jack.

1. Lips and muzzle.
2. Face.
3. Forehead.
4. Poll.
5. Throatlatch.
6. Neck.
7. Withers.
8. Back.
9. Loin.
10. Croup or Rump.
11. Root of tail.
12. Forearm.
13. Knee.
14. Cannon.
15. Gaskin.
16. Hock.
17. Hind cannon.

UNIVERSITY OF KENTUCKY.

DEPARTMENT OF ANIMAL HUSBANDRY.

STUDENTS' SCORE CARD.

FOR JACKS.

| | | Points. |
|---|---|---|
| 1. | Age | |
| | GENERAL APPEARANCE. | |
| 2. | Height (Score according to age) | 4 |
| 3. | Weight (Score according to age) | 4 |
| 4. | Form: broad, symmetrical, well proportioned, smooth | 4 |
| 5. | Quality: bone large, strong, clean; hair fine, glossy | 4 |
| 6. | Action: walk, straight, elastic, true; trot true, straight, should show bottom of foot when trotting | 6 |
| 7. | Temperament: active, disposition agreeable | 4 |
| 8. | Head: well proportioned, bone large; profile of nose, straight or slightly Roman | 4 |
| 9. | Muzzle: neat; nostrils large; lips thin, firm | 1 |
| 10. | Eyes: full, clear, intelligent, prominent | 1 |
| 11. | Forehead: broad, full | 1 |
| 12. | Ears: long, pointed, well set, alert (33 inches or over preferred for aged jack) | 1 |
| 13. | Neck: long, muscled, throat latch heavy, windpipe large | 2 |
| | FOREQUARTERS. | |
| 14. | Shoulders: sloping, smooth | 2 |
| 15. | Arm: short, well muscled, correctly set | 2 |
| 16. | Forearm: long, clean, heavily muscled | 2 |
| 17. | Knees: very wide, deep, strong, clean | 2 |
| 18. | Cannons: wide, clean, tendons defined, fluted bone | 2 |
| 19. | Fetlocks: wide, straight, clean | 1 |
| 20. | Pasterns: sloping, clean, strong | 4 |
| 21. | Feet: large, deep, wide, dense and lively horn | 8 |
| | BODY. | |
| 22. | Chest: deep, wide, girth large | 2 |
| 23. | Ribs: deep, well sprung, closely ribbed to hip | 4 |
| 24. | Back: straight, long, muscular | 2 |
| 25. | Loins: short, wide, heavy muscled | 2 |
| 26. | Underline: long, straight, flanks low | 2 |
| | HIND QUARTERS. | |
| 27. | Hips: smooth, well muscled | 2 |
| 28. | Croup: wide, muscled, not too sloping | 2 |
| 29. | Thighs: deep, broad, muscled, strong | 2 |
| 30. | Quarters: deep, well muscled | 2 |
| 31. | Stifles: clean, muscular, strong | 2 |
| 32. | Gaskins: long, wide, clean | 2 |
| 33. | Hocks: large, strong, free from meat, clean, well set | 2 |
| 34. | Cannons: wide, clean, tendons defined | 2 |
| 35. | Fetlocks: wide, clean, strong, straight | 1 |
| 36. | Pasterns: clean, straight, sloping. Any indication of knuckling should be severely scored | 4 |
| 37. | Feet: large, deep with dense and lively horn | 8 |

greatest care he has lost some fine animals through the contraction of pneumonia. This same man would not permit a jack to be walked more than ten miles in a day.

REARING JACK COLTS:—In rearing a jack colt he should be allowed to run in a pasture with a horse colt or a filly colt. Young jacks are so rough in their play that a horse colt is preferred. If a jack colt is associated only with young jacks or jennets during his early life, he will not ordinarily serve mares later on.

It is very difficult to get jacks to serve mares if they have not been so reared, and even when they are properly reared it is occasionally necessary to have a jennet present at the time of service. Every precaution should be exercised to get the jack colt onto a firm footing of friendship with horse stock while he is young. So many jacks are slow or faulty in their service that it is well when purchasing a jack to see him work before the deal is closed. In Kentucky it is customary to charge ten to twelve dollars for services by a good jack to mares, and from twenty to thirty dollars for service to a jennet.

A two year old jack is allowed fifteen mares a season, a three year old twenty-five mares, and an aged jack forty to fifty, but never over two in one day.

The jack pictured in Fig. 1 has served during the past ten months seventy mares and ten jennets. A growthy, three year old jack on the same farm has served fourteen mares and eighteen jennets. The season ordinarily extends from the first of April to the middle of June.

RAISING JENNETS:—The jennet colts are permitted to run with their dams in pasture from spring to fall. The old practice of establishing a colt creep in the pasture where the young ones might secure grain, is unsuccessful, because the jennets will crawl under fences that enclose the creep. Also the nose of the jennet is nearly as small as that of the colt and this makes it possible for the jennet to steal the grain from the colt if small divisions are provided in a feed trough in the pasture.

In October the jennet foals are brought to the barn and

weaned. Then they are fed cut sheaf oats and cut sorghum, and one ear of corn per day. In the spring the young jennets are placed on pasture, and rough it until winter, when they are again supplied some shelter and provided roughage during the winter with a small amount of grain.

When two and one-half to three years old the jennet is bred. Aged jennets are maintained on pasture in winter and summer, but during cold, inclement weather they are supplied some corn stover, and given a place of shelter.

## High Prices For Jacks.

It is often difficult to get jennets safe with foal. Then again the colts are often inferior in size and conformation, and to properly rear a jack colt costs money. Therefore, the price for a mature jack varies from $750 to $2000, with a few undersized jacks selling at $300 and upwards.

Also according to information that we have received from jack breeders it is difficult to prophesy whether a promising colt will develop into a first class jack, because they often disappoint the owner as they grow.

All of these uncertainties cause the high prices received for jacks of extra size and quality.

## Measurement of Jacks.

There is an entire absence of material in regard to the measurement that jacks should possess. The most experienced jack breeders have learned in a general way what constitutes a perfect jack, but so far no one has ever compiled information in regard to this matter by actually taking a tape in hand and measuring jacks from ears to heels and at the same time presenting photographs of the animals that they have measured.

In this bulletin we present pictures of a number of jacks together with measurements which we hope will be of interest to the readers of this bulletin.

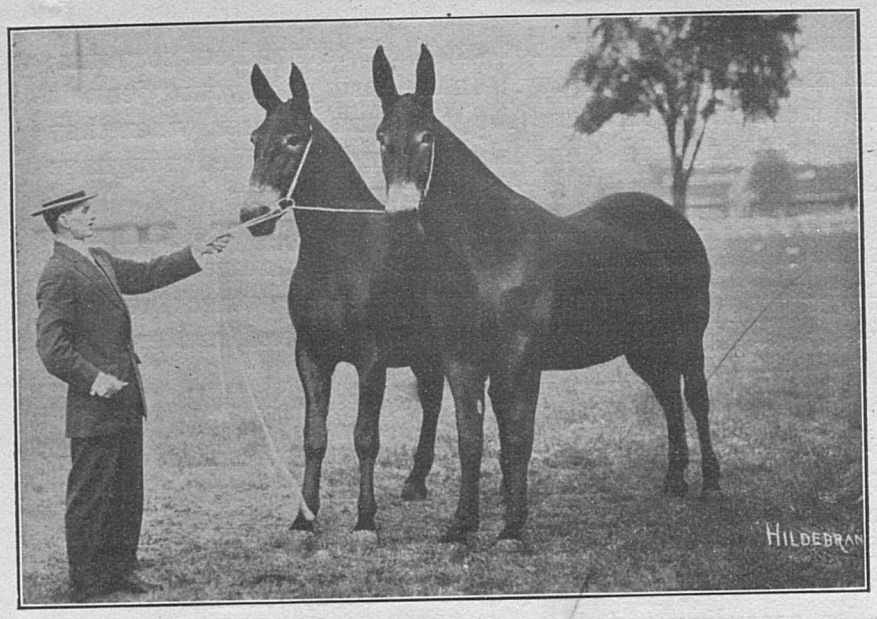



Fig. 15. TEAM OF MULES.

These mules are of the most desirable size and weight. They are three years old. First premium was placed on the span at the Louisville State Fair in 1912 and again in 1913. They are each 16¼ hands and average 1650 pounds in weight. The span sold for $1150. This type of mule is produced by mating a large jack with a large mare. To give the breedy head and intelligent appearance evidenced by this span of mules, their dams should possess a strong infusion of saddle, trotting or thoroughbred blood. To secure weight their dams must have some draft blood.

## II. THE MULE.

The work animal of the farm is the mule. He it is that bears the brunt of the work of cultivating the growing crop, harvests it when mature and hauls it to market. In the South the horses on the farm remain in field or stable until all the mules are harnessed, and are only called into use when the labor to be done is more than the mules can accomplish.

The mule is the draft animal for the lumberman, the cotton and sugar planter, the contractor, and the miner.

The horse may be honored for his procreative ability, he may be kept on the best in the land because of his beauty and style, but the mule is fed that he may labor. Should he be prepared for the show ring, the ultimate reason for so

fitting him is that he may be sold at a high price to some one who wants a work animal. The number of mules in Kentucky was estimated by the statisticians of the United States Government on Jan. 1, 1913, at 229,000 with a value of $120 per head or a total value of $27,480,000. When it is calculated further that this State furnishes annually thousands for mine and draft use, it becomes necessary to produce each year something like 40,000 to 60,000 mule colts.

This means then that in the State of Kentucky there must be a group of something like 60,000 brood mares required to produce the necessary number of mule colts. The average price of horses for the State is $104 per head. This band of mares would be worth no less than $6,240,000. The jacks necessary to sire 50,000 mule colts would be near 2,000 allowing 25 living colts to the jack. These jacks are worth from $3,000 down to a few hundred dollars apiece. All told the production of mules respresents one of the most important activities of the farmers of this State.

The New England farmers raise almost no mules, yet they use a considerable number. The increase from 1900 to 1910 was about 24 per cent. Such states as Minnesota, Iowa, Wisconsin and the Dakotas are calling for mules in larger numbers, the demand for them in some states being 50 per cent. more in 1910 than it was in 1900.

The farmers in the agricultural states of the south raise but few mules and yet they are dependent on mules to cultivate their crops. Almost half the mules in the United States are used in the Southern States. Many of these, like North Carolina, Georgia, Alabama and Mississippi likewise depend on importing the indispensable mule. Kentucky is near these states and our mules find ready sale.

There is an ever growing demand for the draft mule. The lumber interests of the northwest demand very heavy mules as do the transfer companies of the cities. Railroad construction requires the service of a large number of draft animals most of which are mules, while the mines create a constant demand. There has been since 1867, when the United States Government began keeping records, a gradual increase in the

production and use of the mule as well as a steady advance in the value. In 1867 the mules in the United States numbered 822,000 with an average value of $66.94. In 1890 the number was 2,321,000 valued at $78.25 each. In 1900 there were 2,086,000 mules valued at $53.55 each. From this date to 1910 a most phenomenal increase in number and value was recorded. The total number in 1910 was 4,123,000 with a value of $119.84 per head. In 1913 the number had expanded to 4,386,000 with an average value of $124.31.

If these figures indicate anything they show that the industry is in a prosperous condition. The increase in the price of the mule proves that the demand has increased faster than the supply. There are no indications that this demand will abate. Our State should continue to produce a large surplus of young mules. In view of this it may be well to study the laws of heredity involved in the heritage of mules.

## III. BROOD MARES FOR PRODUCING MULES.

We have interviewed many breeders and exhibitors of mules as well as judges and dealers. The question of most importance which we have asked each is this: What kind of a brood mare produces the best mule? The various answers to this question have shown a remarkable unanimity of opinion.

The first point of absolute agreement is that the small mare is unfit for mule rearing. There are many cold blooded, light, frail mares in Kentucky which are not deemed by their owners good enough to breed to stallions, so they are used to produce mules. It matters not how good a jack these mares are mated with the mules produced from such dams must be undersized. There is no demand for the small mule colt. The demand is for weight and size as the first essential qualities. After this, activity with a certain finish or smoothness is desired. The best mules come from mares possessing draft blood—that is, mares of size and finish. They need not be pure bred draft mares, in fact good grades seem better adapted than pure breds. Pure bred draft mares produce a mule that is too sluggish. The grade draft mares from standard or

thoroughbred lines are almost ideal for mule production. From the draft blood comes size and weight, from the other blood activity and finish.

Again, this kind of a mare will do much work on the farm and produce a mule colt that will be worth from $75 to $110 at weaning time, while the small mare cannot do as much work and her mule colt will not be worth more than half as much as the mule from the heavier and more rangy mares. It is the opinion of successful breeders that the more expensive and heavier mares are better in the long run as a paying

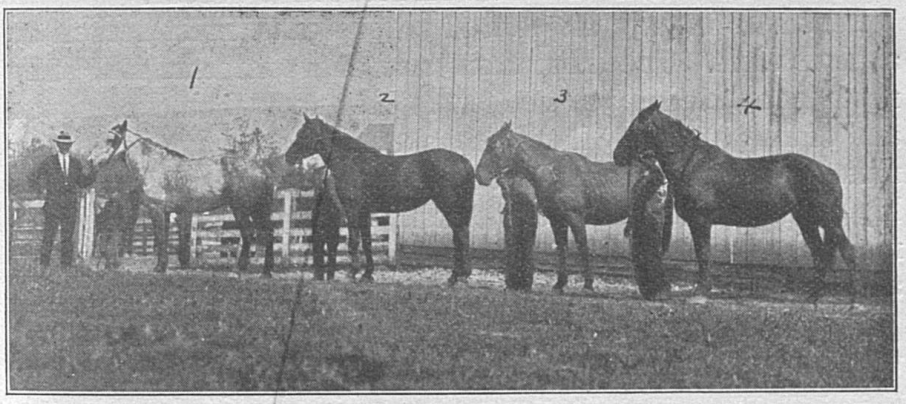



Fig.16. Four Mule Brood Mares.

In the above half-tone we have four mares that are above the average. No. 4 is considered the best brood mare for mules since she has greater length and depth of barrel and a larger and cleaner bone than any of the four. Number 2 would be considered second because of her great length of body, scale and quality, but she is hardly as deep in body as Number 4. Number 1 comes next on account of her size and quality of bone. Number 3 is placed last because she is lacking in muscling, is short in the body and rather leggy. Number 4 is the outstanding mule mare of the class.

investment. The initial cost is more, the food bill is greater with the larger mares, but the returns in service are larger and the mules they can produce during their productive period will be so superior that a much greater percentage can be realized on the investment.

Kentucky is an ideal state for the production of mules because no other state has the same amount of good saddle,

trotting and thoroughbred blood. If to any of these warm-blooded animals a cross is made with the draft horse an ideal mule mare is the result. This does not mean that large, roomy, pure bred mares of the breeds mentioned are not themselves good dams for mules, but the difficulty is that the best and most suitable of these must be used to propagate their own breed.

It is true that many good mares of these pure, stylish and warm-blooded breeds are used directly to mate with jacks. Where they are heavy enough they make ideal mares for the purpose, but they are in reality needed to preserve and continue the blood lines of their own respective breeds.

Be this as it may, the dam of a good mule must herself be a good mare. She must have size and conformation. She needs good, clean, well set legs. Her feet should be broad and of fine texture. Her head should be breedy, her barrel must be long and roomy, and she must be well ribbed to the hip bones, and have a short back. The mare to be used for mule production needs to be heavily muscled and vigorous, in addition to the qualities mentioned above.

It is generally recognized that in the cross of the ass and the mare the coarser qualities of the ass are dominant over the finer qualities of the mare; that is, the distinctive features of the ass are to be found in the mule. These appear in the head, ears, mane, legs, tail and feet. The mares in most cases are able to modify these distinctive characteristics but not to suppress them. For example, the foot of the ass is contracted, and needs to be widened in the mule. The mare to overcome this as much as possible, should have broad, solid feet. The body of the jack has a tendency to narrowness and angularity. The big, round, smooth brood mares will add as their complement, size and smoothness to the mule.

## Consensus of Opinion as to Kind of Brood Mares, Valuable for Mule Production.

Of fifteen Kentucky stockmen who rear mules, four have stated to us that they use mares weighing 1,100 pounds and under, with a height of 15 to 16 hands. Seven use from

1,100 to 1,200 pound mares, and the other four use from 1,100 to 1,500 pound mares.

Twelve breeders consulted by the writers consider that the best mules are produced from mares weighing 1,400 pounds and over, while nine prefer the mule from a mare less than 1,400 pounds in weight. One breeder, who used to raise a large number of mules, writes:

"Our experience with mule raising has been that none too good mares can be used for that purpose. Ours were all of Percheron breeding, mostly grades of good size and fine conformation.

"We also learned that the quality of the mules depended more upon the kind of jack than upon the type of the dam.

"We had two jacks of very different conformation, one

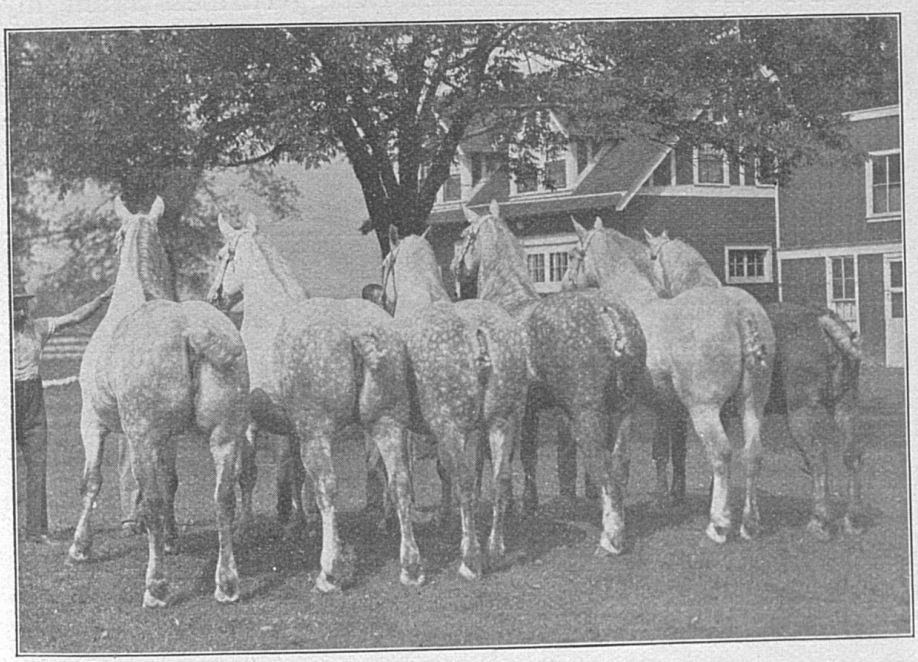


Fig. 17. DRAFT MARES.

While mares of the type illustrated in the photograph, produce heavy, high priced mules, yet the mules are usually sluggish. Mules out of mares that have a strong infusion of light horse blood, but that also weigh 1200 to 1400 pounds, produce mules that are more energetic and which can do more work in a day. The ideal mare is one possessing weight derived from draft ancestry, and finish derived from light horse ancestry.

being a large, rough, homely looking fellow, and his offspring in most cases, regardless of the good qualities of the dam bore a striking resemblance to the sire.

"The other jack was a compactly built animal, with neat head and fine conformation, and for this one we selected the largest, coarsest mares we had, and this cross gave us much better mules.

"And by reversing we also learned that our best quality mules, though not quite so large, were the product of the smaller jack, so we have come to believe that the only way to get large mules of fine conformation is to cross the largest jack of the very best conformation upon the mares of the draft breeds, of the largest size and best type.

"If I were going into the mule raising business again, my first object would be to get the best jacks that money could buy, and then use nothing but grade Percheron mares of the largest and best quality that could be had, for mules produced from this crossing will bring better prices in the open market today than horses.

"And in conclusion I will say again that so far as our experience has gone, more depends upon the quality and size of the jack than upon the dam."

The reasons given for the use of the smaller mares indicate that their mules have more quality and action, while those from draft mares are sluggish and cannot withstand heat, and vice versa, the large mare gives larger sized and more tractable mules.

Eight breeders who have made the comparison say that trotting bred mares produce larger mules than thoroughbreds, while four state that thoroughbred mares produce mules that have more finish and finer bone, even indicating that the bone is too fine. Four state that mules from thoroughbred mares have better constitution, while one reports that he has found mules from trotting bred mares to have more endurance. Two complain that mules from thoroughbred mares are harder to handle and are more excitable.

## Maintenance of Brood Mares.

The estimates of the cost of keeping brood mares vary from $1.50 to $5.00 per month, the average being about $3.00. Nine breeders report that they give the brood mares light work enough to pay for their keep. Three of the nine think it better for the mares to do light work than to remain idle. Seven do not work mares and do not think it practical to do so except in extreme cases, or where the farm is small. One man says: "Mares worked every day on farm and road were our most successful mule mares. We lighten the work when near foaling time. We have 18 such mares and work nothing else." The price of the jack service varies from five to fifteen dollars.

## Feeding Mules.

Questions were asked breeders and feeders concerning kinds, amount, and cost of feed for mules. Sixteen stock-

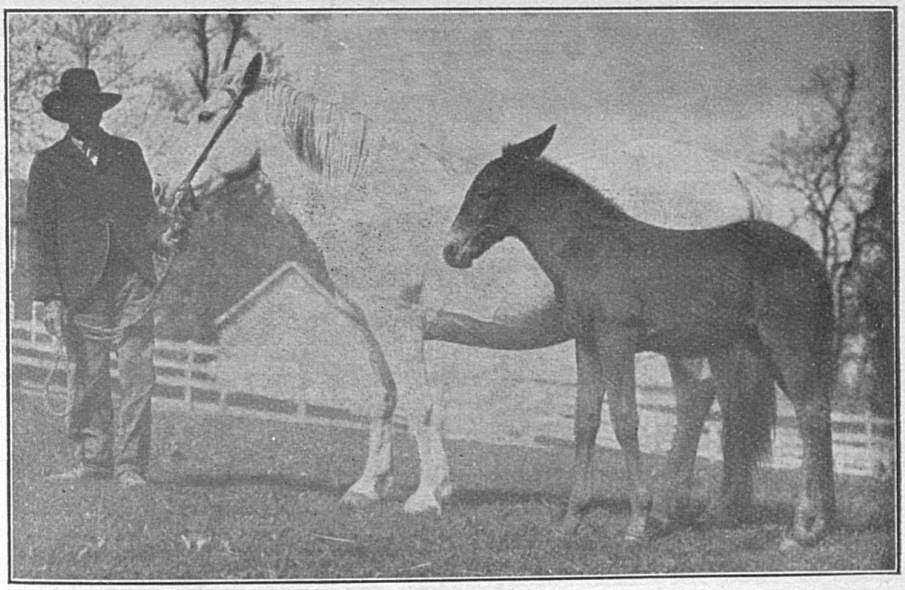


Fig. 18. MULE MARE.

This is a Western mare, and she has a strong infusion of draft blood. She is too low, being 14 hands, 3½ inches in height. A mare must be up-standing and active if her mule colts are to be of the highest grade. The mule colt is sorrel in color, and it is 40 inches high. Bone of mare and colt is of large, desirable size. She has had four mule colts.

men were consulted, all of whom use corn and hay. Eleven use mixed hay and timothy; five report the use of cow-pea hay; two use alfalfa; eight use clover hay; two of the eight report use of clover hay alone; fifteen use oats; three of these fifteen use shelled oats mixed with shelled corn: three have specified sheaf oats. Four use corn stover; five use sorghum; two report the use of ship stuff and two are using oil meal.

As to the ration, only one man offered a proportion of concentrates. This is as follow: Two-fifths shelled corn, two-fifths shelled oats and one-fifth ship stuff. None specified a certain amount per mule, but a number added, "feed them all they will eat."

The cost of keep for mules during the growing period was estimated as follows: The cost for the first year ranges from one to four dollars per month, the average being $2.15. For the second year the variation is from $1.50 to $7.00 per month, with an average of $3.40. For the third year the reports ran from $2.00 to $10.00 per month, with an average of $4.70.

An enterprising breeder writes:

"I am not satisfied with results from my methods of feeding. We need something that will make better hair during the winter and fall months. I am trying cotton seed meal (limited) and hulls, so far with good results. I do not expect to feed this to the mules longer than thirty to forty days. The trade demands good hair and it will sell a mule that is half fat for as much as one 'big fat' but with long, rough hair."

From the foregoing, using the averages, the cost of raising a three-year-old mule is as follows:

| | |
|---|---|
| Cost of feed for mare for one year | $36.00 |
| Cost of feed for mule for 1st year | 25.80 |
| Cost of feed for mule for 2nd year | 40.80 |
| Cost of feed for mule for 3rd year | 56.40 |
| Jack fee | 10.00 |
| Total | $169.00 |

If the mare is used at light work she will pay for her own keep which will reduce the total to $133.00. If the breeder

owns his own land, the pasture from 6 to 8 months in the year does not cost him as much as is allowed in the above estimate, so that the actual cost of producing a three-year-old mule is not much in excess of $100.00. However, $169.00 is not too high a figure for maturing a mule. This does not allow any interest on the investment in the brood mare or anything for depreciation in value on the investment.

Prof. E. R. Lloyd, of the Mississippi Experiment Station, in a recent report states :

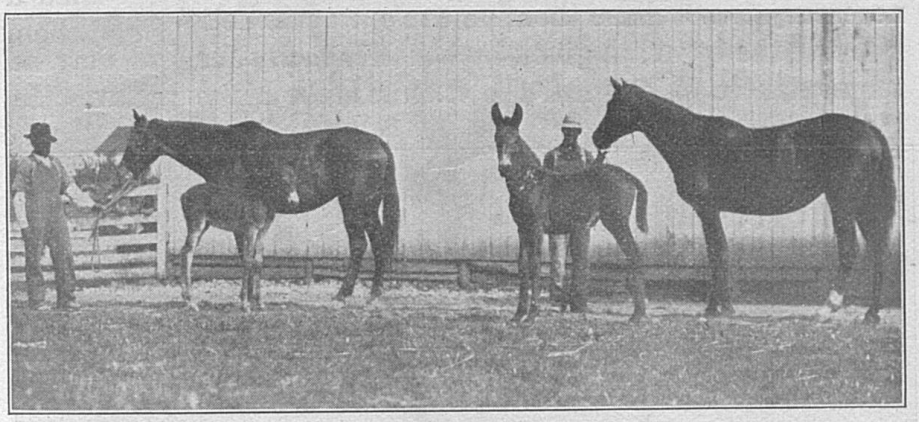


Fig. 19. MULE MARES.

These two mares and their colts present a striking lesson. The mare on the right is a thoroughbred and she stands 15 hands, 3 inches high, and the colt was 41 inches high at birth Because of the length of barrel and the length of quarters and general capacity, this mare is considered an excellent mule mare The toppiest mules that are nervous and active and weigh from 900 to 1000 pounds, are bred from thoroughbred mares, of which both the colt and mother are typical animals The mare is slightly light-boned and calf-kneed. The Southern farmer desires a mule that is active and energetic and we have an illustration of such a mule in this picture The mare to the left is of an opposite type. She is light-boned, is short in the barrel, is leggy and has short quarters. The mare stands 16 hands, 2 inches, but the colt was only 40 inches high at birth. This is an inferior mule mare.

"The cost of raising a three-year-old mule is as follows :

| | |
|---|---|
| Cost of feed to winter mare | $20.68 |
| Pasture for mare and colt first year | 10.00 |
| Wintering weanling | 8.80 |
| Pasture for yearling | 5.00 |
| Wintering yearling | 12.00 |

| | |
|---|---|
| Pasture for two-year-old | 5.00 |
| Wintering two-year-old | 11.59 |
| Jack fee | 10.00 |
| Total cost | $83.07 |

"No account was taken for the interest and depreciation on the investment, but the draft mares easily do enough work to take care of the interest and depreciation on the original investment. Our experiments so far show conclusively that mules can be raised on the farm at about one-half the cost necessary to purchase them on the open market."

While the estimate given by our Kentucky feeders may be somewhat too high, Prof. Lloyd must have his very low. He



Fig. 20. AN EXCELLENT MULE MARE.

This roan trotting bred mare is six years old. The mule colt at her side was 42 inches high when nine days old. She also has an excellent two-year-old horse mule colt. Experienced mule men pronounce this mare to be excellent for the production of mules. She is 15 hands, 3½ inches high, and weighs 1250 pounds. Her bone is excellent in size and in cleanness. A mule colt should be 42 inches high when a few days old.

allows only $5.00 for pasturing the mule during each of its two summers. This is not $1.00 per month. Bluegrass pasture cannot be furnished at that price. He also uses Johnson grass hay which is not so expensive as the Kentucky hays, nor is it as good. He also makes free use of cotton seed meal with corn and cob meal. Few Kentucky feeders use the cotton seed meal for young mules. Perhaps a saving might be effected by a more liberal use of it.

## Market Requirements and Types.

To bring their full value the mule must be sound and in good flesh. While not an excessive feeder the mule should be

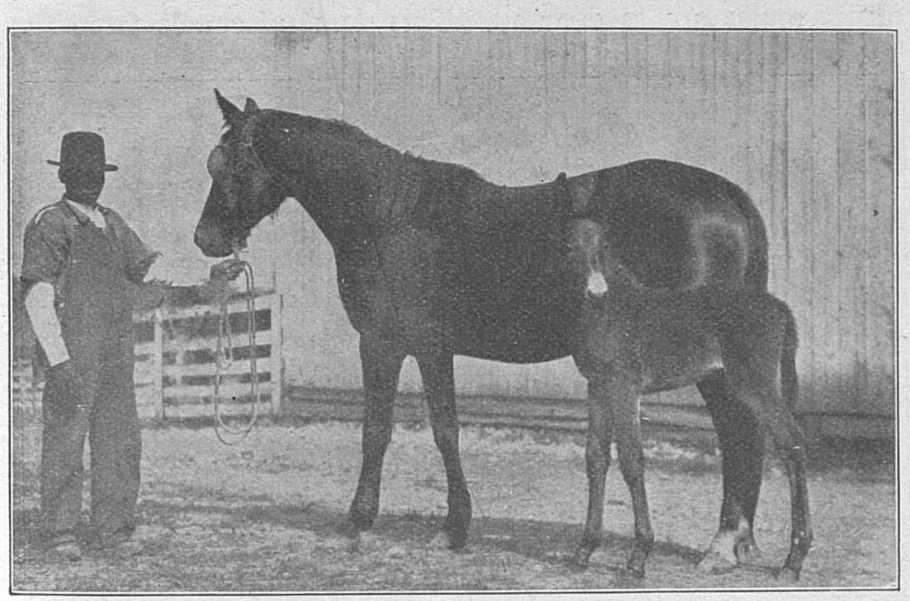


Fig. 21. A Light Mule Mare.

This mare is rather light in bone and is too nervous to produce the heavy desirable type of mule. Her mules will be tall enough, but will lack depth of barrel and weight. This sorrel mare is four years old and is 15 hands, 2¼ inches high. She and the colt are both very light in bone. The colt was 42 inches high at birth.

given an abundance of food until he matures and is placed on the market. Kentucky dealers after securing a bunch of mules keep liberal supplies of corn and oats in their mangers as well as hay and other roughage. The fat thus acquired

nets a handsome profit. Mules must be sound also to bring the top price. Blemishes which do not interfere with the working ability of the mule are not as unfortunate as in the horse, but unsightly scars decrease his value. There is a demand for mules at all times, although the demand varies somewhat at different seasons.

DRAFT MULES:—The most valuable mules belong to the draft class. To be in this class they must stand 16 to 16½ hands high, have well set legs and large feet, and be well muscled throughout. Such mules weigh 1,300 pounds or over. There must be a happy blending of weight, muscle and strength. Whenever there is a demand for heavy work the draft mules are in demand. This demand comes from the

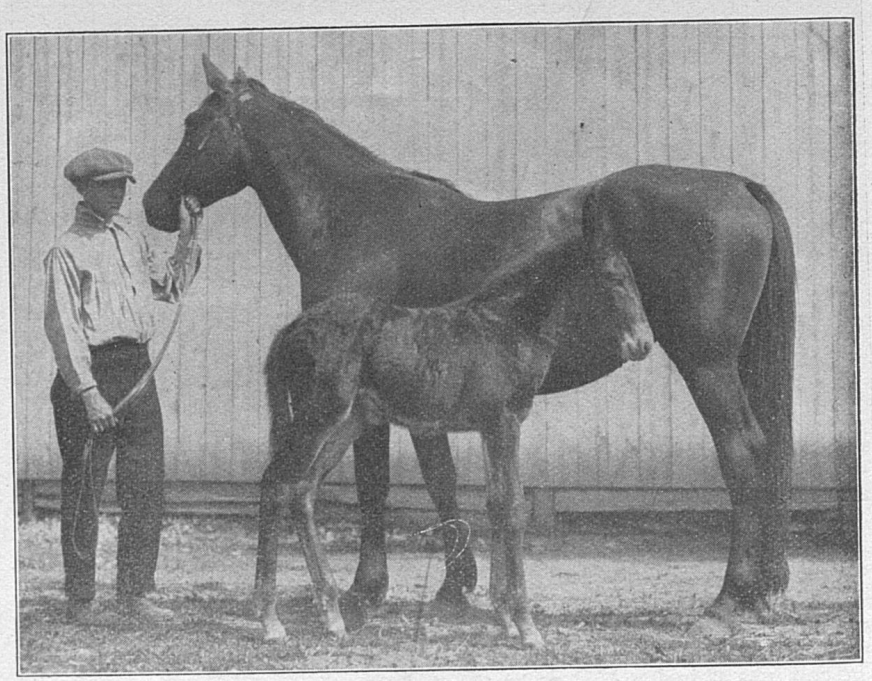


Fig. 22. MULE MARE

This young sorrel trotting bred mare has a clean, but light, bone. The sorrel mule colt was 40 inches high when born. The mare is leggy and is 15 hands, 3 inches in height. She will produce a toppy, thousand pound mule. One of the local dealers in mules has a standing offer of $800 for a span of toppy, sorrel, mealy-nosed mules.

cities where they are used in moving heavy freight, but the lumbermen and railroad construction camps also use them.

FARM AND PLANTATION MULES:—The farmers in the mule producing states use mules of all kinds from the most inferior to the very best. They often use young mules until they are broken and matured and then sell them at long prices in pairs. For farm work the mule ranking below the draft mule is ideal, standing 15 to 16 hands high, and weighing from 1,000 to 1,300 pounds. The "sugar mule" to be used on the sugar plantations is heavier and of better quality than the farm mule, while the "cotton mule" may be as small as 15 hands or less.

MINING MULES:—This is the only class of market mules where a lack of size constitutes a virtue. Some mines cannot accommodate animals over 12½ to 14 hands, and if their con-

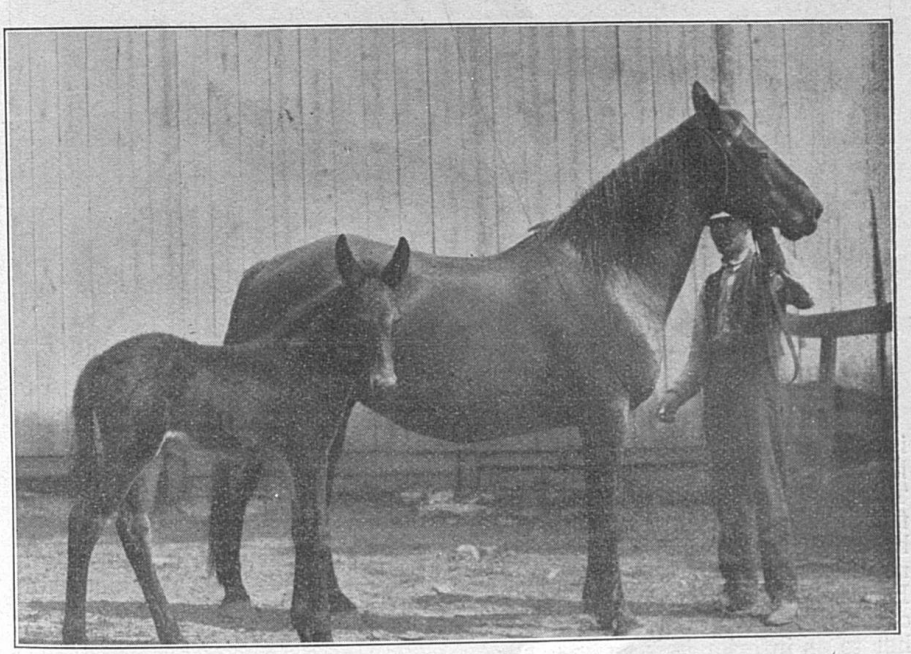


Fig. 23. A FAMOUS MULE MARE.

This is a famous mule mare. She is 15 hands, 2¼ inches high and weighs 1200 pounds. She was sired by a German coach horse and she is out of a trotting bred mare. Men who breed mules have greatly admired this mare because of her great length of barrel and her scale. The colt at her side is 43 inches high and is by the jack pictured in Fig. 1.

ditions demand this height, such small animals only can fill the requirements. The small mule is preferred to the pony, because when a mule touches the top of the shaft with his ears he will lower his head, while a pony will injure himself by throwing his head upward, and also, mules stand confinement better than horse stock. In the mines the mules cannot be taller than the height of the passageways.

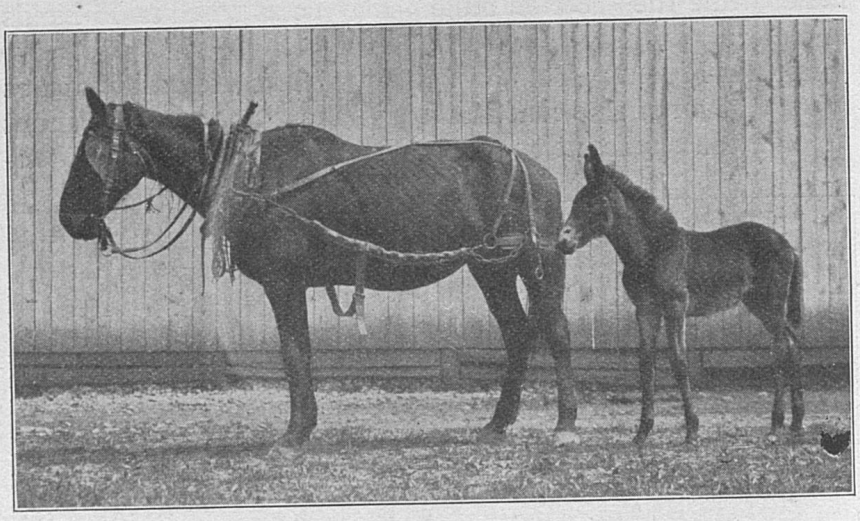


Fig. 24. A NICE MULE MARE.

This mare weighs 1300 pounds and her filly colt at her side is only 38 inches high. This colt was sired by a jack that stood 15 hands high, was light in bone, and weighed 800 pounds, and was called a Spanish jack. That the colt will attain a height of 15 hands and a weight of 900 pounds at five years old, is the prediction of experienced mule breeders. This mare has had four mule colts and, mated with larger jacks, she has produced mules that reached 16 hands in height and weighed 1200 pounds each. Her mule colts have usually sold for $200 as two-year-olds. The owner of this mare stated that he would never make the mistake of breeding her to an inferior jack again.

# IV. TWO MULE FEEDING EXPERIMENTS.

## Experiment I. Dried Brewers' Grains as a Horse and Mule Feed.

Through the kindness of the Lexington Brewing Company, this Department was enabled to carry out an interesting feeding experiment with some of the work stock employed at the brewery. In this work we used the following: A team of horses, averaging 1500 pounds each in weight; a team of 1300 pound mules and a team of 1100 pound mules.

The purpose of the experiment was to determine the palat-

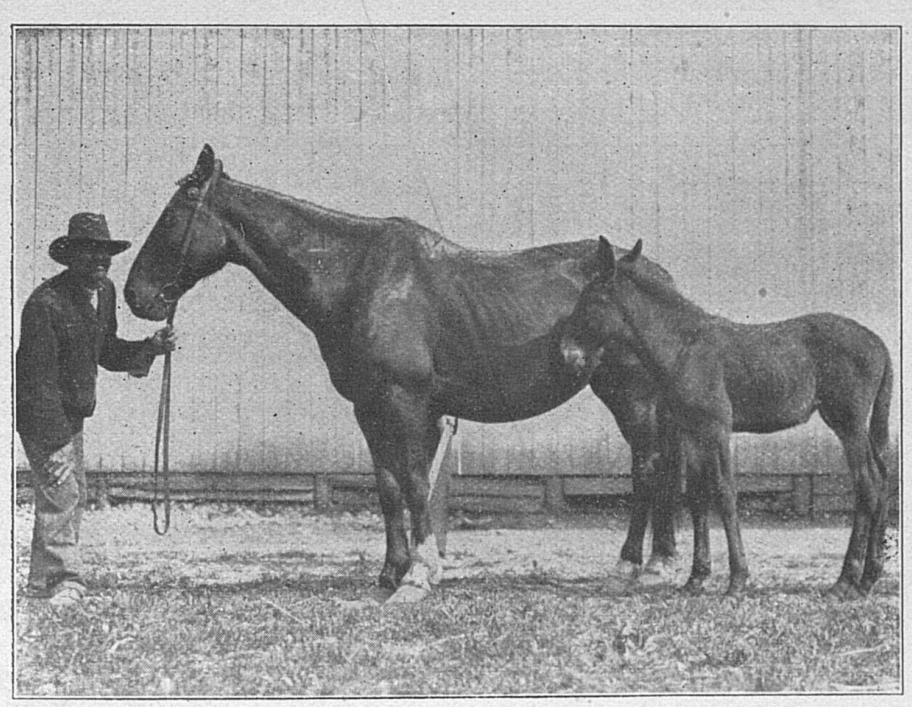


Fig. 25. MULE MARE.

This saddle bred mare is eight years old. She stands 15 hands, 1½ inches high and the bay mule colt is 41 inches high. This mare has been used for driving purposes and she weighs 1050 pounds. Both the mare and colt are light in bone. While the colt has good head and ears, yet he has an objectionable Roman nose and because of a tendency to crooked hocks, a drooping rump, a straight shoulder and light bone, the colt is considered as being rather second class.

ability and efficiency of dried brewers' grains. The experiment continued from March 21st. to May 15th, 1913.

It was accurately determined that the dried brewers' grains are not relished by the mules, but they will consume grain mixtures containing as high as 20 per cent. by weight, of this feed. The horses would eat mixtures containing as high as 30 per cent. of the dried brewers' grains. Cracked corn, rolled oats and bran which are relished by horses and mules, were mixed with the dried brewers' grains.

COST OF FEED:—The feeds cost per ton as follows: Cracked corn, $25; rolled oats, $29; wheat bran, $28, and dried brewers' grains, $20. At these prices the dried brewers' grains served to cheapen the ration.

These animals were weighed on three successive days at the start and the finish of the experiment and an average of the three weights was considered their true weight. They maintained their weight, and worked as hard and as satisfactorily while in the experiment, as they did before the brewers' grains were fed them in such large proportions. At the brewery some of this feed has been furnished the work stock for several years, but the proportion heretofore has varied from 10 to 15 per cent. The dried brewers' grains were found to be slightly constipating.

## Experiment II. An Experiment to Determine the Relative Value of Corn and Mixed Feed for Mules.

In cooperation with the City Ice Company, of Lexington, Kentucky, this department carried out an experiment with eight teams of mules to determine the relative feeding value of ear corn in comparison with a mixed grain feed. This experiment started on March 1st, and ended May 1st, 1913, and covered sixty-one days.

The original purpose was to use some cotton seed meal with one set of mules, but this idea was abandoned after a fourteen day preliminary feeding in February, when it was observed that the mules would either push the feed containing it out of their feed boxes or would leave this grain mixture uneaten. Mules have in several instances been fed as much as two

pounds of this meal per day, and probably these mules would have finally eaten it, but the short duration of this experiment made it necessary to substitute more palatable linseed oil meal for the cotton seed meal.

One mule in each team was fed a grain ration consisting exclusively of ear corn, while his team mate was fed the grain mixture, consisting of 7 pounds of cracked corn, 2.3 pounds of wheat bran, and 2.3 pounds of oil meal. The total consumption of grain mixture for this lot averaged 11.6 pounds grain per mule daily. The mules in the other lot consumed

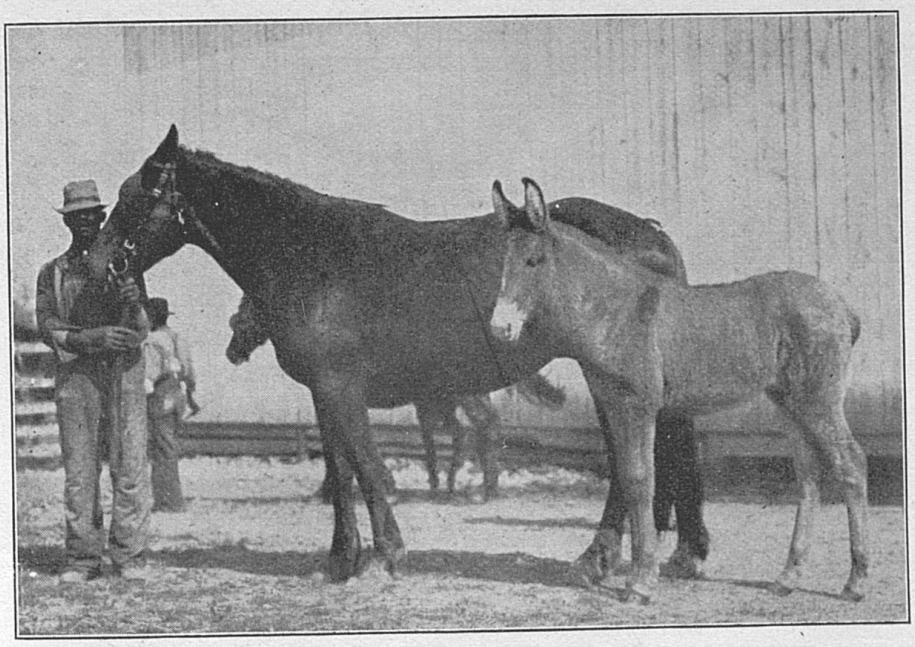


Fig. 26. MULE MARE.

This mare possesses some draft blood and she weighs 1350 pounds. The chestnut colt at her side was 44 inches high at birth. Her colt of 1912 sold for $155 at weaning time in the fall. The colt and dam both have large bone.

an average of 13 pounds of ear corn, which supplied 11 pounds of shelled corn, each day.

Both lots were supplied 12.4 pounds of good timothy hay and 6.9 pounds of baled oat hay each per day. Most of this was eaten, but some was wasted under foot.

AMOUNT OF DIGESTIBLE NUTRIENTS FED EACH MULE PER DAY.

| | Ear Corn Lot. | Grain Mixture Lot. |
|---|---|---|
| Protein | 1.38 lbs. | 2.088 lbs. |
| Carbohydrates | 14.86 lbs. | 14.117 lbs. |
| Fat | 0.66 lbs. | 0.753 lbs. |

These mules were employed in drawing the ice wagons used in delivering ice in the city. The average ice wagon weighed 3,000 pounds and the load of ice averaged 3,000 pounds, so the load was heavy. The mules were driven approximately six hours each day, so they performed hard work. The mules averaged 1,253 pounds in weight.

## Results.

1. No great difficulty was experienced in gradually changing eight of the mules from their original ear corn ration to a mixture containing cracked corn, bran and oil meal.

2. The health and spirit of the mules fed the ear corn ration, were not noticeably different from those fed the grain mixture.

3. Both rations served to maintain the weight of the mules.

4. The cotton seed meal was not as palatable as oil meal.

5. The skin and hair of the mules fed on ear corn were not as soft and glossy as of those fed the mixed grain. This desirable gloss of the coat of hair was due probably to the oil meal.

6. The feeds were purchased in small lots and cost more than if they had been purchased in large quantities. Their cost per ton is as follows: Cracked corn, $36; bran, $29; oil meal, $38, and cotton seed meal, $32. Corn on ear, $3.50 per barrel, or 70 cents per bushel. Because of the high price of bran and oil meal, the ear corn ration was the cheaper. The ear corn ration cost 30.3 cents per day, the grain mixture ration 31.8 cents.

7. A great difference was noted in regard to the behavior and efficiency of these sixteen mules. The ones that were

deep and wide of barrel, large in bone, and closely coupled, showed the least loss of weight on warm days when the work was unusually hard and prolonged. Such mules were ready for their feed and were never ill-tempered. Some of the other mules were long and shallow in body and light in bone and the last rib did not fit close to the hip. Such mules were fretful; were off feed occasionally and lost in weight when unusual work was put upon them.

These differences were apparent, because in three teams used in the experiment, the team mates were of different types.

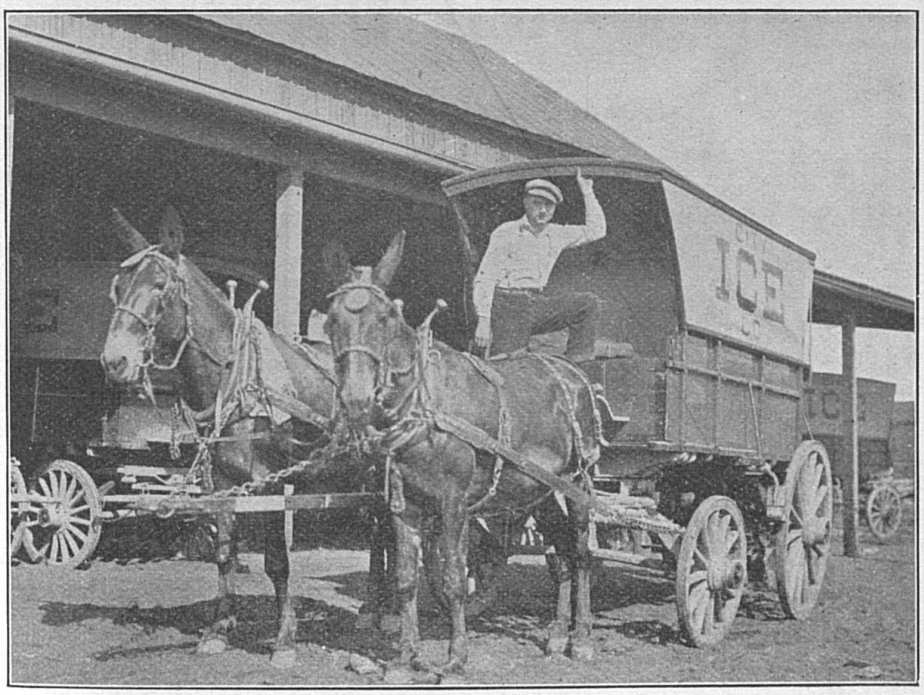



Fig. 27. One Team Used In the Experiment.

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# KENTUCKY
# AGRICULTURAL EXPERIMENT STATION

OF THE

# STATE UNIVERSITY

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BULLETIN NO. 177

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# COMMERCIAL FERTILIZERS

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LEXINGTON, KENTUCKY.
DECEMBER 31, 1913.

411

# KENTUCKY AGRICULTURAL EXPERIMENT STATION

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**NOTICE.**

The Bulletins of the Station will be mailed free to any citizen of Kentucky who sends his name and address to the Director.

# BULLETIN NO. 177

## Analyses of Commercial Fertilizers

The matter of plant food is all important in purchasing fertilizers. When a farmer buys a ton of an average commercial fertilizer he buys in reality only about 300 pounds of actual plant food. If he buys a cheap fertilizer he gets less than this amount. If he buys a high grade fertilizer he may receive as much as 600 pounds. It costs as much to mix a ton of fertilizer containing 300 pounds of plant food as it does one containing 600 pounds. The cost of sacking, hauling, and freighting is the same. Therefore, it is evident that the manufacturer can sell the plant food in a high grade fertilizer cheaper per pound than he can the plant food in a low grade fertilizer. In other words the higher the grade the cheaper can the plant food be bought. Farmers are advised therefore to purchase only high grade fertilizers.

Attention is called to those brands which have less than two per cent. of ammonia or potash. Less than two per cent. of either of these ingredients is too small a quantity where such ingredients are needed, and where not needed it is useless to purchase them. It is an utter waste of money to purchase potash or ammonia in fertilizers containing less than one per cent. of these ingredients.

*Number of Brands.* There were 735 different brands of commercial fertilizers registered during the year 1913. Of these different brands, 434 were complete fertilizers, or fertilizers containing all three of the essential ingredients namely: phosphoric acid, nitrogen and potash (non acidulated bone and potash mixtures are not counted in this item); 89 acid phosphates or superphosphates, 12 nitrogenous superphosphates, 110 acid phosphates and potash mixtures, 78 bones, tankage and non-acidulated bone and potash mixtures; 8 potash salts, and 4 samples of

nitrate of soda. Samples of these various brands sent by manufacturers have been analyzed, as well as samples collected by deputy inspectors and those sent by farmers, and the results are given in the tables which follow.

*Results of Analyses.* The results of these analyses show that in most cases the samples analyzed have come fully up to the guarantee, or where there is a slight deficiency in one ingredient, it has been made up by an excess in one or both of the other ingredients. But in a few instances, the deficiency in one ingredient, while fully made up by an excess of the other ingredients, is still too low to be considered acceptable, this being due to bad mixing at the factory. In a few instances, there seems to be an inclination on the part of the manufacturer to guarantee higher percentages than their goods contain. Especially is this the case in a number of instances with respect to the guaranty on total phosphoric acid, where it is four or five per cent. higher than the guaranty on available phosphoric acid. In most of these the analysis shows that while the available phosphoric acid guaranteed is present, the insoluble and total phosphoric acid are both deficient. In some cases, however, the deficiency in insoluble phosphoric acid is made up by an excess of available phosphoric acid which is to be preferred, but in such cases the total phosphoric acid is not deficient. Although the insoluble phosphoric acid is of little value, at the same time we feel inclined to call special attention to these guarantees and hope that all persons who purchase fertilizers will carefully study the bulletins and see how the guarantees have compared with our analyses with respect to the available and total phosphoric acid. Some manufacturers also have used muriate of potash in making fertilizers in which the potash was guaranteed from sulphate.

*Method of Reporting Results.* The following changes have been made in the method of reporting results. First: Nitrogen is separated into the various forms in which it occurs, namely, nitrogen in nitrates, nitrogen in ammonia salts and organic nitrogen. Second: In case of bones, the bone phosphate of lime equivalent is given and the percentage of fineness is shown also, fine bone being that which passes through a sieve with meshes one-twenty-fifth inch square, and medium bone that which passes through a sieve with meshes one-sixth inch square, but not including the fine bone. Third: The analyses are

grouped under tables, the classification being based upon the nature of the fertilizer, as follows:

Table 1. Complete fertilizers.
Table 2. Bones, tankage and mixtures of bone and potash.
Table 3. Acid Phosphates.
Table 4. Acid phosphate and potash mixtures.
Table 5. Nitrogenous superphosphates.
Table 6. Potash Salts.
Table 7. Nitrate of soda.

*Free Analysis of Fertilizers.* It is hoped that farmers who purchase fertilizers in quantity, at least, will take advantage of Section 8 of the fertilizer law, and send a sample to the Station for free analysis.

*Essentials in Taking Samples* 1. Take it at the time of purchase and if possible in the presence of agent or seller. 2. Take a sample from not less than two bags, and from one additional bag for every ten purchased; mix these samples carefully and take at least a pint of this mixed sample, put into a fruit jar, seal, box and express to J. H. Kastle, Director, Lexington, Ky. 3. Take the sample in the presence of at least one witness, and have the witness sign the required certificate. 4. The certificate for free analysis to be sent *by mail,* and should be in accordance with the law as given in section 8.

If the sample is taken in accordance with the above directions it may be sent by express, and the charges will be paid by the Station.

Blank certificates will be furnished free upon application to the Station. The section of the fertilizer law describing the manner in which samples are to be taken for free analysis is also printed on the certificate.

*Values Used.* In calculating the relative value per ton, the following values have been used:

Soluble and reverted phosphoric acid in mixed fertilizers.....6 c lb.
Soluble and reverted phosphoric acid in plain acid phosphates. 5 c lb.
Insoluble phosphoric acid in mixed fertilizers ..... 2 c lb.
Phosphoric acid in fine bone ..... 4 c lb.
Phosphoric acid in medium bone ..... 3 c lb.
Nitrogen in all fertilizers ..... 17½c lb.
Potash in all fertilizers, from sulphate ..... 6 c lb.
Potash in all fertilizers, from muriate ..... 5 c lb.

The term "Potash from muriate" does not indicate necessarily that the manufacturers used muriate of potash in furnishing the potash; they may have used sulphate of potash, or other salts of potash, but in all fertilizers where the term "Potash from muriate" is used there is enough chlorine present to combine with the potash, either from salt in the tankage used, or the potash salts used as muriate, kainit, carnallite, etc. As the objection to the use of muriate of potash arises from the chlorine present in this salt, it likewise follows that chlorine in a fertilizer is objectionable, whether put in with the potash or otherwise. The using of sulphate of potash where there is chlorine present in other ingredients of the fertilizer will not obviate the injurious effect of the chlorine, and therefore we take this method of showing chlorine present by designating the potash as "from muriate."

*Explanation of the Table.* In the table of analyses, following the name of each brand will be found the analysis of the sample furnished by the manufacturer at the time the fertilizer was entered for sale and which was accompanied by an affidavit giving the guaranteed analysis. This is the analysis that is marked "manufacturer" in the column headed "From Whom Obtained." If any other analyses of the same brand have been made, they will be found following this analysis. These samples have been collected by deputy inspectors or sent in by farmers. The manufacturer's guarantee is printed last in *italic* figures.

The figures in the table which are set in bold face type are those results which, in the judgment of the Director, were too low to be acceptable.

The names of the manufacturers are arranged in alphabetical order, and the analyses of the same brand have been grouped together.

Part 1. contains the names of all brands registered during the year, their guaranteed analyses, analyses of the official samples and analyses of all samples collected by inspectors or sent in by farmers during the spring season.

Part 11. contains the analyses of all samples collected by inspectors, etc., during the fall season.

PART I; TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **A. D. Adair and McCarty Bros., Atlanta, Ga.** | |
| 42229 | High Grade Special Tobacco Grower | Manufacturer |
| 42234 | David Harum Extra High Grade Guano | Manufacturer |
| 42235 | High Grade Special Potato Grower | Manufacturer |
| 42236 | Adair's Ammoniated Dissolved Bone | Manufacturer |
| 42270 | Big Leaf Tobacco Producer | Manufacturer |
| 42297 | Furman High Grade Fertilizer | Manufacturer |
| | **American Agr'l Chemical Co., Cincinnati Sales Department, Cincinnati, Ohio** | |
| 39990 | Complete Fertilizer | Manufacturer |
| 39992 | High Grade Tobacco and Truck Fertilizer | Manufacturer |
| 42336 | | Joseph H. Dodson, Maysville |
| 39993 | Special Potato and Vegetable Manure | Manufacturer |
| 42337 | | Lowry, Hines & Co., Science Hill |
| 39994 | K. and T. Special Manure | Manufacturer |
| 42338 | | Hatter Hardware Co., Franklin |
| 39999 | A. A. C. Co's High Grade Tobacco Grower | Manufacturer |
| 42340 | | L. Smith & Co., Upton |

## Complete Fertilizers.

| Phosphoric Acid. | | | NITROGEN. | | | | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate. | | |
| 7.19 | 1.40 | 8.59 | | | | 1.66 | 2.02 | 6.20 | | $21.20 | 42229 |
| *8.00* | | | | | | *1.65* | *2.00* | *6.00* | | *21.38* | |
| 9.67 | 1.70 | 11.37 | | | | 3.17 | 3.85 | 4.60 | | 27.98 | 42234 |
| *10.00* | | | | | | *3.29* | *4.00* | *4.00* | | *27.52* | |
| 8.00 | 1.33 | 9.33 | | | | 1.71 | 2.08 | 6.56 | | 22.68 | 42235 |
| *8.00* | | | | | | *1.65* | *2.00* | *6.00* | | *21.38* | |
| 7.78 | 1.44 | 9.22 | | | | 1.64 | 1.99 | 2.22 | | 17.88 | 42236 |
| *8.00* | | | | | | *1.65* | *2.00* | *2.00* | | *17.38* | |
| 6.61 | 1.36 | 7.97 | | | | 0.94 | 1.14 | 5.33 | | 17.09 | 42270 |
| *7.00* | | | | | | *0.82* | *1.00* | *5.00* | | *16.27* | |
| 9.94 | 1.20 | 11.14 | | 0.97 | 0.69 | 1.66 | 2.02 | 1.93 | | 20.15 | 42297 |
| *10.00* | | | | | | *1.65* | *2.00* | *2.00* | | *19.78* | |
| 10.77 | 2.35 | 13.12 | | 0.58 | 0.80 | 1.38 | 1.68 | 2.41 | | 21.10 | 39990 |
| *10.00* | *2.00* | *12.00* | | | | *1.65* | *2.00* | *2.00* | | *20.58* | |
| 7.76 | 1.28 | 9.04 | | 1.05 | 0.82 | 1.87 | 2.27 | 5.12 | | 21.49 | 39992 |
| 8.07 | 1.54 | 9.61 | | 0.79 | 0.92 | 1.71 | 2.08 | 5.15 | | 21.44 | 42336 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *5.00* | | *21.18* | |
| 5.87 | 0.48 | 6.35 | | | | 0.91 | 1.10 | 11.21 | | 21.63 | 39993 |
| 6.33 | 0.78 | 7.11 | | | | 0.95 | 1.15 | 10.50 | | 21.74 | 42337 |
| *5.00* | *2.00* | *7.00* | | | | *0.82* | *1.00* | *10.00* | | *19.67* | |
| 7.51 | 0.94 | 8.45 | | 1.73 | 0.86 | 2.59 | 3.14 | 1.40 | 5.67 | 26.66 | 39994 |
| 8.45 | 1.95 | 10.40 | | 1.94 | 0.58 | 2.52 | 3.06 | 1.16 | 5.31 | 27.27 | 42338 |
| *8.00* | *2.00* | *10.00* | | | | *2.47* | *3.00* | | *6.00* | *26.25* | |
| 8.03 | 1.68 | 9.71 | | 1.10 | 0.88 | 1.98 | 2.40 | | 11.28 | 30.78 | 39999 |
| 8.04 | 1.30 | 9.34 | | 1.15 | 0.64 | 1.79 | 2.17 | 1.12 | 9.65 | 29.14 | 42340 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | | *10.00* | *28.18* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| 40000 | **American Agr'l Chemical Co.** A. A. C. Co's. Wheat and Corn Special ..... | Manufacturer ..... |
| 42004 | **The American Agr'l Chemical Co., Bowker Fertilizer Works, Cincinnati, Ohio.** Bowker's Harvest Bone.. | Manufacturer ..... |
| 42006<br>42345 | Bowker's Fish Guano.... | Manufacturer .....<br>G. W. Richardson, Somerset ..... |
| 42007 | Bowker's Grain and Grass Grower ..... | Manufacturer ..... |
| 42008<br>42346 | Bowker's Kentucky Special ..... | Manufacturer .....<br>G. W. Richardson, Somerset ..... |
| 42009<br>42347 | Bowker's Tobacco Grower | Manufacturer .....<br>Dunagan & Kirtley, Horse Cave .... |
| 42010<br>42348 | Bowker's 10% Manure.. | Manufacturer .....<br>C. P. Clark, Owensboro ..... |
| 42013<br>42350 | Bowker's High Grade Fertilizer ..... | Manufacturer .....<br>L. Smith & Co., Upton ..... |
| 42014 | **American Agr'l Chemical Co., Cincinnati Sales Department, Cincinnati, Ohio.** Bradley Fertilizer Works B. D. Sea Fowl Guano... | Manufacturer ..... |
| 42015<br>42352 | Bradley Fertilizer Works Potato and Root Fertilizer | Manufacturer .....<br>J. H. Lennon, Hardinsburg ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 8.29 | 1.08 | 9.37 | | 1.10 | 0.56 | 1.66 | 2.02 | 2.51 | | $19.20 | 40000 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |
| 9.37 | 0.51 | 9.88 | | 0.45 | 0.58 | 1.03 | 1.25 | 1.45 | | 16.50 | 42004 |
| *8.00* | *1.50* | *9.50* | | | | *0.82* | *1.00* | *1.00* | | *14.07* | |
| 9.18 | 1.15 | 10.33 | | | | 1.04 | 1.26 | 3.39 | | 18.51 | 42006 |
| 7.44 | 3.01 | 10.45 | | | | 0.97 | 1.18 | 3.35 | | 16.88 | 42345 |
| *8.00* | *1.50* | *9.50* | | | | *0.82* | *1.00* | *3.00* | | *16.07* | |
| 8.15 | 1.47 | 9.62 | | 1.05 | 0.64 | 1.69 | 2.05 | 2.43 | | 18.72 | 42007 |
| *8.00* | *1.50* | *9.50* | | | | *1.65* | *2.00* | *2.00* | | *17.98* | |
| 7.74 | 1.21 | 8.95 | | | | 1.24 | 1.51 | 3.95 | | 18.06 | 42008 |
| 8.25 | 2.08 | 10.33 | | 0.63 | 0.67 | 1.30 | 1.58 | 4.29 | | 19.57 | 42346 |
| *8.00* | *1.50* | *9.50* | | | | *1.23* | *1.50* | *4.00* | | *18.51* | |
| 8.16 | 1.52 | 9.68 | | 1.29 | 0.53 | 1.82 | 2.21 | 1.14 | 4.24 | 23.00 | 42009 |
| 7.31 | 2.40 | 9.71 | | 0.27 | 1.50 | 1.77 | 2.15 | 0.94 | 4.05 | 21.73 | 42347 |
| *8.00* | *1.50* | *9.50* | | | | *1.65* | *2.00* | | *5.00* | *21.98* | |
| 5.20 | 0.78 | 5.98 | | | | 0.84 | 1.02 | 11.90 | | 21.39 | 42010 |
| 6.19 | 0.66 | 6.85 | | | | 0.89 | 1.08 | 11.00 | | 21.81 | 42348 |
| *5.00* | *1.50* | *6.50* | | | | *0.82* | *1.00* | *10.00* | | *19.47* | |
| 7.43 | 0.96 | 8.39 | | 1.71 | 0.92 | 2.63 | 3.19 | | 7.08 | 27.01 | 42013 |
| 7.76 | 1.53 | 9.29 | | 1.61 | 0.90 | 2.51 | 3.05 | 0.86 | 5.79 | 26.52 | 42350 |
| *8.00* | *1.50* | *9.50* | | | | *2.47* | *3.00* | | *6.00* | *26.05* | |
| 9.29 | 1.12 | 10.41 | | 0.84 | 1.34 | 2.18 | 2.65 | 2.69 | | 22.46 | 42014 |
| *8.00* | *2.00* | *10.00* | | | | *2.06* | *2.50* | *1.50* | | *19.11* | |
| 8.78 | 1.62 | 10.40 | | 0.37 | 0.67 | 1.04 | 1.26 | 3.36 | | 18.19 | 42015 |
| 9.33 | 0.87 | 10.20 | | | | 0.89 | 1.08 | 3.32 | | 17.99 | 42352 |
| *8.00* | *2.00* | *10.00* | | | | *0.82* | *1.00* | *3.00* | | *16.27* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **American Agr'l Chemical Co.** | |
| 42016 | Bradley Fertilizer Works Corn and Wheat Phosphate | Manufacturer |
| 42017 | Bradley Fertilizer Works Dissolved Bone With Potash | Manufacturer |
| 42353 | | J. H. Lennon, Hardinsburg |
| 42018 | Bradley Fert. Wks. Niagara Phosphate | Manufacturer |
| 42023 | Cleveland Dryer Works Phospho Bone | Manufacturer |
| 42024 | Cleveland Dryer Works Potato and Tobacco Fertilizer | Manufacturer |
| 42356 | | W. G. Wesley, Science Hill |
| | **The American Agr'l Chem. Co., Michigan Carbon Works, Cincinnati, Ohio.** | |
| 42028 | Red Line Complete Manure | Manufacturer |
| 42359 | | Woodson Lewis, Greensburg |
| 42030 | Red Line Tobacco Manure | Manufacturer |
| 42361 | | Bradford Bros., Glasgow |
| 42031 | A-1 Potash Fertilizer | Manufacturer |
| 42032 | Red Line Crop Grower | Manufacturer |
| 42033 | Homestead Bone Black Fertilizer | Manufacturer |
| 42362 | | E. S. Ferrell & Sons, Buffalo |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN. | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 10.19 | 1.30 | 11.49 | | 0.31 | 0.77 | 1.08 | 1.31 | 1.50 | | $18.03 | 42016 |
| *10.00* | *2.00* | *12.00* | | | | *0.82* | *1.00* | *1.00* | | *16.67* | |
| 9.29 | 1.66 | 10.95 | | 0.35 | 1.06 | 1.41 | 1.71 | 3.25 | | 20.00 | 42017 |
| 8.07 | 1.10 | 9.17 | | 0.32 | 1.06 | 1.38 | 1.68 | 3.37 | | 18.32 | 42353 |
| *8.00* | *2.00* | *10.00* | | | | *1.03* | *1.25* | *2.00* | | *16.01* | |
| 6.35 | 2.14 | 8.49 | | 0.44 | 0.51 | 0.95 | 1.15 | 1.50 | | 13.31 | 42018 |
| *7.00* | *1.00* | *8.00* | | | | *0.82* | *1.00* | *1.00* | | *12.67* | |
| 10.46 | 1.08 | 11.54 | | 0.28 | 0.78 | 1.06 | 1.29 | 1.50 | | 18.19 | 42023 |
| *10.00* | *2.00* | *12.00* | | | | *0.82* | *1.00* | *1.00* | | *16.67* | |
| 8.67 | 1.57 | 10.24 | | 0.44 | 0.56 | 1.00 | 1.21 | 3.29 | | 17.82 | 42024 |
| 8.60 | 1.66 | 10.26 | | 0.20 | 0.70 | 0.90 | 1.09 | 2.97 | | 17.10 | 42356 |
| *8.00* | *2.00* | *10.00* | | | | *0.82* | *1.00* | *3.00* | | *16.27* | |
| 6.45 | 2.07 | 8.52 | | 0.45 | 0.52 | 0.97 | 1.18 | 1.45 | | 13.42 | 42028 |
| 7.29 | 1.76 | 9.05 | | | | 0.92 | 1.12 | 1.13 | | 13.80 | 42359 |
| *7.00* | *1.00* | *8.00* | | | | *0.82* | *1.00* | *1.00* | | *12.67* | |
| 8.57 | 1.90 | 10.47 | | 0.44 | 0.61 | 1.05 | 1.27 | 3.33 | | 18.05 | 42030 |
| 9.07 | 1.54 | 10.61 | | | | 0.90 | 1.09 | 3.20 | | 17.85 | 42361 |
| *8.00* | *2.00* | *10.00* | | | | *0.82* | *1.00* | *3.00* | | *16.27* | |
| 8.56 | 1.78 | 10.34 | | 0.44 | 0.56 | 1.00 | 1.21 | 3.24 | | 17.72 | 42031 |
| *8.00* | *2.00* | *10.00* | | | | *0.82* | *1.00* | *3.00* | | *16.27* | |
| 7.96 | 1.50 | 9.46 | | 1.11 | 0.53 | 1.64 | 1.99 | 2.29 | | 18.18 | 42032 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |
| 8.99 | 1.30 | 10.29 | | 0.77 | 1.46 | 2.23 | 2.71 | 2.55 | | 21.72 | 42033 |
| 8.88 | 1.48 | 10.36 | | 1.33 | 0.84 | 2.17 | 2.63 | 1.85 | | 20.70 | 42362 |
| *8.00* | *2.00* | *10.00* | | | | *2.06* | *2.50* | *1.50* | | *19.11* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **American Agr'l Chemical Co.** | |
| 42034 | Homestead Potato and Tobacco Special ..... | Manufacturer ..... |
| 42363 | | Lebanon Carriage & Implement Co., Lebanon ..... |
| 42035 | Homestead 10% Potash Manure ..... | Manufacturer ..... |
| 42037 | Homestead Tobacco Grower ..... | Manufacturer ..... |
| 42364 | | Woodson Lewis, Greensburg..... |
| | **The American Agr'l Chem. Co., Cincinnati Sales Department, Cincinnati, O.** | |
| 42038 | N. W. Horseshoe Brand 3-8-6 Fertilizer ..... | Manufacturer ..... |
| 42366 | | Snow & Conrad, Dry Ridge..... |
| 42039 | N. W. Horseshoe Brand Tobacco Grower ..... | Manufacturer ..... |
| 42367 | | Snow & Conrad, Dry Ridge..... |
| 42040 | N. W. Horseshoe Brand Special Onion and Vegetable Manure ..... | Manufacturer ..... |
| 42041 | N. W. Horseshoe Brand Challenge Corn Grower .. | Manufacturer ..... |
| 42368 | | E. P. Barnes & Bro., Beaver Dam.. |
| 42042 | N. W. Horseshoe Brand Ky. Tobacco Grower .... | Manufacturer ..... |
| 42369 | | M. L. Spurling, Campbellsville..... |
| 42043 | N. W. Horseshoe Brand Corn and Wheat Grower. | Manufacturer ..... |
| 42370 | | E. S. Ferrell & Sons, Buffalo..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| **6.82** | 1.90 | 8.72 | | 1.07 | 0.82 | 1.89 | 2.29 | 4.94 | | $20.50 | 42034 |
| 8.65 | 1.42 | 10.07 | | 0.74 | 0.98 | 1.72 | 2.09 | 5.14 | | 22.11 | 42363 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *5.00* | | *21.18* | |
| 5.57 | 0.70 | 6.27 | | | | 0.89 | 1.08 | 11.18 | | 21.26 | 42035 |
| *5.00* | *2.00* | *7.00* | | | | *0.82* | *1.00* | *10.00* | | *19.67* | |
| 9.98 | 2.42 | 12.40 | | 2.27 | 0.82 | 3.09 | 3.75 | 4.98 | | 28.75 | 42037 |
| 10.87 | 1.01 | 11.88 | | 1.35 | 1.41 | 2.76 | 3.35 | 3.79 | | 26.89 | 42364 |
| *10.00* | *1.00* | *11.00* | | | | *2.88* | *3.50* | *3.56* | | *25.98* | |
| 7.57 | 0.79 | 8.36 | | 1.71 | 1.00 | 2.71 | 3.29 | 1.30 | 5.82 | 27.15 | 42038 |
| 8.29 | 1.81 | 10.10 | | 1.92 | 0.59 | 2.51 | 3.05 | | 6.46 | 27.23 | 42366 |
| *8.00* | *2.00* | *10.00* | | | | *2.47* | *3.00* | | *6.00* | *26.25* | |
| 7.49 | 1.31 | 8.80 | | 1.07 | 0.82 | 1.89 | 2.29 | 5.10 | | 21.23 | 42039 |
| 8.01 | 1.42 | 9.43 | | 0.70 | 0.95 | 1.65 | 2.00 | 5.12 | | 21.08 | 42367 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *5.00* | | *21.18* | |
| 4.83 | 1.40 | 6.23 | | | | 0.89 | 1.08 | 11.92 | | 21.40 | 42040 |
| *5.00* | *2.00* | *7.00* | | | | *0.82* | *1.00* | *10.00* | | *19.67* | |
| 9.34 | 1.05 | 10.39 | | 0.84 | 1.32 | 2.16 | 2.62 | 2.87 | | 22.06 | 42041 |
| 8.11 | 1.94 | 10.05 | | 0.80 | 1.21 | 2.01 | 2.44 | 1.85 | | 19.40 | 42368 |
| *8.00* | *2.00* | *10.00* | | | | *2.06* | *2.50* | *1.50* | | *19.11* | |
| 8.52 | 1.13 | 9.65 | | 1.24 | 0.43 | 1.67 | 2.03 | 2.28 | | 18.80 | 42042 |
| 8.20 | 1.76 | 9.96 | | 1.02 | 0.73 | 1.75 | 2.12 | 2.39 | | 19.06 | 42369 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |
| 7.80 | 1.67 | 9.47 | | 0.97 | 0.70 | 1.67 | 2.03 | 2.28 | | 18.16 | 42043 |
| 8.47 | 1.49 | 9.96 | | 0.93 | 0.67 | 1.60 | 1.94 | 2.48 | | 18.84 | 42370 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **American Agr'l Chemical Co.** | |
| 42044 | N. W. Horseshoe Brand Acidulated Bone and Potash ..... | Manufacturer ..... |
| 42371 | | J. A. Shaver, Greenville ..... |
| 42045 | N. W. Horseshoe Brand Potash Manure ..... | Manufacturer ..... |
| 42372 | | Edmiston Bros., Crab Orchard ..... |
| 42046 | N. W. Horseshoe Brand Dark Tobacco Grower .. | Manufacturer ..... |
| 42373 | | Woodson Lewis, Greensburg ..... |
| 42055 | Packers Boar's Head Brand Faultless Grain Grower ..... | Manufacturer ..... |
| 42057 | Packers Boar's Head Brand Ammoniated Bone and Potash ..... | Manufacturer ..... |
| 42381 | | J. H. Wyan, London ..... |
| 42058 | Packers Boar's Head Brand Sure Growth Potash Manure ..... | Manufacturer ..... |
| 42059 | Packers Boar's Head Brand Special Tobacco Grower ..... | Manufacturer ..... |
| 42060 | Packers Boar's Head Brand Corn and Wheat Grower ..... | Manufacturer ..... |
| 42382 | | J. H. Wyan, London ..... |
| 42061 | Packers Boar's Head Brand World of Good Superphosphate ..... | Manufacturer ..... |
| 42383 | | Lowry, Hines & Co., Science Hill.... |
| 42062 | Packers Boar's Head Brand High Grade Vegetable Fertilizer ..... | Manufacturer ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 9.96 | 1.67 | 11.63 | | 0.21 | 0.86 | 1.07 | 1.30 | 1.43 | | $17.80 | 42044 |
| 9.98 | 2.64 | 12.62 | | | | 0.95 | 1.15 | 1.14 | | 17.50 | 42371 |
| *10.00* | *2.00* | *12.00* | | | | *0.82* | *1.00* | *1.00* | | *16.67* | |
| 8.36 | 2.03 | 10.39 | | 0.42 | 0.64 | 1.06 | 1.29 | 3.49 | | 18.04 | 42045 |
| 7.61 | 1.76 | 9.37 | | 0.45 | 0.54 | 0.99 | 1.20 | 3.66 | | 16.96 | 42372 |
| *8.00* | *2.00* | *10.00* | | | | *0.82* | *1.00* | *3.00* | | *16.27* | |
| 6.72 | 2.33 | 9.05 | | 0.42 | 0.55 | 0.97 | 1.18 | 1.49 | | 13.88 | 42046 |
| 7.15 | 1.90 | 9.05 | | 0.39 | 0.52 | 0.91 | 1.10 | 1.38 | | 13.91 | 42373 |
| *7.00* | *1.00* | *8.00* | | | | *0.82* | *1.00* | *1.00* | | *12.67* | |
| 6.53 | 2.19 | 8.72 | | 0.44 | 0.78 | 1.22 | 1.48 | 1.49 | | 14.48 | 42055 |
| *7.00* | *1.00* | *8.00* | | | | *0.82* | *1.00* | *1.00* | | *12.67* | |
| 9.57 | 2.11 | 11.68 | | 0.35 | 0.72 | 1.07 | 1.30 | 1.35 | | 17.42 | 42057 |
| 8.58 | 2.87 | 11.45 | | 0.28 | 0.67 | 0.95 | 1.15 | 1.34 | | 16.12 | 42381 |
| *10.00* | *2.00* | *12.00* | | | | *0.82* | *1.00* | *1.00* | | *16.67* | |
| 9.08 | 1.50 | 10.58 | | 0.44 | 0.56 | 1.00 | 1.21 | 3.24 | | 18.24 | 42058 |
| *8.00* | *2.00* | *10.00* | | | | *0.82* | *1.00* | *3.00* | | *16.27* | |
| 8.58 | 1.34 | 9.92 | | 1.22 | 0.53 | 1.75 | 2.12 | 2.22 | | 19.19 | 42059 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |
| 8.19 | 1.75 | 9.94 | | 1.21 | 0.52 | 1.73 | 2.10 | 2.23 | | 18.82 | 42060 |
| 7.75 | 1.82 | 9.57 | | 1.05 | 0.57 | 1.62 | 1.97 | 2.37 | | 18.07 | 42382 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |
| 9.85 | 0.71 | 10.56 | | 0.87 | 1.34 | 2.21 | 2.68 | 2.56 | | 22.40 | 42061 |
| 7.17 | 2.15 | 9.32 | | 1.04 | 0.66 | 1.70 | 2.06 | 5.29 | | 20.70 | 42383 |
| *8.00* | *2.00* | *10.00* | | | | *2.06* | *2.50* | *1.50* | | *19.11* | |
| 7.44 | 1.30 | 8.74 | | 1.10 | 0.87 | 1.97 | 2.39 | 5.41 | | 21.76 | 42062 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *5.00* | | *21.18* | |

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The Armour Fertilizer Works, Nashville, Tenn.** | |
| 42067 | Armour's Mixed Bone and Potash ..... | Manufacturer ..... |
| 42068 | Armour's Bone Meal and Potash ..... | Manufacturer ..... |
| 42384 | | D. M. Brakefield, Adairville ..... |
| 42069 | Armour's Wheat Special No. 2 ..... | Manufacturer ..... |
| 42070 | Armour's Record Brand.. | Manufacturer ..... |
| 42071 | Armour's Champion .... | Manufacturer ..... |
| 42385 | | V. G. Rexroat, Somerset ..... |
| 42072 | Armour's Tobacco Grower ..... | Manufacturer ..... |
| 42386 | | Rubel Hardware Co., Lebanon ..... |
| 42073 | Armour's High Grade Tobaco and Potato Grower. | Manufacturer ..... |
| 42387 | | Miller, Butler & Cartwright, Elkton. |
| 42074 | Armour's Grain Grower. | Manufacturer ..... |
| 42388 | | E. S. Ferrell & Sons, Buffalo ..... |
| 42075 | Armour's Corn and Wheat Grower ..... | Manufacturer ..... |
| 42389 | | J. T. Lawson, Greenup ..... |
| 42076 | Armour's Bone, Blood and Potash ..... | Manufacturer ..... |
| 42077 | Armour's White Burley and Black Tobacco ..... | Manufacturer ..... |
| 42390 | | Sparks, Wood & Sparks, North Pleasureville ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | | POTASH | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Avalable. | Isoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate | Estimated Value Per Ton. | Station Number. |
| 11.86 | 7.93 | 19.79 | | | | 1.21 | 1.47 | | 4.07 | $26.25 | 42067 |
| *10.00* | *8.00* | *18.00* | | | | *0.82* | *1.00* | | *4.00* | *22.87* | |
| 10.85 | 6.54 | 17.39 | | | | 1.07 | 1.30 | | **2.16** | 21.98 | 42068 |
| 10.71 | 5.89 | 16.60 | | | | 1.40 | 1.70 | | 2.94 | 23.64 | 42384 |
| *10.00* | *6.00* | *16.00* | | | | *1.23* | *1.50* | | *3.00* | *22.31* | |
| 9.97 | 3.35 | 13.32 | | | | 0.80 | 0.97 | 2.16 | | 18.26 | 42069 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | *2.00* | | *18.47* | |
| 9.97 | 3.53 | 13.50 | | | | 0.84 | 1.02 | 0.58 | 0.72 | 17.33 | 42070 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | *1.00* | | *17.47* | |
| 10.26 | 1.42 | 11.68 | | | | 2.02 | 2.45 | 0.64 | 1.55 | 22.45 | 42071 |
| 11.23 | 0.84 | 12.07 | | | | 1.60 | 1.94 | 0.68 | 1.85 | 22.32 | 42385 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 8.15 | 1.22 | 9.37 | | | | 1.99 | 2.42 | | 5.42 | 23.74 | 42072 |
| 9.28 | 1.42 | 10.70 | | | | 1.44 | 1.75 | **1.30** | **3.07** | **21.73** | 42386 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *5.00* | *22.98* | |
| 8.06 | 1.25 | 9.31 | | | | 1.76 | 2.14 | | 10.35 | 28.99 | 42073 |
| 8.39 | 0.79 | 9.18 | | | | 1.46 | 1.77 | **1.18** | **8.24** | **26.57** | 42387 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *10.00* | *28.98* | |
| 7.86 | 1.59 | 9.45 | | | | 1.86 | 2.26 | 2.25 | | 18.83 | 42074 |
| 7.60 | 2.09 | 9.69 | | | | 1.52 | 1.85 | 0.86 | 1.52 | **17.96** | 42388 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | *2.00* | | *18.98* | |
| 8.41 | 3.03 | 11.44 | | | | 0.98 | 1.19 | 4.19 | | 18.92 | 42075 |
| 8.60 | 1.24 | 9.84 | | | | 0.95 | 1.15 | 1.06 | 3.03 | 18.85 | 42389 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | *4.00* | | *18.07* | |
| 8.16 | 1.31 | 9.47 | | 2.27 | 2.15 | 4.42 | 5.37 | 1.76 | 5.64 | 34.31 | 42076 |
| *8.00* | *4.00* | *12.00* | | | | *4.12* | *5.00* | | *7.00* | *34.02* | |
| 7.89 | 1.45 | 9.34 | | 1.47 | 1.59 | 3.06 | 3.71 | 1.10 | 3.30 | 25.82 | 42077 |
| 9.57 | 1.94 | 11.51 | | 0.52 | 1.23 | **1.75** | 2.12 | 1.46 | 2.88 | **23.31** | 42390 |
| *8.00* | *4.00* | *12.00* | | | | *2.88* | *3.50* | | *4.00* | *26.08* | |

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The Armour Fertilizer Works.** | |
| 42078 | Armour's Dark Tobacco Special ..... | Manufacturer ..... |
| 42391 | | E. S. Ferrell & Sons, Buffalo ..... |
| 42079 | Armour's Wheat, Corn and Oats Special ..... | Manufacturer ..... |
| 42392 | | E. S. Ferrell & Sons, Buffalo ..... |
| 42080 | Armour's Ammoniated Bone and Potash ..... | Manufacturer ..... |
| 42393 | | J. T. Lawson, Greenup ..... |
| 42108 | Fisher Bros.' Special.... | Manufacturer ..... |
| 42401 | | The Fisher Bros. Co., Newport ..... |
| 42109 | Fisher Bros.' High Grade Fertilizer ..... | Manufacturer ..... |
| 42402 | | The Fisher Bros. Co., Newport ..... |
| 42095 | Smith's Special Tobacco Grower ..... | Manufacturer ..... |
| 42597 | | Greenville Hardware & Grocery Co., Greenville ..... |
| 42096 | Smith's Corn and Wheat Grower ..... | Manufacturer ..... |
| 42097 | Smith's Success Crop Grower ..... | Manufacturer ..... |
| 42098 | Smith's Standard Tobacco Grower ..... | Manufacturer ..... |
| 42099 | Smith's Kentucky Tobacco Grower ..... | Manufacturer ..... |
| 42598 | | Greenville Hardware & Grocery Co., Greenville ..... |
| 42100 | Smith's High Grade Potato Grower ..... | Manufacturer ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| | | | | | | | | | 4.09 | $20.54 | 42078 |
| | | | | | | 1.89 | 2.29 | | | | |
| 7.10 | 1.22 | 8.32 | | | | **1.13** | 1.37 | **0.58** | **2.72** | **17.95** | 42391 |
| 7.96 | 1.50 | 9.46 | | | | *1.65* | *2.00* | | *4.00* | *20.58* | |
| *7.00* | *4.00* | *11.00* | | | | | | | | | |
| | | | | | | 1.07 | 1.30 | 1.20 | | 14.78 | 42079 |
| 7.07 | 3.38 | 10.45 | | | | 0.75 | 0.91 | 2.14 | | 14.54 | 42392 |
| 7.62 | 1.58 | 9.20 | | | | *0.82* | *1.00* | *1.00* | | *13.87* | |
| *7.00* | *4.00* | *11.00* | | | | | | | | | |
| | | | | | | | | **1.29** | | **18.03** | 42080 |
| 5.89 | 1.15 | 7.04 | | 0.87 | 1.76 | 2.63 | 3.19 | 0.72 | 2.48 | **17.61** | 42393 |
| 6.52 | 0.94 | 7.46 | | | | **1.63** | 1.98 | *2.00* | | *19.45* | |
| *6.00* | *4.00* | *10.00* | | | | *2.47* | *3.00* | | | | |
| | | | | | | 1.50 | 1.82 | | 4.00 | 21.14 | 42108 |
| 8.69 | 1.64 | 10.33 | | | | 1.08 | 1.31 | **0.68** | **2.69** | 19.76 | 42401 |
| 8.60 | 4.37 | 12.97 | | 0.28 | 0.80 | *1.23* | *1.50* | | *4.00* | *20.31* | |
| *8.00* | *4.00* | *12.00* | | | | | | | | | |
| | | | | | | | | | 6.39 | 27.72 | 42109 |
| 8.25 | 1.40 | 9.65 | | 1.11 | 1.63 | 2.74 | 3.33 | | 4.52 | **25.07** | 42402 |
| **7.19** | 1.24 | 8.43 | 0.20 | 0.76 | 1.69 | 2.65 | 3.22 | 1.24 | *6.00* | *27.05* | |
| *8.00* | *4.00* | *12.00* | | | | *2.47* | *3.00* | | | | |
| | | | | | | 1.87 | 2.27 | | 5.24 | 23.18 | 42095 |
| 8.26 | 1.07 | 9.33 | | | | | | | | | |
| | | | | | | 1.70 | 2.06 | 0.76 | 5.11 | 22.18 | 42597 |
| **7.46** | 0.98 | 8.44 | 0.86 | | 0.84 | *1.65* | *2.00* | | *5.00* | *22.98* | |
| *8.00* | *4.00* | *12.00* | | | | | | | | | |
| | | | | | | 1.71 | 2.08 | 2.29 | | 18.47 | 42096 |
| 8.16 | 0.99 | 9.15 | | | | *1.65* | *2.00* | *2.00* | | *18.98* | |
| *8.00* | *4.00* | *12.00* | | | | | | | | | |
| | | | | | | 1.02 | 1.24 | 0.88 | 0.52 | 15.43 | 42097 |
| 7.68 | 2.86 | 10.54 | | | | *0.82* | *1.00* | *1.00* | | *13.87* | |
| *7.00* | *4.00* | *11.00* | | | | | | | | | |
| | | | | | | 1.77 | 2.15 | | 2.22 | 18.91 | 42098 |
| 7.94 | 1.30 | 9.24 | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| *8.00* | *4.00* | *12.00* | | | | | | | | | |
| | | | | | | 1.81 | 2.20 | | 4.38 | 20.22 | 42099 |
| 6.77 | 1.25 | 8.02 | | | | | | | | | |
| | | | | | | 1.67 | 2.03 | 0.90 | 4.44 | 20.82 | 42598 |
| 6.63 | 1.96 | 8.59 | 0.21 | | 1.46 | *1.65* | *2.00* | | *4.00* | *20.58* | |
| *7.00* | *4.00* | *11.00* | | | | | | | | | |
| | | | | | | 2.62 | 3.18 | 0.76 | 6.02 | 28.06 | 42100 |
| 8.65 | 1.33 | 9.98 | | 1.19 | 1.43 | *2.47* | *3.00* | | *6.00* | *27.05* | |
| *8.00* | *4.00* | *12.00* | | | | | | | | | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The Armour Fertilizer Works.** | |
| 42101 | Smith's Grain Special ... | Manufacturer ..... |
| 42102 | Smith's Beef, Blood and Bone ..... | Manufacturer ..... |
| 42103 | Smith's Pure Bone Meal With Potash ..... | Manufacturer ..... |
| | **The Armour Fertilizer Wks for The T. J. Turley Co., Owensboro.** | |
| 42089 | Ideal Half and Half ..... | Manufacturer ..... |
| 42090 | Ideal Grain Grower ..... | Manufacturer ..... |
| 42091 | Ideal Tobacco Grower ... | Manufacturer ..... |
| 42628 | | McAtee, Vickers Hdw. Co., Russellville ..... |
| 42092 | Ideal Truck and High Grade Tobacco Grower.. | Manufacturer ..... |
| 42629 | | McAtee, Vickers Hdw. Co., Russellville ..... |
| 42094 | Ideal Wheat Grower .... | Manufacturer ..... |
| | **Baugh & Sons Co., Norfolk, Va.** | |
| 42262 | Baugh's Animal Base and Potash Compound for all Crops ..... | Manufacturer ..... |
| 42263 | Baugh's Complete Animal Base Fertilizer ..... | Manufacturer ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic | Total. | | From Muriate. | From Sulphate | | |
| | | | | | | 0.98 | 1.19 | 2.14 | | $18.85 | 42101 |
| 9.99 | 3.23 | 13.22 | | | | *0.82* | *1.00* | *2.00* | | *18.47* | |
| *10.00* | *4.00* | *14.00* | | | | | | | | | |
| | | | | | | 1.88 | 2.28 | | 2.20 | 22.42 | 42102 |
| 10.55 | 1.35 | 11.90 | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| *10.00* | *4.00* | *14.00* | | | | | | | | | |
| | | | | | | 1.11 | 1.35 | | 4.15 | 26.28 | 42103 |
| 12.03 | 7.43 | 19.46 | | | | *0.82* | *1.00* | | *4.00* | *22.87* | |
| *10.00* | *8.00* | *18.00* | | | | | | | | | |
| | | | | | | 1.09 | 1.32 | | 1.55 | 21.42 | 42089 |
| 10.95 | 6.49 | 17.44 | | | | *1.23* | *1.50* | | *2.00* | *21.11* | |
| *10.00* | *6.00* | *16.00* | | | | | | | | | |
| | | | | | | 1.00 | 1.21 | 3.23 | | 17.95 | 42090 |
| 8.28 | 3.19 | 11.47 | | | | *0.82* | *1.00* | *3.00* | | *17.07* | |
| *8.00* | *4.00* | *12.00* | | | | | | | | | |
| | | | | | | 1.77 | 2.15 | | 4.38 | 21.48 | 42091 |
| 8.02 | 1.01 | 9.03 | | | | | | | | | |
| | | | | | | 1.30 | 1.58 | | 3.46 | 23.70 | 42628 |
| 9.99 | 7.53 | 17.52 | 0.33 | | 0.97 | *1.65* | *2.00* | | *4.00* | *21.78* | |
| *8.00* | *4.00* | *12.00* | | | | | | | | | |
| | | | | | | 1.77 | 2.15 | | 10.51 | 29.42 | 42092 |
| 8.49 | 1.05 | 9.54 | | | | | | | | | |
| | | | | | | 1.71 | 2.08 | 8.40 | | **26.67** | 42629 |
| 7.85 | 5.64 | 13.49 | | | | *1.65* | *2.00* | | *10.00* | *28.98* | |
| *8.00* | *4.00* | *12.00* | | | | | | | | | |
| | | | | | | 1.87 | 2.27 | 2.21 | | 19.50 | 42094 |
| 8.61 | 1.03 | 9.64 | | | | *1.65* | *2.00* | *2.00* | | *18.98* | |
| *8.00* | *4.00* | *12.00* | | | | | | | | | |
| | | | | | | 1.52 | 1.85 | 2.54 | | 17.93 | 42262 |
| 7.99 | 1.19 | 9.18 | | 0.62 | 0.90 | *1.65* | *2.00* | *2.00* | | *17.38* | |
| *8.00* | | | | | | | | | | | |
| | | | | | | 1.54 | 1.87 | 4.92 | | 20.79 | 42263 |
| 8.32 | 1.24 | 9.56 | | 0.35 | 1.19 | *1.65* | *2.00* | *5.00* | | *20.38* | |
| *8.00* | | | | | | | | | | | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **C. S. Brent, Lexington, Ky.** | |
| 42288 | Brent's Grain Grower... | Manufacturer |
| 42403 | | Manufacturer's Warehouse |
| 42289 | Brent's Tobacco and Hemp Special | Manufacturer |
| 42404 | | Manufacturer's Warehouse |
| | **Central Manufacturing Co., Lockland, Ohio.** | |
| 39772 | Equity Grain Favorite.. | Manufacturer |
| 42405 | | W. H. Murray, London |
| 39773 | Equity Clay Land Wheat Special | Manufacturer |
| 39774 | Equity Wheat Special.... | Manufacturer |
| 42406 | | W. W. Ross, Flemingsburg |
| 39776 | Equity Crop Maker .... | Manufacturer |
| 42407 | | Virginia M. Fultz, Grayson |
| 39777 | Equity Home Mixture ... | Manufacturer |
| 39778 | Equity Pota-Bacco Special | Manufacturer |
| 42408 | | Virginia M. Fultz, Grayson |
| 39779 | Equity High Grade Truck Food | Manufacturer |
| 42409 | | W. W. Ross, Flemingsburg |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | | POTASH | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate. | Estimated Value Per Ton. | Station Number. |
| 7.86 | 1.99 | 9.85 | | | | 1.48 | 1.80 | 2.29 | | $17.70 | 42288 |
| 7.79 | 2.47 | 10.26 | | 0.74 | 0.71 | 1.45 | 1.76 | 3.16 | | 18.58 | 42403 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |
| 7.65 | 1.64 | 9.29 | | 1.04 | 2.01 | **3.05** | 3.70 | 1.20 | 8.75 | 32.22 | 42289 |
| 5.15 | 2.13 | 7.28 | | 1.54 | 2.40 | 3.94 | 4.78 | 1.74 | 9.24 | 33.65 | 42404 |
| *5.00* | | | | | | *4.00* | *4.86* | | *10.00* | *32.00* | |
| 9.41 | 1.73 | 11.14 | | | | 0.68 | 0.83 | 4.01 | | 18.37 | 39772 |
| 8.48 | 2.38 | 10.86 | | | | 0.55 | 0.67 | 3.71 | | 16.77 | 42405 |
| *9.00* | | | | | | *0.41* | *0.50* | *3.00* | | *15.24* | |
| **9.13** | 1.28 | 10.41 | | | | 1.16 | 1.41 | 1.48 | | 17.01 | 39773 |
| *10.00* | | | | | | *0.82* | *1.00* | *1.00* | | *15.87* | |
| 10.08 | 1.62 | 11.70 | | | | 0.82 | 1.00 | 3.53 | | 19.15 | 39774 |
| **6.97** | 1.56 | 8.53 | | | | 1.06 | 1.29 | 3.76 | 0.99 | 17.64 | 42406 |
| *8.00* | | | | | | *0.82* | *1.00* | *4.00* | | *16.47* | |
| 8.79 | 2.01 | 10.80 | | | | 1.61 | 1.95 | 3.24 | | 20.23 | 39776 |
| 8.30 | 2.49 | 10.79 | | | | 1.42 | 1.72 | 2.76 | | 18.69 | 42407 |
| *8.00* | | | | | | *1.23* | *1.50* | *2.50* | | *16.41* | |
| 8.52 | 2.07 | 10.59 | | | | 2.51 | 3.05 | 2.82 | | 22.66 | 39777 |
| *8.00* | | | | | | *2.06* | *2.50* | *3.00* | | *19.81* | |
| 10.07 | 1.75 | 11.82 | | | | 1.82 | 2.21 | 0.74 | 4.35 | 25.11 | 39778 |
| 8.55 | **3.33** | 11.88 | | | | 1.63 | 1.98 | 0.78 | 4.38 | 23.34 | 42408 |
| *9.00* | | | | | | *1.65* | *2.00* | | *5.00* | *22.58* | |
| 7.10 | 1.35 | 8.45 | | | | 2.47 | 3.00 | 7.75 | | 25.46 | 39779 |
| 6.27 | 2.60 | 8.87 | | | | 2.04 | 2.48 | 3.92 | 4.58 | 25.12 | 42409 |
| *6.00* | | | | | | *2.06* | *2.50* | *8.00* | | *22.41* | |

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The Cincinnati Phosphate Co., Cincinnati, Ohio.** | |
| 42203 | High Grade Manure ... | Manufacturer ..... |
| 42204 | Grain and Grass Grower. | Manufacturer ..... |
| 42208 | Tobacco, Potato and Beet Grower ..... | Manufacturer ..... |
| 42412 | | Hines & Gardner, Vanceburg ..... |
| 42211 | Bone and Phosphate Mixture Wheat Special ..... | Manufacturer ..... |
| 42212 | Truck and Tobacco Fertilizer ..... | Manufacturer ..... |
| 42413 | | Wilson & Boyer, Campbellsville.... |
| | **Continental Fertilizer Co., Nashville, Tenn.** | |
| 39870 | Bear Special Corn and Wheat Grower ..... | Manufacturer ..... |
| 42416 | | Yerkes & Pritchard, Paris ..... |
| 39871 | Bear Special Tobacco Grower ..... | Manufacturer ..... |
| 42417 | | T. Z. Leachman, Greensburg ..... |
| 39872 | Bear Grain Grower .... | Manufacturer ..... |
| 42418 | | Wm. Leming, Hodgenville ..... |
| 39873 | Bear Grain Special ..... | Manufacturer ..... |
| 42419 | | T. Z. Leachman, Greensburg ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Isoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic | Total. | | From Muriate. | From Sulphate | | |
| 9.05 | 1.15 | 10.20 | | 0.44 | 0.91 | 1.35 | 1.64 | 3.05 | | $19.10 | 42203 |
| *8.00* | *1.00* | *9.00* | | | | *1.23* | *1.50* | *2.50* | | *16.81* | |
| 8.70 | 1.26 | 9.96 | | 0.34 | 0.57 | 0.91 | 1.10 | 2.31 | | 16.44 | 42204 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *2.00* | | *14.87* | |
| 8.91 | 1.38 | 10.29 | | | | 1.14 | 1.38 | 3.77 | | 19.00 | 42208 |
| 8.19 | 1.36 | 9.55 | | | | 0.83 | 1.01 | 4.06 | | 17.34 | 42412 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *4.00* | | *16.87* | |
| 7.53 | 12.33 | 19.86 | | | | 1.31 | 1.59 | 1.78 | 0.92 | 21.44 | 42211 |
| *8.00* | *8.00* | *16.00* | | | | *1.23* | *1.50* | *2.00* | | *19.11* | |
| 8.08 | 1.43 | 9.51 | | | | 1.35 | 1.64 | | 6.94 | 23.33 | 42212 |
| 6.95 | 1.12 | 8.07 | | 0.29 | 1.27 | 1.56 | 1.89 | | 6.30 | 21.81 | 42413 |
| *6.00* | *1.00* | *7.00* | | | | *1.65* | *2.00* | | *6.00* | *20.58* | |
| 7.26 | 0.89 | 8.15 | | | | 0.95 | 1.15 | 0.66 | 0.53 | 13.70 | 39870 |
| 7.30 | 2.55 | 9.85 | | | | † | | †4.87 | | 14.65 | 42416 |
| *7.00* | *4.00* | *11.00* | | | | *0.82* | *1.00* | | *1.00* | *14.07* | |
| 8.60 | 0.66 | 9.26 | | | | 0.81 | 0.98 | 1.88 | | 15.30 | 39871 |
| 8.59 | 2.12 | 10.71 | | | | 1.15 | 1.40 | **0.52** | **0.62** | 16.45 | 42417 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *1.50* | *15.87* | |
| 8.15 | 0.52 | 8.67 | | | | 0.32 | 0.39 | | 4.40 | **16.23** | 39872 |
| 9.34 | 1.20 | 10.54 | | | | 0.61 | 0.74 | | 4.90 | 19.71 | 42418 |
| *8.00* | *4.00* | *12.00* | | | | *0.41* | *0.50* | | *4.00* | *17.44* | |
| 10.63 | 0.91 | 11.54 | | | | 0.95 | 1.15 | 0.58 | 2.25 | 19.73 | 39873 |
| 9.90 | 1.66 | 11.56 | | | | 0.86 | 1.04 | | 2.39 | 18.42 | 42419 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | | *2.00* | *18.87* | |

†Evidently an error has been made in labeling this fertilizer.

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Continental Fertilizer Co.** | |
| 39874<br>42420 | Bear Slaughter House Bone | Manufacturer<br>Grayson Co. Supply Co., Leitchfield. |
| 39875<br>42421 | Bear Beef, Blood and Bone | Manufacturer<br>Grayson Co. Supply Co., Leitchfield. |
| 39876<br>42422 | Bear High Grade Tobacco and Potato Grower | Manufacturer<br>T. Z. Leachman, Greensburg |
| 39878<br>42424 | Bear Tobacco Grower | Manufacturer<br>W. F. Grainger, Franklin |
| 39879 | Bear Potato Grower | Manufacturer |
| 39880<br>42425 | Bear Truck Grower | Manufacturer<br>W. H. Scott, Olive Hill |
| | **Duncan and Brother, La Grange, Ky.** | |
| 42238<br>42426 | Tiger Brand Tobacco Grower | *Manufacturer<br>Manufacturers Warehouse |
| 42239<br>42427 | Tiger Brand Grain Grower | *Manufacturer<br>Manufacturers Warehouse |
| 42240<br>42428 | Tiger Brand Special Corn and Wheat Grower | *Manufacturer<br>Manufacturers Warehouse |

*The manufacturer failed to furnish Samples as required by law.

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | | POTASH | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate | Estimated Value Per Ton. | Station Number. |
| 8.40 | 0.78 | 9.18 | | 0.93 | 0.81 | 1.74 | 2.11 | 1.14 | 1.44 | $19.35 | 39874 |
| 9.74 | 2.01 | 11.75 | | 0.70 | 0.63 | 1.33 | 1.61 | 0.64 | 1.83 | 19.99 | 42420 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| 10.92 | 1.35 | 12.27 | | | | 1.72 | 2.09 | 0.58 | 1.96 | 22.59 | 39875 |
| 10.37 | 2.41 | 12.78 | | 0.49 | 0.81 | **1.30** | 1.58 | 0.64 | 1.29 | **20.14** | 42421 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 7.47 | 1.70 | 9.17 | | | | 1.68 | 2.04 | 1.34 | 3.57 | 21.14 | 39876 |
| 8.17 | 0.96 | 9.13 | | 0.77 | 0.62 | 1.39 | 1.69 | 0.84 | 3.04 | **19.54** | 42422 |
| *7.00* | *4.00* | *11.00* | | | | *1.65* | *2.00* | | *4.00* | *20.58* | |
| 8.12 | 0.70 | 8.82 | | 1.85 | 0.72 | 2.57 | 3.12 | 2.22 | 4.93 | 27.16 | 39878 |
| 8.18 | 1.98 | 10.16 | | 0.67 | 1.59 | 2.26 | 2.74 | 2.16 | 4.18 | **25.70** | 42424 |
| *8.00* | *4.00* | *12.00* | | | | *2.47* | *3.00* | | *6.00* | *27.05* | |
| 8.81 | 0.69 | 9.50 | | 1.91 | 0.40 | 2.31 | 2.80 | 2.00 | 5.02 | 26.96 | 39879 |
| *8.00* | *4.00* | *12.00* | | | | *2.47* | *3.00* | | *6.00* | *27.05* | |
| 8.38 | 1.16 | 9.54 | | 1.49 | 0.35 | 1.84 | 2.23 | 1.36 | 11.20 | 31.76 | 39880 |
| 9.93 | 0.93 | 10.86 | | 0.49 | 0.95 | 1.44 | 1.75 | **0.96** | **6.02** | **25.51** | 42425 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *10.00* | *28.98* | |
| | | | | | | | | | | | 42238 |
| 8.21 | 1.12 | 9.33 | 0.62 | | 0.94 | 1.56 | 1.89 | **1.10** | **4.27** | **21.98** | 42426 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | | *6.00* | *23.38* | |
| | | | | | | | | | | | 42239 |
| 11.43 | 1.42 | 12.85 | | | | 0.94 | 1.14 | 0.72 | 1.11 | 19.63 | 42427 |
| *12.00* | *2.00* | *14.00* | | | | *0.82* | *1.00* | | *1.06* | *19.27* | |
| | | | | | | | | | | | 42240 |
| 10.15 | 1.29 | 11.44 | 0.59 | | 0.78 | 1.37 | 1.66 | 0.78 | 1.72 | 20.34 | 42428 |
| *10.00* | *2.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *20.98* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The Empire Guano Co., Nashville, Tenn.** | |
| 39968 | Special Grain Grower.... | Manufacturer ..... |
| 39969 | Blood, Bone and Potash.. | Manufacturer ..... |
| 39970 | Red Banner Special .... | Manufacturer ..... |
| 39971 | Red Banner Tobacco Special ..... | Manufacturer ..... |
| 39972 | High Grade Tobacco Grower ..... | Manufacturer ..... |
| 39973 | High Grade Tobacco Special ..... | Manufacturer ..... |
| 39974 | Climax Tobacco Grower .. | Manufacturer ..... |
| 39975 | XXX Tobacco Special... | Manufacturer ..... |
| 39977 | Wheat and Corn Grower. | Manufacturer ..... |
| 39979 | Special Corn Grower.... | Manufacturer ..... |
| 39987 | Climax Wheat Grower ... | Manufacturer ..... |
| 39988 | Favorite Manure ..... | Manufacturer ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic | Total. | | From Muriate. | From Sulphate | | |
| 11.64 | 2.74 | 14.38 | | 0.66 | 0.60 | 1.26 | 1.53 | 1.75 | | $21.23 | 39968 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | *1.00* | | *17.47* | |
| **6.75** | 4.19 | 10.94 | | | | 2.12 | 2.57 | 1.22 | 0.91 | 19.51 | 39969 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | *2.00* | | *18.98* | |
| **8.54** | 3.37 | 11.91 | | 0.70 | 1.35 | 2.05 | 2.49 | 2.30 | 0.62 | 21.82 | 39970 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | *2.00* | | *21.38* | |
| **6.74** | 4.19 | 10.93 | | | | 2.16 | 2.62 | 0.88 | 1.50 | 20.01 | 39971 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| **6.40** | 3.33 | 9.73 | | | | 2.02 | 2.45 | 0.90 | 3.26 | 20.89 | 39972 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *4.00* | *21.78* | |
| 8.30 | 4.08 | 12.38 | | | | 2.23 | 2.71 | | 8.99 | 30.19 | 39973 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *8.00* | *26.58* | |
| 10.02 | 3.15 | 13.17 | | | | 1.99 | 2.42 | 0.66 | 3.80 | 25.47 | 39974 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *4.00* | *24.18* | |
| 8.68 | 2.47 | 11.15 | | | | 1.93 | 2.34 | 0.98 | 8.74 | 29.64 | 39975 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *10.00* | *28.98* | |
| 11.57 | 4.46 | 16.03 | | 0.31 | 0.55 | 0.86 | 1.04 | 1.77 | | 20.44 | 39977 |
| *11.00* | *3.00* | *14.00* | | | | *0.41* | *0.50* | *1.00* | | *16.84* | |
| **9.43** | 4.84 | 14.27 | | 0.70 | 0.53 | 1.23 | 1.49 | 3.78 | | 21.35 | 39979 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | *3.00* | | *17.07* | |
| 10.30 | 2.78 | 13.08 | | | | 1.98 | 2.40 | 0.74 | 3.62 | 25.48 | 39987 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | *4.00* | | *23.38* | |
| 10.98 | 2.29 | 13.27 | | 0.62 | 0.61 | 1.23 | 1.49 | 3.72 | | 22.13 | 39988 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | *3.00* | | *19.47* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The Evansville Packing Co., Evansville, Ind.** | |
| 39728 | Tobacco Special ..... | Manufacturer ..... |
| 39730 | Half and Half Mixture... | Manufacturer ..... |
| 39731 | Special 10% Potash ..... | Manufacturer ..... |
| 39732 | Potato and Tobacco Grower ..... | Manufacturer ..... |
| 39733<br>42435 | Beef, Blood and Bone... | Manufacturer .....<br>Eldred Hardware Co., Princeton.... |
| 39734<br>42436 | Harvest King ..... | Manufacturer .....<br>J. H. Brown, Cloverport ..... |
| 39735 | Bone and Potash ..... | Manufacturer ..... |
| 39737 | Favorite Formula ..... | Manufacturer ..... |
| 39738 | Corn and Wheat Special.. | Manufacturer ..... |
| 42241<br>42438 | Guenther's Superior Tobacco Fertilizer ..... | Manufacturer .....<br>Owensboro Hdw. & Iron Company, Owensboro ..... |
| 42242<br>42439 | Guenther's Superior Corn Grower ..... | Manufacturer .....<br>Owensboro Hdw. & Iron Company, Owensboro. ..... |
| 42243<br>42440 | Guenther's 10% Potash.. | Manufacturer .....<br>Owensboro Hdw. & Iron Company, Owensboro ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 10.90 | 1.53 | 12.43 | 0.67 | | 3.32 | 3.99 | 4.84 | 0.98 | 3.28 | $32.59 | 39728 |
| *10.00* | *2.00* | *12.00* | | | | *3.29* | *4.00* | | *4.00* | *29.12* | |
| 10.55 | 4.41 | 14.96 | | | | 3.06 | 3.71 | 2.40 | | 27.53 | 39730 |
| *10.00* | *2.00* | *12.00* | | | | *2.47* | *3.00* | *2.00* | | *23.45* | |
| 5.38 | 0.65 | 6.03 | | | | 0.74 | 0.90 | 1.14 | 9.32 | 21.63 | 39731 |
| *5.00* | *1.00* | *6.00* | | | | *0.82* | *1.00* | | *10.00* | *21.27* | |
| 8.08 | 2.37 | 10.45 | | | | 1.64 | 1.99 | | 6.88 | 24.65 | 39732 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | | *5.00* | *22.18* | |
| 7.93 | 3.29 | 11.22 | | | | 1.55 | 1.88 | 0.58 | 2.47 | 19.81 | 39733 |
| **6.99** | 3.68 | 10.67 | | | | 1.57 | 1.91 | | 2.30 | 18.12 | 42435 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | | *2.00* | *18.58* | |
| 7.55 | 2.65 | 10.20 | | | | 1.28 | 1.55 | | 2.13 | 16.73 | 39734 |
| 7.66 | 2.26 | 9.92 | | | | 1.21 | 1.47 | 2.25 | | 16.58 | 42436 |
| *8.00* | *2.00* | *10.00* | | | | *1.00* | *1.21* | *2.00* | | *15.90* | |
| **6.17** | 2.38 | 8.55 | | | | 1.10 | 1.34 | 1.42 | | 13.62 | 39735 |
| *7.00* | *2.00* | *9.00* | | | | *0.82* | *1.00* | *1.00* | | *13.07* | |
| 9.47 | 3.00 | 12.47 | | | | 2.00 | 2.43 | | 7.60 | 28.68 | 39737 |
| *10.00* | *2.00* | *12.00* | | | | *1.65* | *2.00* | | *7.00* | *26.98* | |
| 12.63 | 3.44 | 16.07 | | | | 1.02 | 1.24 | 2.77 | | 22.88 | 39738 |
| *12.00* | *2.00* | *14.00* | | | | *0.82* | *1.00* | *3.00* | | *21.07* | |
| **8.65** | 4.65 | 13.30 | | | | 1.88 | 2.28 | | 7.87 | 28.26 | 42241 |
| 9.38 | 4.21 | 13.59 | | | | 1.90 | 2.31 | | **5.83** | 26.59 | 42438 |
| *10.00* | *2.00* | *12.00* | | | | *1.65* | *2.00* | | *7.00* | *26.98* | |
| 8.07 | 2.38 | 10.45 | | | | 1.15 | 1.40 | 1.60 | 1.74 | 18.35 | 42242 |
| 8.21 | 2.45 | 10.66 | | | | 1.22 | 1.48 | 1.14 | 0.58 | 16.94 | 42439 |
| *8.00* | *2.00* | *10.00* | | | | *1.00* | *1.21* | *2.00* | | *15.90* | |
| 6.60 | 1.62 | 8.22 | | | | 0.88 | 1.07 | 8.80 | 2.41 | 23.34 | 42243 |
| 5.27 | 1.53 | 6.80 | | | | 0.87 | 1.06 | 4.16 | 5.82 | 20.68 | 42440 |
| *5.00* | *1.00* | *6.00* | | | | *0.82* | *1.00* | | *10.00* | *21.27* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Federal Chemical Co., Louisville, Ky.** | |
| 39580 | Daybreak Standard Corn and Wheat Grower ..... | Manufacturer ..... |
| 39581 | Daybreak High Grade Fertilizer ..... | Manufacturer ..... |
| 39582 | Daybreak Favorite ..... | Manufacturer ..... |
| 39583 | Daybreak Special Tobacco Grower ..... | Manufacturer ..... |
| 42441 | | W. P. Walling, Campbellsville ..... |
| 39584 | Daybreak Vegetable Grower ..... | Manufacturer ..... |
| 42442 | | A. Hamblen, Corbin ..... |
| 39585 | Daybreak Standard Crop and Tobacco Grower .... | Manufacturer ..... |
| 42443 | | W. P. Walling, Campbellsville ..... |
| 39586 | Daybreak Special Manure. | Manufacturer ..... |
| 39587 | Grigsby's Special Wheat Grower ..... | Manufacturer ..... |
| 39588 | Daybreak Wheat and Corn Special ..... | Manufacturer ..... |
| 42444 | | A. H. Miller Implement Co., Elizabethtown ..... |
| 39589 | Daybreak Corn and Clover Grower ..... | Manufacturer ..... |
| 39590 | Daybreak Grain Grower.. | Manufacturer ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 10.61 | 6.51 | 17.12 | | | | 2.02 | 2.45 | | 2.59 | $25.51 | 39580 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| 12.50 | 3.02 | 15.52 | | | | 1.82 | 2.21 | | 2.70 | 25.82 | 39581 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 13.26 | 3.06 | 16.32 | | | | 1.41 | 1.71 | | 3.86 | 26.70 | 39582 |
| *11.00* | *4.00* | *15.00* | | | | *0.82* | *1.00* | | *3.00* | *21.27* | |
| 10.26 | 4.90 | 15.16 | | | | 1.60 | 1.94 | | 7.04 | 28.32 | 39583 |
| 8.72 | 2.52 | 11.24 | | | | 1.23 | 1.50 | 1.14 | 4.79 | 22.67 | 42441 |
| *8.00* | *4.00* | *12.00* | | | | *1.23* | *1.50* | | *6.00* | *22.71* | |
| 10.10 | 4.64 | 14.74 | | | | 2.05 | 2.49 | | 6.25 | 28.66 | 39584 |
| 8.36 | 2.88 | 11.24 | 0.24 | | 1.34 | 1.58 | 1.92 | 1.28 | 4.10 | 22.91 | 42442 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *5.00* | *22.98* | |
| 10.19 | 7.02 | 17.21 | | | | 1.37 | 1.66 | | 4.80 | 25.60 | 39585 |
| 8.53 | 3.61 | 12.14 | | | | 0.88 | 1.07 | 3.90 | | 18.66 | 42443 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *4.00* | *18.87* | |
| 11.80 | 5.46 | 17.26 | | | | 1.41 | 1.71 | | 2.70 | 24.52 | 38586 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | | *2.00* | *18.87* | |
| 12.68 | 4.92 | 17.60 | | | | 1.24 | 1.51 | | 2.77 | 24.85 | 39587 |
| *10.00* | *2.00* | *12.00* | | | | *0.82* | *1.00* | | *2.00* | *18.07* | |
| 13.00 | 6.64 | 19.64 | | | | 0.57 | 0.69 | | 1.10 | 21.58 | 39588 |
| **10.32** | 0.92 | 11.24 | | | | 0.56 | 0.68 | 1.43 | | **16.14** | 42444 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *1.00* | *17.44* | |
| 11.69 | 7.33 | 19.02 | | | | 1.25 | 1.52 | | 2.40 | 24.22 | 39589 |
| *9.00* | *4.00* | *13.00* | | | | *0.82* | *1.00* | | *1.00* | *16.47* | |
| 11.96 | 9.28 | 21.24 | | | | 0.59 | 0.72 | | 2.32 | 22.91 | 39590 |
| *9.00* | *4.00* | *13.00* | | | | *0.41* | *0.50* | | *1.50* | *15.64* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Federal Chemical Co.** | |
| 39591 | Daybreak Potato and Tobacco Grower | Manufacturer |
| 39604 | Daybreak Beef, Blood and Bone | Manufacturer |
| 39605 | Daybreak Champion Mixture | Manufacturer |
| 42446 | | A. Hamblen, Corbin |
| 39606 | Daybreak High Grade Truck and Tobacco Grower | Manufacturer |
| 39607 | Daybreak Red Rooster Grain and Tobacco Grower | Manufacturer |
| 39608 | Daybreak Bone and Tobacco Special | Manufacturer |
| 39609 | Daybreak Royal Tobacco Mixture | Manufacturer |
| 42447 | | A. Hamblen, Corbin |
| 42329 | Daybreak Special | Manufacturer |
| | **Fox Chemical Co., Branch Federal Chemical Co., Louisville, Ky.** | |
| 39610 | Fox Wheat and Corn Manure | Manufacturer |
| 42448 | | Eaton & McGuire, Clay City |
| 39611 | Fox Tobacco Grower | Manufacturer |
| 42449 | | W. E. Matin, Pleasureville |
| 39612 | Fox Wheat and Corn Grower | Manufacturer |
| 42450 | | J. H. Lennon, Hardinsburg |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | | POTASH | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate | Estimated Value Per Ton. | Station Number. |
| 9.88 | 3.23 | 13.11 | | | | 1.87 | 2.27 | | 8.43 | $29.82 | 39591 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *7.50* | *25.98* | |
| 12.51 | 3.24 | 15.75 | | | | 1.86 | 2.26 | | 2.74 | 26.11 | 39604 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.87* | |
| 13.07 | 4.81 | 17.88 | | | | 0.69 | 0.84 | | 4.74 | 25.71 | 39605 |
| 11.91 | 2.19 | 14.10 | | | | 0.50 | 0.61 | 3.65 | | 20.57 | 42446 |
| *11.00* | *4.00* | *15.00* | | | | *0.40* | *0.50* | | *3.50* | *20.44* | |
| 9.77 | 2.63 | 12.40 | 0.68 | | 1.97 | 2.65 | 3.22 | | 7.14 | 30.62 | 39606 |
| *8.00* | *4.00* | *12.00* | | | | *2.47* | *.00* | | *6.00* | *27.05* | |
| 10.75 | 6.96 | 17.71 | | | | 1.35 | 1.64 | 0.86 | 2.29 | 24.02 | 39607 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *2.00* | *16.47* | |
| 11.78 | 6.73 | 18.51 | | | | 0.60 | 0.73 | | 3.30 | 22.89 | 39608 |
| *10.00* | *4.00* | *14.00* | | | | *0.21* | *0.25* | | *2.00* | *16.74* | |
| 11.58 | 5.06 | 16.64 | | | | 0.57 | 0.69 | 0.88 | 5.32 | 25.18 | 39609 |
| 11.21 | 3.26 | 14.47 | | | | 0.22 | 0.27 | 3.94 | | 19.46 | 42447 |
| *10.00* | *4.00* | *14.00* | | | | *0.21* | *0.25* | | *4.00* | *19.14* | |
| 11.80 | 5.39 | 17.19 | | | | 0.89 | 1.08 | 0.80 | 4.64 | 25.81 | 42329 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *5.00* | *22.24* | |
| 9.38 | 7.37 | 16.75 | | | | 2.05 | 2.49 | 0 54 | 1.99 | 24.32 | 39610 |
| 8.70 | 2.77 | 11.47 | 0.37 | | 1.64 | 2.01 | 2.44 | 2.20 | 1.03 | 22.03 | 42448 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| 10.05 | 6.81 | 16.86 | | | | 1.91 | 2.32 | 0.74 | 1.94 | 24.54 | 39611 |
| 8.55 | 3.05 | 11.60 | 0.24 | | 1.52 | 1.76 | 2.14 | 2.51 | | 20.15 | 42449 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| 12.49 | 3.24 | 15.73 | | | | 1.73 | 2.10 | 0.68 | 1.10 | 24.35 | 39612 |
| 9.78 | 0.56 | 10.34 | 0.50 | | 1.40 | 1.90 | 2.31 | 2.43 | | 21.04 | 42450 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Fox Chemical Co.** | |
| 39613<br>42451 | Fox Formula ..... | Manufacturer .....<br>T. Z. Leachman, Greensburg ..... |
| 39614<br>42452 | Fox Special Tobacco Grower ..... | Manufacturer .....<br>T. Z. Leachman, Greensburg ..... |
| 39615<br>42453 | Fox Vegetable Grower... | Manufacturer .....<br>Sparks & Brown, London ..... |
| 39616<br>42454 | Fox Crop and Tobacco Grower ..... | Manufacturer .....<br>J. F. Hardyman, Burtonville ..... |
| 39617 | Fox Early Harvest ..... | Manufacturer ..... |
| 39618<br>42455 | Fox Ten One Ten ..... | Manufacturer .....<br>A. A. Clay, Indian Fields ..... |
| 39619 | Fox High Grade Tobacco Grower ..... | Manufacturer ..... |
| 39620 | Fox Wheat and Grain Special ..... | Manufacturer ..... |
| 39621<br>42456 | Fox Bone, Blood and Potash ..... | Manufacturer .....<br>T. Z. Leachman, Greensburg ..... |
| 39622 | Fox Grain Grower ..... | Manufacturer ..... |
| 39623 | Fox Grain Special ..... | Manufacturer ..... |
| 39624<br>42457 | Fox Potato and Tobacco Grower ..... | Manufacturer .....<br>W. E. Matin, Pleasureville ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 13.72 | 2.78 | 16.50 | | | | 1.84 | 2.23 | | 4.41 | $29.30 | 39613 |
| 11.32 | 3.29 | 14.61 | 0.31 | | 0.65 | 0.96 | 1.17 | 3.10 | | 21.36 | 42451 |
| *11.00* | *4.00* | *15.00* | | | | *0.82* | *1.00* | | *3.00* | *21.27* | |
| 10.29 | 5.01 | 15.30 | | | | 2.10 | 2.55 | | 6.19 | 29.13 | 39614 |
| 8.34 | 5.15 | 13.49 | 0.21 | | 1.30 | 1.51 | 1.83 | 0.68 | 5.46 | 24.59 | 42452 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *5.00* | *22.98* | |
| 9.46 | 5.04 | 14.50 | | | | 2.19 | 2.66 | | 6.02 | 28.26 | 39615 |
| **7.24** | 1.48 | 8.72 | 0.57 | | 1.49 | 2.06 | 2.50 | 1.12 | 5.08 | 23.71 | 42453 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *5.00* | *22.98* | |
| 10.41 | 7.52 | 17.93 | | | | 1.44 | 1.75 | | 4.86 | 26.37 | 39616 |
| 8.82 | 3.93 | 12.75 | | | | 0.90 | 1.09 | 4.22 | | 19.52 | 42454 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *4.00* | *18.87* | |
| 12.38 | 5.25 | 17.63 | | | | 1.40 | 1.70 | | 2.63 | 25.02 | 39617 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | | *2.00* | *18.87* | |
| 11.45 | 0.62 | 12.07 | 0.86 | | 1.02 | 1.88 | 2.28 | | 10.76 | 33.48 | 39618 |
| 10.14 | 1.33 | 11.47 | | | | 1.02 | 1.24 | | 10.89 | 29.34 | 42455 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | | *10.00* | *28.47* | |
| 9.81 | 2.05 | 11.86 | 1.87 | | 1.91 | 3.78 | 4.59 | | 5.42 | 32.32 | 39619 |
| *8.00* | *4.00* | *12.00* | | | | *3.29* | *4.00* | | *4.00* | *27.52* | |
| 13.54 | 2.88 | 16.42 | | | | 1.37 | 1.66 | | 2.07 | 24.68 | 39620 |
| *12.00* | *4.00* | *16.00* | | | | *0.82* | *1.00* | | *1.00* | *20.07* | |
| 13.30 | 6.03 | 19.33 | | | | 0.68 | 0.83 | | 1.14 | 22.12 | 39621 |
| 11.18 | 6.67 | 17.85 | | | | 0.55 | 0.67 | 1.13 | | 19.15 | 42456 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *1.00* | *17.44* | |
| 11.96 | 7.22 | 19.18 | | | | 1.30 | 1.58 | | 2.53 | 24.83 | 39622 |
| *9.00* | *4.00* | *13.00* | | | | *0.82* | *1.00* | | *1.00* | *16.47* | |
| 11.59 | 8.86 | 20.45 | | | | 0.60 | 0.73 | | 2.43 | 22.47 | 39623 |
| *9.00* | *4.00* | *13.00* | | | | *0.41* | *0.50* | | *1.50* | *15.64* | |
| 9.09 | 3.60 | 12.69 | | | | 2.17 | 2.63 | | 8.56 | 30.21 | 39624 |
| 9.03 | 2.78 | 11.81 | 0.33 | | 1.31 | 1.64 | 1.99 | 1.74 | 5.55 | 26.09 | 42457 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *7.50* | *25.98* | |

PART I, TABLE I.

| Station Number | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Fox Chemical Co.** | |
| 39638<br>42461 | Fox Ideal Fertilizer .... | Manufacturer .....<br>W. G. Baker, Mt. Vernon ..... |
| 39639 | Red Fox Grain and Tobacco Special ..... | Manufacturer ..... |
| 39640 | Fox Burley Tobacco Special ..... | Manufacturer ..... |
| 39641<br>42462 | Fox Tobacco and Potash Mixture ..... | Manufacturer .....<br>J. W. Proctor, Brodhead ..... |
| | **Globe Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.** | |
| 39642<br>42465 | Eagle Wheat and Corn Grower ..... | Manufacturer .....<br>M. F. Powers, Monticello ..... |
| 39643<br>42466 | Big Four Tobacco Grower | Manufacturer .....<br>Duke & Farris, Cave City ..... |
| 39644 | Globe Wheat Grower ... | Manufacturer ..... |
| 39645<br>42467 | Braden Formula ..... | Manufacturer .....<br>R. H. Chrisman, Berea ..... |
| 39646<br>42468 | Kentucky Standard Tobacco Grower ..... | Manufacturer .....<br>Duke & Farris, Cave City ..... |
| 39647<br>42469 | Globe Soluble Vegetable Manure ..... | Manufacturer .....<br>Razor Hardware Co., Salt Lick .... |
| 39648<br>42470 | Universal Crop and Tobacco Grower ..... | Manufacturer .....<br>J. W. Cloyd, Campbellsville ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 13.71 | 5.21 | 18.92 | | | | 0.54 | 0.66 | | 3.34 | $24.97 | 39638 |
| 11.39 | 0.82 | 12.21 | | | | 0.43 | 0.52 | 2.97 | | 18.48 | 42461 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *2.50* | *19.24* | |
| 10.01 | 7.46 | 17.47 | | | | 1.30 | 1.58 | | 3.22 | 23.40 | 39639 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *2.00* | *16.47* | |
| 12.57 | 6.41 | 18.98 | | | | 0.58 | 0.70 | | 3.08 | 23.37 | 39640 |
| *10.00* | *4.00* | *14.00* | | | | *0.21* | *0.25* | | *2.00* | *16.74* | |
| 11.45 | 5.09 | 16.54 | | | | 0.58 | 0.70 | | 6.25 | 25.31 | 39641 |
| 10.78 | 1.49 | 12.27 | | | | 0.48 | 0.58 | 3.91 | | 19.13 | 42462 |
| *10.00* | *4.00* | *14.00* | | | | *0.21* | *0.25* | | *4.00* | *19.14* | |
| 10.40 | 6.81 | 17.21 | | | | 1.97 | 2.39 | | 2.63 | 25.26 | 39642 |
| 8.19 | 4.14 | 12.33 | 0.21 | | 1.32 | 1.53 | 1.86 | 2.26 | 0.64 | 19.88 | 42465 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| 10.21 | 6.48 | 16.69 | | | | 2.09 | 2.54 | | 2.64 | 25.33 | 39643 |
| 7.98 | 1.34 | 9.32 | 0.37 | | 1.23 | 1.60 | 1.94 | 1.24 | 1.03 | **18.20** | 42466 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| 12.46 | 3.06 | 15.52 | | | | 2.03 | 2.46 | | 2.72 | 26.54 | 39644 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 13.31 | 2.70 | 16.01 | | | | 1.32 | 1.60 | | 3.70 | 26.11 | 39645 |
| 12.01 | 1.30 | 13.31 | | | | 0.90 | 1.09 | 3.30 | | 21.38 | 42467 |
| *11.00* | *4.00* | *15.00* | | | | *0.82* | *1.00* | | *3.00* | *21.27* | |
| 10.19 | 4.67 | 14.86 | | | | 1.99 | 2.42 | | 5.87 | 28.11 | 39646 |
| 8.62 | 1.45 | 10.07 | 0.20 | | 1.28 | 1.48 | 1.80 | 0.92 | 4.29 | 22.17 | 42468 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *5.00* | *22.98* | |
| 10.37 | 4.64 | 15.01 | | | | 1.85 | 2.25 | | 5.91 | 27.87 | 39647 |
| 7.53 | 3.09 | 10.62 | 0.26 | | 1.52 | 1.78 | 2.16 | 1.38 | 5.79 | 24.84 | 42469 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *5.00* | *22.98* | |
| 9.72 | 7.80 | 17.52 | | | | 1.33 | 1.61 | | 4.89 | 25.31 | 39648 |
| 9.62 | 1.15 | 10.77 | | | | 0.90 | 1.09 | 0.74 | 4.10 | 20.81 | 42470 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *4.00* | *18.87* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Globe Fertilizer Co.** | |
| 39649 | Progress Corn and Wheat Grower | Manufacturer |
| 42471 | | R. H. Chrisman, Berea |
| 39650 | Globe Blood, Bone and Tobacco Mixture | Manufacturer |
| 42472 | | E. G. Fristoe & Co., Mayfield |
| 39651 | Globe Special Potato Grower | Manufacturer |
| 39652 | Globe High Grade Tobacco Grower | Manufacturer |
| 42473 | | R. B. Hutchcraft, Paris |
| 39653 | Globe Potato Grower | Manufacturer |
| 39654 | Globe Wheat and Grain Special | Manufacturer |
| 39655 | Globe Bone and Potash | Manufacturer |
| 42474 | | J. W. Cloyd, Campbellsville |
| 39656 | Globe Grain and Grass Grower | Manufacturer |
| 39657 | Globe Bone Dust | Manufacturer |
| 39658 | Globe Grain Grower | Manufacturer |
| 39659 | Globe Potato and Tobacco Grower | Manufacturer |
| 42475 | | J. W. Cloyd, Campbellsville |
| 39660 | Globe Special Tobacco Grower | Manufacturer |
| 42476 | | J. A. Allen, Bloomfield |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 12.08 | 5.58 | 17.66 | | | | 1.33 | 1.61 | | 2.61 | $24.52 | 39649 |
| 11.45 | 3.20 | 14.65 | | | | 0.86 | 1.04 | 1.83 | | 19.86 | 42471 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | | *2.00* | *18.87* | |
| 9.07 | 9.34 | 18.41 | | | | 1.03 | 1.25 | | 3.45 | 22.37 | 39650 |
| 7.95 | 2.87 | 10.82 | | | | 0.40 | 0.49 | | 3.60 | **15.33** | 42472 |
| *8.00* | *4.00* | *12.00* | | | | *0.41* | *0.50* | | *4.00* | *17.44* | |
| 10.42 | 2.14 | 12.56 | 1.10 | | 1.79 | 2.89 | 3.51 | | 7.27 | 32.20 | 39651 |
| *8.00* | *4.00* | *12.00* | | | | *2.47* | *3.00* | | *6.00* | *27.05* | |
| 10.16 | 1.61 | 11.77 | 1.77 | | 1.85 | 3.62 | 4.39 | | 5.52 | 32.12 | 39652 |
| 8.30 | 1.06 | 9.36 | 0.73 | | 2.35 | 3.08 | 3.74 | | 4.68 | 26.78 | 42473 |
| *8.00* | *4.00* | *12.00* | | | | *3.29* | *4.00* | | *4.00* | *27.52* | |
| 9.78 | 1.71 | 11.49 | 1.96 | | 1.98 | 3.94 | 4.78 | | 5.49 | 32.80 | 39653 |
| *8.00* | *4.00* | *12.00* | | | | *3.29* | *4.00* | | *4.00* | *27.52* | |
| 13.89 | 2.74 | 16.63 | | | | 1.38 | 1.68 | | 2.02 | 25.02 | 39654 |
| *12.00* | *4.00* | *16.00* | | | | *0.82* | *1.00* | | *1.00* | *20.07* | |
| 13.21 | 6.37 | 19.58 | | | | 0.61 | 0.74 | | 1.09 | 21.85 | 39655 |
| 11.60 | 1.20 | 12.80 | | | | 0.65 | 0.79 | 1.69 | | 17.77 | 42474 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *1.00* | *17.44* | |
| 13.12 | 6.59 | 19.71 | | | | 0.61 | 0.74 | | 1.02 | 21.74 | 39656 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *1.00* | *17.44* | |
| 11.15 | 6.92 | 18.07 | | | | 1.28 | 1.55 | | 2.48 | 23.61 | 39657 |
| *9.00* | *4.00* | *13.00* | | | | *0.82* | *1.00* | | *1.00* | *16.47* | |
| 11.79 | 8.80 | 20.59 | | | | 0.54 | 0.66 | | 2.41 | 22.45 | 39658 |
| *9.00* | *4.00* | *13.00* | | | | *0.41* | *0.50* | | *1.50* | *15.64* | |
| 10.12 | 2.75 | 12.87 | | | | 2.04 | 2.48 | | 9.02 | 31.20 | 39659 |
| 7.98 | 1.07 | 9.05 | 0.34 | | 0.95 | **1.29** | 1.57 | 1.34 | 6.12 | **23.21** | 42475 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *7.50* | *25.98* | |
| 9.80 | 0.77 | 10.57 | 1.69 | | 1.16 | 2.85 | 3.46 | | 10.98 | 35.23 | 39660 |
| 8.12 | 1.08 | 9.20 | 1.19 | | 1.16 | 2.35 | 2.85 | | 11.11 | 31.73 | 42476 |
| *8.00* | *4.00* | *12.00* | | | | *2.47* | *3.00* | | *10.00* | *31.85* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Globe Fertilizer Co.** | |
| 39663 | Globe Truck Grower ... | Manufacturer ..... |
| 39675 | Globe High Grade Special | Manufacturer ..... |
| 39676 | Globe Good Luck Crop Grower ..... | Manufacturer ..... |
| 39677 | Globe Gold Medal Mixture | Manufacturer ..... |
| 39678 | Globe Tobacco Dust Special ..... | Manufacturer ..... |
| 42481 | | Morris & Burton, Columbia ..... |
| 39679 | Globe Ground Tobacco Compound ..... | Manufacturer ..... |
| 42432 | Globe Tip Top Tobacco Grower ..... | Manufacturer ..... |
| | **Grayson County Fertilizer Co., Leitchfield, Ky.** | |
| 39934 | Grain Grower ..... | Manufacturer ..... |
| 42482 | | Manufacturers Warehouse ..... |
| 39935 | Tobacco Grower ..... | Manufacturer ..... |
| 42483 | | Manufacturers Warehouse ..... |
| | **Grigsby & Co., Bardstown, Ky.** | |
| 42365 | Grigsby's Special Wheat Grower ..... | Manufacturer ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | | POTASH | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate | Estimated Value Per Ton. | Station Number. |
| 10.74 | 6.09 | 16.83 | | | | 0.61 | 0.74 | | 9.60 | $28.99 | 39663 |
| *8.00* | *4.00* | *12.00* | | | | *0.41* | *0.50* | | *8.00* | *22.24* | |
| 13.36 | 3.88 | 17.24 | | | | 0.62 | 0.75 | | 5.70 | 26.59 | 39675 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *5.00* | *22.24* | |
| 13.31 | 5.38 | 18.69 | | | | 0.61 | 0.74 | | 3.32 | 24.24 | 39676 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *2.50* | *19.24* | |
| 9.49 | 7.85 | 17.34 | | | | 1.28 | 1.55 | | 3.15 | 22.79 | 39677 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *2.00* | *16.47* | |
| 11.87 | 6.83 | 18.70 | | | | 0.55 | 0.67 | | 3.13 | 22.66 | 39678 |
| 10.30 | 3.94 | 14.24 | | | | 0.40 | 0.49 | 2.26 | | 17.60 | 42481 |
| *10.00* | *4.00* | *14.00* | | | | *0.21* | *0.25* | | *2.00* | *16.74* | |
| 11.91 | 4.95 | 16.86 | | | | 0.57 | 0.69 | 0.92 | 5.28 | 25.53 | 39679 |
| *10.00* | *4.00* | *14.00* | | | | *0.21* | *0.25* | | *4.00* | *19.14* | |
| 12.44 | 2.91 | 15.35 | | | | 2.00 | 2.43 | | 2.74 | 26.38 | 42432 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 7.42 | 0.97 | 8.39 | 0.85 | | | **0.85** | 0.98 | 1.02 | 5.44 | 19.82 | 39934 |
| **6.68** | 1.17 | 7.85 | | | | **0.04** | 0.05 | | **1.40** | **10.31** | 42482 |
| *8.00* | | | | | | *1.30* | *1.58* | | *5.00* | *20.15* | |
| **5.25** | 0.55 | 5.80 | 0.75 | | | **0.75** | 0.91 | 2.30 | 10.00 | 23.45 | 39935 |
| **7.37** | 1.16 | 8.53 | | | | **0.07** | 0.08 | | **1.09** | **10.82** | 42483 |
| 8.00 | | | | | | *1.30* | *1.58* | | *8.00* | *23.75* | |
| 10.31 | 1.98 | 12.29 | 0.63 | | 0.37 | 1.00 | 1.21 | | 2.41 | 19.55 | 42365 |
| *10.00* | *2.00* | *12.00* | | | | *0.82* | *1.00* | | *2.00* | *18.03* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The Groves Co., Cincinnati, Ohio.** | |
| 39924 | Complete Grain Grower.. | Manufacturer |
| 39925 | Corn and Tobacco Grower | Manufacturer |
| 42485 | | Haselden Bros., Lancaster |
| 39926 | Favorite Fertilizer | Manufacturer |
| 42486 | | Haselden Bros., Lancaster |
| 39927 | 10% Potash Fertilizer | Manufacturer |
| 39928 | Special Truck Manure | Manufacturer |
| 42487 | | R. J. McDaniel, Adairville |
| 39933 | Square Brand Special | Manufacturer |
| | **Hirsh, Stein & Co., Chicago Ill.** | |
| 42156 | Calumet Brand Tobacco Fertilizer | Manufacturer |
| 42157 | Calumet Brand Bone, Blood and Potash | Manufacturer |
| 42158 | Calumet Brand High Grd. Bone, Blood and Potash. | Manufacturer |
| 42159 | Calumet Brand Bone Blk. Grain Grower | Manufacturer |
| 42166 | Calumet Brand Grain Grower | Manufacturer |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| **6.18** | 2.69 | 8.87 | | | | 0.95 | 1.15 | 1.95 | | **$13.78** | 39924 |
| *8.00* | *2.00* | *10.00* | | | | *0.82* | *1.00* | *2.00* | | *15.27* | |
| 7.91 | 2.11 | 10.02 | | | | 0.98 | 1.19 | 4.42 | | 18.18 | 39925 |
| 7.99 | 1.85 | 9.84 | | | | 0.90 | 1.09 | 4.22 | | 17.70 | 42485 |
| *8.00* | *2.00* | *10.00* | | | | *0.82* | *1.00* | *4.00* | | *17.27* | |
| 7.94 | 1.90 | 9.84 | | | | 1.66 | 2.02 | 2.08 | | 18.18 | 39926 |
| 8.24 | 1.38 | 9.62 | | 0.52 | 1.20 | 1.72 | 2.09 | 2.47 | | 18.93 | 42486 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |
| 4.70 | 1.10 | 5.80 | 0.22 | | 0.65 | 0.87 | 1.06 | 10.11 | | 19.24 | 39927 |
| *5.00* | *2.00* | *7.00* | | | | *0.82* | *1.00* | *10.00* | | *19.67* | |
| 8.56 | 0.78 | 9.34 | 0.34 | | 1.20 | 1.54 | 1.91 | 0.66 | 7.86 | 26.06 | 39928 |
| 8.62 | 1.26 | 9.88 | 0.51 | | 1.12 | 1.63 | 1.98 | 1.10 | 6.78 | 25.79 | 42487 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | | *8.00* | *25.78* | |
| 9.27 | 1.44 | 10.71 | 1.34 | 0.49 | 1.49 | 3.32 | 4.03 | 5.98 | | 29.30 | 39933 |
| *8.00* | *2.00* | *10.00* | | | | *3.29* | *4.00* | *6.00* | | *27.92* | |
| 8.00 | 1.64 | 9.64 | | | | 0.85 | 1.03 | 2.71 | | 15.95 | 42156 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *2.00* | | *14.87* | |
| 11.45 | 0.73 | 12.18 | | | | 0.97 | 1.18 | 2.77 | | 20.20 | 42157 |
| *10.00* | *1.00* | *11.00* | | | | *0.82* | *1.00* | *2.00* | | *17.27* | |
| 10.99 | 0.89 | 11.88 | | | | 1.00 | 1.21 | 6.18 | | 23.23 | 42158 |
| *10.00* | *1.00* | *11.00* | | | | *0.82* | *1.00* | *5.00* | | *27.27* | |
| 8.52 | 2.33 | 10.85 | | 0.62 | 1.44 | 2.06 | 2.50 | **2.23** | | **20.59** | 42159 |
| *8.00* | *1.00* | *9.00* | | | | *2.06* | *2.50* | *6.00* | | *23.21* | |
| 8.07 | 1.12 | 9.19 | | | | 1.78 | 2.16 | 2.08 | | 18.44 | 42166 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | *2.00* | | *17.78* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Hirsh, Stein & Co.** | |
| 42167 | Calumet Brand Wheat Corn and Oats Special .. | Manufacturer ..... |
| 42492 | | Pearson & Breedlove, Franklin .... |
| 42168 | Calumet Brand Kentucky Tobacco Grower ..... | Manufacturer ..... |
| 42493 | | Bricken & Merkley, Lebanon ..... |
| 42169 | Calumet Brand Special Potato, Tobacco and Onion Grower ..... | Manufacturer ..... |
| 42494 | | Pearson & Breedlove, Franklin .... |
| 42170 | Calumet Brand Special 10% Potash Manure ... | Manufacturer ..... |
| 42495 | | Pearson & Breedlove, Franklin .... |
| 42171 | Calumet Brand Corn and Wheat Grower ..... | Manufacturer ..... |
| 42172 | Calumet Brand High Grd. Garden and Vegetable Grower ..... | Manufacturer ..... |
| 42173 | Calumet Brand Bone Phosphate and Potash... | Manufacturer ..... |
| 42496 | | Grayson County Supply Company, Leitchfield ..... |
| 42174 | Calumet Brand High Grd. Bone Phosphate and Potash ..... | Manufacturer ..... |
| | **Hopkins Fertilizer Co., New Albany, Ind.** | |
| 39905 | Old Time Half and Half. | Manufacturer ..... |
| 42498 | | C. R. Perry, Campbellsville ..... |
| 39906 | Old Time Ky. and Indiana Special ..... | Manufacturer ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | | POTASH | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate | Estimated Value Per Ton. | Station Number. |
| 9.26 | 0.84 | 10.10 | | 0.27 | 0.69 | 0.96 | 1.17 | 4.89 | | $19.70 | 42167 |
| 8.26 | 0.94 | 9.20 | | | | 0.72 | 0.87 | 4.54 | | 17.35 | 42492 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *4.00* | | *16.87* | |
| 8.75 | 0.82 | 9.57 | | 1.22 | 0.62 | 1.84 | 2.23 | 0.84 | 4.82 | 23.89 | 42168 |
| 8.90 | 1.15 | 10.05 | | 1.08 | 0.59 | 1.67 | 2.03 | 0.93 | 3.80 | 22.48 | 42493 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | | *5.00* | *21.78* | |
| 8.64 | 0.92 | 9.56 | | | | 1.75 | 2.12 | 1.00 | 9 25 | 28.97 | 42169 |
| 8.36 | 1.40 | 9.76 | | | | 1.64 | 1.99 | 1.20 | 8.21 | 27.38 | 42494 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | | *10.00* | *27.78* | |
| 6.22 | 0.87 | 7.09 | | 0.74 | 0.24 | 0.98 | 1.19 | 9.59 | | 20.83 | 42170 |
| 5.50 | 0.59 | 6.09 | | | | 0.76 | 0.92 | 9.59 | | 19.09 | 42495 |
| *5.00* | *1.00* | *6.00* | | | | *0.82* | *1.00* | *10.00* | | *19.27* | |
| 9.50 | 0.57 | 10.07 | | | | 0.99 | 1.20 | 3.29 | | 18.39 | 42171 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *3.00* | | *15.87* | |
| 9.37 | 1.49 | 10.86 | | 0.79 | 1.22 | 2.01 | 2.44 | 6.74 | | 25.62 | 42172 |
| *8.00* | *1.00* | *9.00* | | | | *2.06* | *2.50* | *6.00* | | *23.21* | |
| 11.45 | 0.45 | 11.90 | | | | 0.50 | 0.61 | 3.19 | | 18.86 | 42173 |
| 11.49 | 1.16 | 12.65 | | | | 0.45 | 0.55 | 2.35 | | 18.18 | 42496 |
| *10.00* | *1.00* | *11.00* | | | | *0.41* | *0.50* | *2.00* | | *15.84* | |
| 10.71 | 0.64 | 11.35 | | | | 0.46 | 0.56 | 5.31 | | 20.03 | 42174 |
| *10.00* | *1.00* | *11.00* | | | | *0.41* | *0.50* | *5.00* | | *18.84* | |
| 7.82 | 5.44 | 13.26 | | | | 2.11 | 2.56 | 0.64 | 2.60 | 22.71 | 39905 |
| 8.57 | 4.92 | 13.49 | | | | 2.14 | 2.60 | 1.94 | | 21.68 | 42498 |
| *8.00* | *5.00* | *13.00* | | | | *2.06* | *2.50* | *2.00* | | *20.81* | |
| 8.69 | 0.55 | 9.24 | 1.89 | 0.58 | | 2.47 | 3.00 | | 10.88 | 32.36 | 39906 |
| *8.00* | *2.00* | *10.00* | | | | *2.47* | *3.00* | | *8.00* | *28.65* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Hopkins Fertilizer Co.** | |
| 39907 | Old Time Potato and Tobacco Grower ..... | Manufacturer ..... |
| 42249 | | C. A. Herr, St. Matthews ..... |
| 42250 | | Meisner Bros., St. Matthews ..... |
| 42251 | | W. H. Herr, St. Matthews ..... |
| 42292 | | St. Matthews Produce Exchange ... |
| 42293 | | Meisner Bros., St. Matthews ..... |
| 42294 | | Meisner Bros., St. Matthews ..... |
| 42295 | | W. H. Herr, St. Matthews ..... |
| 42296 | | W. H. Herr, St. Matthews ..... |
| 42499 | | C. R. Perry, Campbellsville ..... |
| 39908 | Old time Special Tobacco Grower ... ..... | Manufacturer ..... |
| 42500 | | F. A. Yost Co., Hopkinsville ..... |
| 39909 | Old Time Tobacco Grower | Manufacturer ..... |
| 42501 | | C. R. Perry, Campbellsville ..... |
| 39910 | Old Time Truck Grower. | Manufacturer ..... |
| 39911 | Old Time Blood and Bone | Manufacturer ..... |
| 39912 | Old Time Harvest King.. | Manufacturer ..... |
| 39913 | Old Time Ammoniated Potash Mixture ..... | Manufacturer ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 8.74 | 0.59 | 9.33 | 1.79 | 0.42 | 0.22 | 2.43 | 2.95 | | 8.96 | $29.99 | 39907 |
| **5.28** | 3.89 | 9.17 | 0.53 | 0.35 | 1.32 | 2.20 | 2.67 | 3.26 | 3.04 | **22.51** | 42249 |
| **4.65** | 4.37 | 9.02 | 0.60 | 0.45 | 1.20 | 2.25 | 2.73 | 0.90 | 4.98 | **22.09** | 42250 |
| **6.08** | 3.51 | 9.59 | 0.60 | 0.35 | 1.20 | **2.15** | 2.61 | 1.22 | 5.12 | **23.59** | 42251 |
| 8.52 | 1.12 | 9.64 | 0.80 | | 1.31 | **2.11** | 2.56 | 2.06 | 3.89 | **24.79** | 42292 |
| **6.11** | 3.16 | 9.27 | 0.57 | 0.38 | 1.13 | **2.08** | 2.53 | 0.66 | 6.19 | **23.96** | 42293 |
| **6.09** | 2.97 | 9.06 | 0.56 | 0.41 | 1.16 | **2.13** | 2.59 | 0.68 | 5.84 | **23.65** | 42294 |
| **5.44** | 3.85 | 9.29 | 0.49 | 0.41 | 1.17 | **2.07** | 2.51 | 0.54 | 5.75 | **22.66** | 42295 |
| **5.44** | 3.24 | 8.68 | 0.54 | 0.41 | 1.11 | **2.06** | 2.50 | 0.62 | 5.62 | **22.40** | 42296 |
| 8.44 | 0.80 | 9.24 | 1.41 | | 0.81 | 2.22 | 2.70 | | 5.98 | 25.40 | 42499 |
| *8.00* | *2.00* | *10.00* | | | | *2.47* | *3.00* | | *6.00* | *26.25* | |
| 6.52 | 0.40 | 6.92 | 1.23 | 0.48 | 0.21 | 1.92 | 2.33 | | 8.31 | 24.57 | 39908 |
| 6.20 | 2.84 | 9.04 | | 0.97 | 0.74 | 1.71 | 2.08 | 9.00 | | 23.57 | 42500 |
| *6.00* | *2.00* | *8.00* | | | | *1.65* | *2.00* | | *8.00* | *23.38* | |
| 9.05 | 0.59 | 9.64 | 0.89 | 0.45 | 0.26 | 1.60 | 1.94 | | 5.63 | 23.46 | 39909 |
| 8.19 | 0.57 | 8.76 | 0.71 | | 0.75 | 1.46 | 1.77 | 1.66 | 2.29 | **19.58** | 42501 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | | *4.00* | *20.98* | |
| 6.42 | 0.45 | 6.87 | 0.96 | 0.52 | 0.21 | 1.69 | 2.05 | | 8.60 | 24.12 | 39910 |
| *6.00* | *2.00* | *8.00* | | | | *1.65* | *2.00* | | *8.00* | *23.38* | |
| 9.87 | 1.53 | 11.40 | 1.19 | | 0.52 | 1.71 | 2.08 | 2.16 | 1.68 | 22.62 | 39911 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |
| 8.96 | 1.66 | 10.62 | | | | 0.76 | 0.92 | 1.96 | 1.42 | 17.73 | 39912 |
| *8.00* | *2.00* | *10.00* | | | | *0.82* | *1.00* | *2.00* | | *15.27* | |
| 10.64 | 0.64 | 11.28 | 0.29 | | 0.24 | 0.53 | 0.64 | 4.58 | | 19.47 | 39913 |
| *10.00* | *2.00* | *12.00* | | | | *0.41* | *0.50* | *4.00* | | *18.24* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained |
|---|---|---|
| | **Hopkins Fertilizer Co.** | |
| 39914 | Old Time Wheat and Corn Grower ..... | Manufacturer ..... |
| 42317 | | W. S. Long, Rineyville ..... |
| 42502 | | C. R. Perry, Campbellsville ..... |
| 39915 | Old Time Bone and Potash ..... | Manufacturer ..... |
| | **International Agricultural Corporation, Cincinnati, Ohio.** | |
| 42128 | Special Tobacco ..... | Manufacturer ..... |
| 42129 | Grain Grower ..... | Manufacturer ..... |
| 42503 | | C. M. Langdon, Science Hill ..... |
| 42268 | Ideal Tobacco ..... | Manufacturer ..... |
| | **International Agr'l. Corp., (Buffalo Fert. Wks.) Cincinnati, Ohio.** | |
| 42185 | Wheat and Corn Grower. | Manufacturer ..... |
| 42186 | Ideal Wheat and Corn.. | Manufacturer ..... |
| 42187 | Truck and Potato Special | Manufacturer ..... |
| 42188 | Tobacco and Garden King | Manufacturer ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic | Total. | | From Muriate. | From Sulphate | | |
| 11.30 | 0.62 | 11.92 | 0.22 | | 0.27 | 0.49 | 0.59 | 2.46 | 0.56 | $18.66 | 39914 |
| 9.87 | 1.40 | 11.27 | | | | 0.43 | 0.52 | 1.80 | | 15.71 | 42317 |
| 9.74 | 1.06 | 10.80 | | | | 0.55 | 0.67 | 1.68 | 0.50 | 16.32 | 42502 |
| *10.00* | *2.00* | *12.00* | | | | *0.41* | *0.50* | *2.00* | | *16.24* | |
| **5.99** | 1.56 | 7.55 | 0.37 | | 0.32 | 0.69 | 0.84 | 2.48 | | 12.71 | 39915 |
| *7.00* | *2.00* | *9.00* | | | | *0.82* | *1.00* | *1.00* | | *13.07* | |
| 8.34 | 1.73 | 10.07 | | | | 1.09 | 1.32 | 0.88 | 3.40 | 19.48 | 42128 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | | *4.00* | *17.67* | |
| 8.34 | 2.60 | 10.94 | 0.84 | | 0.91 | 1.75 | 2.12 | 2.50 | | 19.68 | 42129 |
| 8.96 | 2.49 | 11.45 | | | | 1.50 | 1.82 | 2.26 | | 19.26 | 42503 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | *2.00* | | *17.78* | |
| 8.54 | 1.85 | 10.39 | 0.77 | | 0.90 | 1.67 | 2.03 | | 5.26 | 23.15 | 42268 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | | *5.00* | *21.78* | |
| 10.96 | 2.33 | 13.29 | | | | 1.58 | 1.92 | 2.04 | | 21.65 | 42185 |
| *10.00* | *1.00* | *11.00* | | | | *1.65* | *2.00* | *2.00* | | *20.18* | |
| 8.60 | 2.45 | 11.05 | 0.28 | 0.69 | 0.67 | 1.64 | 1.99 | 5.14 | | 22.18 | 42186 |
| *9.00* | *1.00* | *10.00* | | | | *1.65* | *2.00* | *5.00* | | *21.98* | |
| 7.90 | 1.62 | 9.54 | | 0.76 | 0.80 | 1.56 | 1.89 | 7.16 | 2.94 | 26.28 | 42187 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | *10.00* | | *25.78* | |
| 8.53 | 1.95 | 10.48 | 1.48 | | 0.88 | 2.36 | 2.87 | | 7.49 | 28.27 | 42188 |
| *8.00* | *1.00* | *9.00* | | | | *2.47* | *3.00* | | *7.00* | *27.05* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained |
|---|---|---|
| | **International Agr'l. Corp., Interstate Phosphate Wks. Nashville, Tenn.** | |
| 42132 | Special Tobacco Grower.. | Manufacturer ..... |
| 42507 | | E. B. Ferguson, Benton ..... |
| | **International Agr'l. Corp. Tennessee Valley Fert. Works, Nashville, Tenn.** | |
| 42134 | Three Link. | Manufacturer ..... |
| 42135 | Monarch ..... | Manufacturer ..... |
| 42136 | Blood and Bone ..... | Manufacturer ..... |
| 42137 | Pride of Kentucky ..... | Manufacturer ..... |
| 42138 | Tiger Special Tobacco Grower ..... | Manufacturer ..... |
| 42463 | Ashcraft's Wheat Special | Manufacturer ..... |
| | **International Agr'l. Corp., Nat. Fert. Branch, Nashville, Tenn** | |
| 42144 | Old Hickory Tobacco Grower ..... | Manufacturer ..... |
| 42316 | | Mrs. M. J. Dehart, Sewellton ..... |
| 42508 | | I. K. Miller & Sons, Campbellsville.. |
| 42145 | Old Hickory Corn and Wheat Grower ..... | Manufacturer ..... |
| 42314 | | Mrs. M. J. Dehart, Sewellton ..... |
| 42509 | | Barnett Bros., London ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| | | | | | | 1.85 | 2.25 | 5.40 | | $23.38 | 42132 |
| 9.41 | 0.52 | 9.93 | | | | | | | | | |
| 7.83 | 6.95 | 14.78 | 0.82 | | 0.77 | 1.59 | 1.93 | 3.50 | | 21.95 | 42507 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | | *4.00* | *20.58* | |
| | | | | | | 1.76 | 2.14 | 2.24 | | 22.41 | 42134 |
| 11.14 | 1.61 | 12.75 | | | | | | | | | |
| *10.00* | *1.00* | *11.00* | | | | *1.65* | *2.00* | *2.00* | | *20.18* | |
| | | | | | | 2.07 | 2.51 | 2.38 | | 21.32 | 42135 |
| 8.51 | 2.49 | 11.00 | | 1.35 | 0.72 | | | | | | |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | *2.00* | | *17.78* | |
| | | | | | | 0.77 | 0.93 | 2.79 | | 18.29 | 42136 |
| 10.36 | 0.92 | 11.28 | | | | | | | | | |
| *10.00* | *1.00* | *11.00* | | | | *0.82* | *1.00* | *1.00* | | *16.27* | |
| | | | | | | 0.86 | 1.04 | 4.24 | 1.45 | 21.16 | 42137 |
| 9.85 | 0.88 | 10.73 | | | | | | | | | |
| *10.00* | *1.00* | *11.00* | | | | *0.82* | *1.00* | | *4.00* | *20.07* | |
| | | | | | | 1.87 | 2.27 | 4.30 | 1.33 | 22.94 | 42138 |
| 8.62 | 0.38 | 9.00 | | | | | | | | | |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | | *4.00* | *20.58* | |
| | | | | | | 0.82 | 1.00 | 1.84 | 1.04 | 19.91 | 42463 |
| 11.35 | 0.83 | 12.18 | | | | | | | | | |
| *10.00* | *1.00* | *11.00* | | | | *0.82* | *1.00* | *3.00* | | *18.27* | |
| | | | | | | 1.76 | 2.14 | 1.66 | 0.52 | 21.29 | 42144 |
| 10.19 | 1.56 | 11.75 | | | | | | | | 21.00 | 42316 |
| 9.31 | 3.63 | 12.94 | 0.53 | | 1.31 | 1.84 | 2.23 | 1.94 | | | |
| 10.60 | 3.76 | 14.36 | 0.94 | | 0.80 | 1.74 | 2.11 | 0.58 | 1.96 | 23.24 | 42508 |
| *10.00* | *1.00* | *11.00* | | | | *1.65* | *2.00* | | *2.00* | *20.58* | |
| | | | | | | 2.09 | 2.54 | 3.73 | | 21.89 | 42145 |
| 7.46 | 4.72 | 12.18 | | | | | | | | | |
| 7.77 | 3.68 | 11.45 | 0.60 | | 1.24 | 1.84 | 2.23 | 3.03 | | 20.26 | 42314 |
| 9.42 | 2.74 | 12.16 | 0.41 | | 0.74 | 1.15 | 1.40 | 2.97 | | 19.40 | 42509 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *2.00* | | *14.87* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained |
|---|---|---|
| | **International Agr'l Corporation.** | |
| 42149 | Old Hickory Guano .... | Manufacturer ..... |
| 42315 | | Mrs. M. J. Dehart, Sewellton ..... |
| 42512 | | E. S. Diuguid & Son, Murray ..... |
| 42150 | Old Hickory Corn Grower | Manufacturer ..... |
| 42513 | | Barnett Bros., London ..... |
| 42151 | Old Hickory Special H. Gr. Tobacco Grower .... | Manufacturer ..... |
| 42514 | | I. K. Miller & Sons, Campbellsville. |
| 42152 | Old Hickory Tobacco Grower No. 2. ..... | Manufacturer ..... |
| 42515 | | Barnett Bros., London ..... |
| 42176 | Old Hickory Blood and Bone ..... | Manufacturer ..... |
| 42518 | | I. K. Miller & Sons, Campbellsville. |
| 42247 | Old Hickory Wheat Special ..... | Manufacturer ..... |
| 42321 | Old Hickory Wheat Special ..... | Manufacturer ..... |
| 42332 | Old Hickory Special Mixture ..... | Manufacturer ..... |
| | **The Jarecki Chemical Co., Cincinnati, Ohio.** | |
| 42191 | Lake Erie Guano With Phosphate and Potash ... | Manufacturer ..... |
| 42521 | | Claud B. Terrell, Bedford ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 9.09 | 1.01 | 10.10 | | | | 1.61 | 1.95 | 2.52 | | $19.47 | 42149 |
| 11.07 | 3.38 | 14.45 | 0.45 | | 0.99 | 1.44 | 1.75 | **1.26** | | 20.93 | 42315 |
| 7.56 | 3.52 | 11.08 | 0.68 | | 0.87 | 1.55 | 1.88 | 2.44 | | 18.35 | 42512 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | *2.00* | | *17.78* | |
| 10.19 | 0.85 | 11.04 | | | | 0.85 | 1.03 | 2.65 | | 18.20 | 42150 |
| 9.83 | 3.34 | 13.17 | 0.23 | | 0.65 | 0.88 | 1.07 | 0.96 | | 17.18 | 42513 |
| *10.00* | *1.00* | *11.00* | | | | *0.82* | *1.00* | *1.00* | | *16.27* | |
| 10.99 | 3.07 | 14.06 | | | | **1.24** | 1.51 | 7.90 | 1.90 | 28.94 | 42151 |
| 10.05 | 2.37 | 12.42 | 0.99 | | 1.17 | 2.16 | 2.62 | **1.40** | **5.51** | 28.58 | 42514 |
| *10.00* | *1.00* | *11.00* | | | | *1.65* | *2.00* | | *8.00* | *27.78* | |
| 9.53 | 0.77 | 10.30 | | | | 2.07 | 2.51 | 4.00 | 1.90 | 25.28 | 42152 |
| 8.71 | 3.84 | 12.55 | 0.65 | | 0.85 | 1.50 | 1.82 | 3.86 | 0.73 | 21.98 | 42515 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | | *5.00* | *21.78* | |
| 10.44 | 0.96 | 11.40 | | | | 0.78 | 0.95 | 2.67 | | 18.31 | 42176 |
| 9.99 | 3.60 | 13.59 | | | | 0.86 | 1.04 | 1.64 | | 18.08 | 42518 |
| *10.00* | *1.00* | *11.00* | | | | *0.82* | *1.00* | *1.00* | | *16.27* | |
| 10.91 | 2.93 | 13.84 | | | | 0.53 | 0.64 | 3.98 | 1.52 | 21.92 | 42247 |
| *10.00* | *1.00* | *11.00* | | | | *0.41* | *0.50* | | *4.00* | *18.64* | |
| 10.61 | 2.63 | 13.24 | | | | 0.62 | 0.75 | 3.94 | 1.18 | 21.31 | 42321 |
| *10.00* | *1.00* | *11.00* | | | | *0.41* | *0.50* | *4.00* | | *17.84* | |
| 11.16 | 0.33 | 11.49 | | | | 2.36 | 2.87 | 1.98 | 0.71 | 24.61 | 42332 |
| *10.00* | *1.00* | *11.00* | | | | *2.47* | *3.00* | *2.00* | | *23.05* | |
| 8.47 | 1.47 | 9.94 | | 0.38 | 0.81 | 1.19 | 1.44 | 2.85 | | 17.77 | 42191 |
| 8.27 | 1.76 | 10.03 | | | | 1.22 | 1.48 | 2.63 | | 17.52 | 42521 |
| *8.00* | *1.00* | *9.00* | | | | *1.23* | *1.50* | *2.50* | | *16.81* | |

PART I, TABLE J.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained |
|---|---|---|
| | **The Jarecki Chemical Co.** | |
| 42192 | Number One Formula ... | Manufacturer ..... |
| 42522 | | Claud B. Terrell, Bedford ..... |
| 42196 | Raw Bone and Phosphate Mixture ..... | Manufacturer ..... |
| 42197 | Fish Phosphate and Potash, Tobacco and Potato Food ..... | Manufacturer ..... |
| 42523 | | Rector & Co., Lewisburg ..... |
| 42199 | Tobacco and Truck Grower ..... | Manufacturer ..... |
| 42524 | | Rector & Co., Lewisburg ..... |
| 42200 | Indian Brand Tobacco and Potato Fertilizer ... | Manufacturer ..... |
| 42525 | | Claud B. Terrell, Bedford ..... |
| 42201 | Gilead Phosphate ..... | Manufacturer ..... |
| 42526 | | Staggs Bros., Vanceburg ..... |
| 42202 | The Boone Tobacco Grower ..... | Manufacturer ..... |
| 42527 | | J. C. Everett & Co., Maysville ..... |
| 42232 | Potato and Tobacco Special ..... | *Manufacturer ..... |
| | **Jones Fertilizer, Co., Louisville, Ky.** | |
| 39887 | Jones Corn and Wheat Grower ..... | Manufacturer ..... |
| 39889 | Jones Reliable ..... | Manufacturer ..... |

*The Manufacturer failed to furnish official sample as required by law.

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 8.63 | 1.17 | 9.80 | | 0.34 | 0.51 | 0.85 | 1.03 | 1.84 | 0.59 | $16.36 | 42192 |
| 7.80 | 1.85 | 9.65 | | | | 0.87 | 1.06 | 2.07 | | 15.22 | 42522 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *2.00* | | *14.87* | |
| 7.79 | 11.46 | 19.25 | | | | 1.42 | 1.72 | 2.52 | | 21.42 | 42196 |
| *8.00* | *8.00* | *16.00* | | | | *1.23* | *1.50* | *2.00* | | *19.11* | |
| 8.92 | 1.33 | 10.25 | | | | 1.09 | 1.32 | 3.08 | 0.90 | 19.21 | 42197 |
| 7.97 | 1.57 | 9.54 | | | | 0.72 | 0.87 | 3.75 | | 16.46 | 42523 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *4.00* | | *16.87* | |
| 8.61 | 1.56 | 10.17 | | | | 1.39 | 1.69 | | 6.74 | 23.91 | 42199 |
| 5.83 | 1.34 | 7.17 | | 0.46 | 1.04 | 1.50 | 1.82 | 1.14 | 4.76 | 19.64 | 42524 |
| *6.00* | *1.00* | *7.00* | | | | *1.65* | *2.00* | | *6.00* | *20.58* | |
| 10.38 | 0.84 | 11.22 | | 1.17 | 1.05 | 2.22 | 2.33 | | 5.62 | 27.31 | 42200 |
| 9.89 | 0.54 | 10.43 | | 1.83 | 0.66 | 2.49 | 3.02 | 1.16 | 3.49 | 26.16 | 42525 |
| *9.00* | *1.00* | *10.00* | | | | *2.47* | *3.00* | | *5.00* | *25.85* | |
| 9.26 | 1.05 | 10.31 | | | | 0.99 | 1.20 | 2.42 | 0.57 | 18.10 | 42201 |
| 8.33 | 1.17 | 9.50 | | | | 0.87 | 1.06 | 3.04 | | 16.56 | 42526 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *3.00* | | *15.87* | |
| 9.28 | 2.07 | 11.35 | | | | 1.62 | 1.97 | 9.90 | 3.06 | 31.21 | 42202 |
| 8.75 | 1.42 | 10.17 | | | | 1.61 | 1.95 | **0.90** | **8.32** | 27.59 | 42527 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | | *10.00* | *27.78* | |
| | | | | | | | | | | | 42232 |
| *10.00* | *1.00* | *11.00* | | | | *2.47* | *3.00* | | *7.00* | *29.45* | |
| 7.00 | 0.92 | 7.92 | | | | 0.94 | 1.14 | 0.78 | 0.52 | 13.46 | 39887 |
| *7.00* | *4.00* | *11.00* | | | | *0.82* | *1.00* | | *1.00* | *14.07* | |
| 8.73 | 1.01 | 9.74 | | | | 0.79 | 0.96 | 1.81 | | 15.46 | 39889 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *1.50* | *15.87* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained |
|---|---|---|
| | **Jones Fertilizer Co.** | |
| 39890<br>42528 | Jones Special Tobacco Grower | Manufacturer<br>J. P. Brown & Son, Dry Ridge |
| 39891<br>42529 | Jones Grain Grower | Manufacturer<br>Howerton Sands, Lewisburg |
| 39892 | Jones Grain Special | Manufacturer |
| 39893 | Jones Slaughter House Bone | Manufacturer |
| 39894 | Jones Miami Valley Phosphate | Manufacturer |
| 39895<br>42530 | Jones Tobacco and Potato Grower | Manufacturer<br>T. Z. Leachman, Greensburg |
| 39897 | Jones Potato Grower | Manufacturer |
| 39898<br>42531 | Jones Truck Grower | Manufacturer<br>J. P. Brown & Son, Dry Ridge |
| | **Kaufman Fertilizer Co., Cincinnati, Ohio.** | |
| 42213 | Corn Wheat and Oats Grower | Manufacturer |
| 42214 | Harvest King | Manufacturer |
| 42215<br>42532 | Golden Rule | Manufacturer<br>F. B. Adams, N. Pleasureville |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | Equivalent to Ammonia. | POTASH | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 8.57 | 1.08 | 9.65 | | | | 0.84 | 1.02 | 1.84 | | $15.49 | 39890 |
| 8.37 | 1.57 | 9.94 | 0.20 | | 0.86 | 1.06 | 1.29 | | 2.85 | 16.80 | 42528 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *1.50* | *15.87* | |
| 9.09 | 0.75 | 9.84 | | | | 0.41 | 0.50 | 0.68 | 3.78 | 17.87 | 39891 |
| 8.97 | 7.80 | 16.77 | | | | 0.78 | 0.95 | 1.30 | 2.77 | 21.23 | 42529 |
| *8.00* | *4.00* | *12.00* | | | | *0.41* | *0.50* | | *4.00* | *17.44* | |
| 10.52 | 1.39 | 11.91 | | | | 1.04 | 1.26 | 0.56 | 2.28 | 20.12 | 39892 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | | *2.00* | *18.87* | |
| 8.34 | 1.02 | 9.36 | | 1.02 | 0.80 | 1.82 | 2.21 | 1.08 | 1.62 | 19.81 | 39893 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| 10.66 | 2.05 | 12.71 | | | | 1.63 | 1.98 | | 2.54 | 22.37 | 39894 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 7.37 | 1.78 | 9.15 | | | | 1.58 | 1.92 | 1.56 | 3.34 | 20.65 | 39895 |
| 7.94 | 1.25 | 9.19 | | 0.93 | 0.61 | 1.54 | 1.87 | 0.72 | 3.36 | 20.17 | 42530 |
| *7.00* | *4.00* | *11.00* | | | | *1.65* | *2.00* | | *4.00* | *20.58* | |
| 8.67 | 0.83 | 9.50 | | 1.88 | 0.66 | 2.54 | 3.08 | 2.00 | 4.66 | 27.21 | 39897 |
| *8.00* | *4.00* | *12.00* | | | | *2.47* | *3.00* | | *6.00* | *27.05* | |
| 8.39 | 1.01 | 9.40 | | 1.48 | 0.35 | 1.83 | 2.22 | 1.36 | 10.90 | 31.32 | 39898 |
| **7.40** | 2.68 | 10.08 | | | | 1.48 | 1.80 | | **8.27** | **25.05** | |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *10.00* | *28.98* | |
| 9.39 | 0.83 | 10.22 | | 0.51 | 0.76 | 1.27 | 1.54 | 2.30 | 0.82 | 19.33 | 42213 |
| *8.00* | *1.00* | *9.00* | | | | *1.23* | *1.50* | *2.50* | | *16.81* | |
| 8.86 | 0.93 | 9.79 | | 0.39 | 0.48 | 0.87 | 1.06 | 2.30 | | 16.35 | 42214 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *2.00* | | *14.87* | |
| 8.74 | 1.20 | 9.94 | | | | 1.08 | 1.31 | 3.04 | 1.29 | 19.34 | 42215 |
| 8.37 | 1.50 | 9.87 | | | | 0.82 | 1.00 | 3.61 | | 17.12 | 42532 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *4.00* | | *16.87* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Kaufman Fertilizer Co.** | |
| 42216 | Special Potato and Tobacco Fertilizer ..... | Manufacturer ..... |
| 42533 | | F. B. Adams, N. Pleasureville ..... |
| 42217 | Half and Half ..... | Manufacturer ..... |
| 42221 | Kentucky Tobacco Grower | Manufacturer ..... |
| 42534 | | J. W. Skeggs, Campbellsville ..... |
| | **Kentucky Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.** | |
| 39680 | O. K. Golden Leaf Tobacco Grower ..... | Manufacturer ..... |
| 42535 | | L. A. Collins, Campbellsvilile ..... |
| 39681 | O. K. H. Gr. Mixture .... | Manufacturer ..... |
| 42536 | | L. A. Collins, Campbellsville ..... |
| 39682 | O. K. Tobacco and Vegetable Grower ..... | Manufacturer ..... |
| 42537 | | L. A. Collins, Campbellsville ..... |
| 39683 | O. K. Crop and Tobacco Grower ..... | Manufacturer ..... |
| 39684 | O. K. Corn and Wheat Grower ..... | Manufacturer ..... |
| 39685 | O. K. Grain Grower ..... | Manufacturer ..... |
| 39686 | O. K. Corn, Wheat and Oats Grower ..... | Manufacturer ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN | | | | | POTASH | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate | Estimated Value Per Ton. | Station Number. |
| 8.21 | 1.50 | 9.71 | | | | 1.45 | 1.76 | | 6.91 | $23.82 | 42216 |
| 6.12 | 2.22 | 8.34 | | 0.48 | 1.20 | 1.68 | 2.04 | 0.98 | 5.21 | 21.34 | 42533 |
| *6.00* | *1.00* | *7.00* | | | | *1.65* | *2.00* | | *6.00* | *20.58* | |
| 7.52 | 11.91 | 19.43 | | | | 1.28 | 1.55 | 1.84 | 1.83 | 22.30 | 42217 |
| *8.00* | *8.00* | *16.00* | | | | *1.23* | *1.50* | *2.00* | | *19.11* | |
| 8.85 | 1.13 | 9.98 | | 0.41 | 0.52 | 0.93 | 1.13 | 2.36 | | 16.69 | 42221 |
| 7.75 | 1.77 | 9.52 | | | | 0.81 | 0.98 | 2.13 | | 14.98 | 42534 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *2.00* | | *14.87* | |
| 10.51 | 6.32 | 16.83 | | | | 2.00 | 2.43 | | 2.60 | 25.26 | 39680 |
| 9.41 | 4.22 | 13.63 | 0.23 | | 1.29 | 1.52 | 1.85 | 0.88 | 1.32 | 20.76 | 42535 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| 13.23 | 2.89 | 16.12 | | | | 1.29 | 1.57 | | 3.69 | 25.99 | 39681 |
| **9.31** | 4.21 | 13.52 | 0.28 | | 0.84 | 1.12 | 1.36 | 3.60 | 0.57 | 21.05 | 42536 |
| *11.00* | *4.00* | *15.00* | | | | *0.82* | *1.00* | | *3.00* | *21.27* | |
| 10.17 | 4.77 | 14.94 | | | | 1.69 | 2.05 | | 7.03 | 28.47 | 39682 |
| 7.68 | 3.30 | 10.98 | 0.39 | | 1.14 | 1.53 | 1.86 | **0.98** | **3.68** | **21.30** | 42537 |
| *8.00* | *4.00* | *12.00* | | | | *1.23* | *1.50* | | *6.00* | *22.71* | |
| 10.03 | 7.27 | 17.30 | | | | 1.17 | 1.42 | | 4.84 | 24.86 | 39683 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *4.00* | *18.87* | |
| 12.15 | 5.19 | 17.34 | | | | 1.24 | 1.51 | | 2.56 | 24.02 | 39684 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | | *2.00* | *18.87* | |
| 13.71 | 6.15 | 19.86 | | | | 0.56 | 0.68 | | 1.03 | 22.11 | 39685 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *1.00* | *17.44* | |
| 13.52 | 6.17 | 19.69 | | | | 0.59 | 0.72 | | 1.09 | 22.07 | 39686 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *1.00* | *17.44* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Kentucky Fertilizer Co.** | |
| 39689 | O. K. Complete Manure | Manufacturer |
| 39690<br>42539 | O. K. 20% Fertilizer | Manufacturer<br>L. A. Collins, Campbellsville |
| 39698 | O. K. Special Crop Grower | Manufacturer |
| 39699 | Potash and Tobacco Special | Manufacturer |
| 39700 | O. K. Golden Grain Tobacco Mixture | Manufacturer |
| 42330 | "Old Kentucky" Special | Manufacturer |
| 42433 | O. K. Long Green Tobacco Grower | Manufacturer |
| 42434 | O. K. High Grade Fertilizer | Manufacturer |
| | **Louisville Fertilizer Co., Louisville, Ky.** | |
| 39850<br>42542 | Eagle Special Corn and Wheat Grower | Manufacturer<br>J. A. Simpson, Quinton |
| 39851 | Eagle Soluble Bone | Manufacturer |
| 39852<br>42543 | Eagle Special Tobacco Grower | Manufacturer<br>Spillman & Downing, Fountain Run. |
| 39853<br>42544 | Eagle Grain Grower | Manufacturer<br>E. M. Ford & Sons, Glasgow Junction |

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | | POTASH. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate. | Estimated Value Per Ton. | Station Number. |
| 10.40 | 7.78 | 18.18 | | | | 1.43 | 1.74 | | 3.30 | $24.56 | 39689 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *2.50* | *17.07* | |
| 10.56 | 1.54 | 12.10 | | | | 1.85 | 2.25 | | 11.04 | 33.02 | 39690 |
| 7.96 | 1.50 | 9.46 | | | | 1.83 | 2.22 | **9.39** | | **27.83** | 42539 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *10.00* | *28.98* | |
| 12.95 | 4.77 | 17.72 | | | | 0.52 | 0.63 | | 4.60 | 24.79 | 39698 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *3.50* | *20.44* | |
| 12.31 | 6.48 | 18.79 | | | | 0.59 | 0.72 | | 3.08 | 23.13 | 39699 |
| *10.00* | *4.00* | *14.00* | | | | *0.21* | *0.25* | | *2.00* | *16.74* | |
| 13.06 | 3.58 | 16.64 | | | | 0.55 | 0.67 | | 6.27 | 26.55 | 39700 |
| *10.00* | *4.00* | *14.00* | | | | *0.21* | *0.25* | | *4.00* | *19.14* | |
| 12.06 | 4.97 | 17.03 | | | | 0.88 | 1.07 | 0.92 | 4.64 | 26.03 | 42330 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *5.00* | *22.24* | |
| 12.81 | 2.92 | 15.73 | | | | 1.99 | 2.42 | | 2.73 | 26.79 | 42433 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 12.02 | 3.12 | 15.14 | | | | 2.02 | 2.45 | | 2.72 | 26.00 | 42434 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 7.19 | 0.62 | 7.81 | | | | 0.85 | 1.03 | 0.82 | 0.54 | 13.33 | 39850 |
| 8.18 | 1.05 | 9.23 | | | | 0.67 | 0.81 | 2.43 | | 15.02 | 42542 |
| *7.00* | *4.00* | *11.00* | | | | *0.82* | *1.00* | | *1.00* | *14.07* | |
| 8.84 | 0.52 | 9.36 | | | | 0.75 | 0.91 | 2.02 | | 15.47 | 39851 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *1.50* | *15.87* | |
| 8.57 | 0.65 | 9.22 | | | | 0.76 | 0.92 | 2.14 | | 15.34 | 39852 |
| **7.28** | 1.43 | 8.71 | | | | 0.82 | 1.00 | | 2.31 | 14.95 | 42543 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *1.50* | *15.87* | |
| 8.83 | 0.36 | 9.19 | | | | 0.32 | 0.39 | 0.88 | 3.80 | 17.30 | 39853 |
| 9.09 | 1.19 | 10.28 | | | | 0.65 | 0.79 | 1.10 | 4.48 | 20.15 | 42544 |
| *8.00* | *4.00* | *12.00* | | | | *0.41* | *0.50* | | *4.00* | *17.44* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Louisville Fertilizer Co.** | |
| 39854<br>42545 | Eagle Slaughter House Bone | Manufacturer<br>E. M. Ford & Sons, Glasgow Junction |
| 39855<br>42546 | Eagle Guano | Manufacturer<br>J. A. Simpson, Quinton |
| 39856<br>42547 | Eagle High Grade Tobacco and Potato Grower | Manufacturer<br>J. A. Bennett, Taylorsville |
| 39858 | Eagle Raw Bone Mixture. | Manufacturer |
| 39859 | Eagle Potato Grower | Manufacturer |
| 39860<br>42548 | Eagle Tobacco Grower | Manufacturer<br>E. M. Ford & Sons, Glasgow Junction |
| 39861<br>42549 | Eagle Truck Grower | Manufacturer<br>L. S. Brough, Bowling Green |
| | **Morris & Co., Chicago, Ill.** | |
| 39787 | Big Three | Manufacturer |
| 39788<br>42553 | Big Four | Manufacturer<br>Redmon & Burba Co., Hodgenville |
| 39789 | Big Five | Manufacturer |
| 39791<br>42554 | Big Seven—Special Bone Meal and Potash | Manufacturer<br>Hatter Hardware Co., Franklin |

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | | POTASH. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate. | Estimated Value Per Ton. | Station Number. |
| 8.07 | 0.51 | 8.58 | | 0.94 | 0.91 | 1.85 | 2.25 | 1.10 | 1.77 | $19.58 | 39854 |
| 9.44 | 1.40 | 10.84 | | | | **0.92** | 1.12 | 0.88 | 3.25 | 19.89 | 42545 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| 11.25 | 1.33 | 12.58 | | | | 1.68 | 2.04 | 0.66 | 1.93 | 22.89 | 39855 |
| 9.71 | 0.88 | 10.59 | | 0.83 | 0.81 | 1.64 | 1.99 | 0.68 | 3.30 | 22.38 | 42546 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 7.43 | 1.21 | 8.64 | | | | 1.59 | 1.93 | 1.52 | 3.66 | 20.88 | 39856 |
| 8.09 | 0.96 | 9.05 | | 0.58 | 1.25 | 1.83 | 2.22 | 0.82 | 5.00 | 23.32 | 42547 |
| *7.00* | *4.00* | *11.00* | | | | *1.65* | *2.00* | | *4.00* | *20.58* | |
| 8.02 | 7.46 | 15.48 | | | | 1.93 | 2.34 | | 1.82 | 21.54 | 39858 |
| *7.00* | *8.00* | *15.00* | | | | *1.65* | *2.00* | | *1.00* | *18.58* | |
| 8.74 | 0.62 | 9.36 | | 1.98 | 0.70 | 2.68 | 3.25 | 2.34 | 4.68 | 28.08 | 39859 |
| *8.00* | *4.00* | *12.00* | | | | *2.47* | *3.00* | | *6.00* | *27.05* | |
| 8.36 | 0.74 | 9.10 | | 1.97 | 0.56 | 2.53 | 3.07 | 2.68 | 4.09 | 26.78 | 39860 |
| 9.21 | 1.31 | 10.52 | | | | 2.69 | 3.27 | 0.96 | 7.09 | 30.46 | 42548 |
| *8.00* | *4.00* | *12.00* | | | | *2.47* | *3.00* | | *6.00* | *27.05* | |
| 8.36 | 1.10 | 9.46 | | 1.46 | 0.27 | 1.73 | 2.10 | 1.10 | 10.83 | 30.63 | 39861 |
| 7.81 | 0.23 | 8.04 | | 1.30 | 0.43 | 1.73 | 2.10 | 2.16 | 9.95 | 29.62 | 42549 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *10.00* | *28.98* | |
| 7.54 | 4.09 | 11.63 | | | | 2.58 | 3.13 | 0.60 | 1.39 | 21.99 | 39787 |
| *6.00* | *4.00* | *10.00* | | | | *2.47* | *3.00* | | *2.00* | *19.85* | |
| 9.55 | 3.60 | 13.15 | | | | 4.15 | 5.04 | | 4.03 | 32.27 | 39788 |
| 8.44 | 4.40 | 12.84 | | | | 4.28 | 5.20 | **0.64** | **2.85** | 30.93 | 42553 |
| *7.00* | *5.00* | *12.00* | | | | *4.12* | *5.00* | | *4.00* | *29.62* | |
| 8.11 | 3.72 | 11.83 | | | | 2.55 | 3.10 | | 1.12 | 21.49 | 39789 |
| *6.00* | *4.00* | *10.00* | | | | *2.47* | *3.00* | | *1.00* | *18.65* | |
| 8.11 | 8.39 | 16.50 | | | | 1.26 | 1.53 | 0.36 | 3.44 | 21.99 | 39791 |
| **5.71** | 7.84 | 13.55 | | | | 1.72 | 2.09 | 0.64 | 2.84 | 20.06 | 42554 |
| *8.00* | *8.00* | *16.00* | | | | *1.23* | *1.50* | | *3.00* | *20.71* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Morris & Co.** | |
| 39792 | Big Eight—Ammoniated Acid Phosphate and Potash | Manufacturer |
| 39793 | Big Nine—Prepared Manure With Phosphate and Potash | Manufacturer |
| 42555 | | Redmon & Burba Co., Hodgenville |
| 39794 | Big Ten—Prepared Manure With Phosphate and Potash | Manufacturer |
| 39795 | Big Eleven—Bone Meal and Potash | Manufacturer |
| 39796 | Big Twelve—Prepared Manure With Phosphate and Potash | Manufacturer |
| 42556 | | Woodson Lewis, Greensburg |
| | **Mt. Pleasant Fertilizer Co., Mt. Pleasant, Tenn.** | |
| 39740 | Black Patch Farmers Friend | Manufacturer |
| 39741 | Big Success Blood, Bone and Potash | Manufacturer |
| 39742 | Big Success Universal | Manufacturer |
| 39743 | Big Success Potato Special | Manufacturer |
| 39744 | Big Success Cantaloupe and Vegetable Special | Manufacturer |
| 39745 | Big Success Corn Special. | Manufacturer |
| 42557 | | W. F. Davis & Sons, Barbourville |

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | | POTASH. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate. | Estimated Value Per Ton. | Station Number. |
| 7.46 | 0.98 | 8.44 | | | | 1.06 | 1.29 | | 1.47 | $14.81 | 39792 |
| *7.00* | *1.00* | *8.00* | | | | *0.82* | *1.00* | | *1.00* | *12.87* | |
| 10.40 | 0.56 | 10.96 | | | | 0.87 | 1.06 | | 7.71 | 24.50 | 39793 |
| 10.01 | 1.17 | 11.18 | | | | 1.58 | 1.92 | 0.70 | 4.96 | 24.66 | 42555 |
| *7.00* | *2.00* | *9.00* | | | | *0.82* | *1.00* | | *7.00* | *20.47* | |
| 9.38 | 1.10 | 10.48 | | | | 1.86 | 2.26 | | 2.34 | 21.02 | 39794 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | | *2.00* | *18.58* | |
| 8.56 | 7.45 | 16.01 | | | | 1.00 | 1.21 | 1.32 | 9.14 | 29.04 | 39795 |
| *8.00* | *8.00* | *16.00* | | | | *0.82* | *1.00* | | *10.00* | *27.67* | |
| 9.40 | 0.94 | 10.34 | | | | 0.97 | 1.18 | | 3.17 | 18.86 | 39796 |
| 8.40 | 0.91 | 9.31 | | | | 1.55 | 1.88 | 0.62 | 2.01 | 18.90 | 42556 |
| *7.00* | *2.00* | *9.00* | | | | *0.82* | *1.00* | | *3.00* | *15.67* | |
| 10.05 | 4.70 | 14.75 | | | | 1.01 | 1.23 | 2.78 | | 20.26 | 39740 |
| *10.00* | *3.00* | *13.00* | | | | *0.82* | *1.00* | *3.00* | | *19.07* | |
| 9.77 | 5.30 | 15.07 | | | | 1.25 | 1.52 | 0.94 | 7.78 | 28.50 | 39741 |
| *9.00* | *4.00* | *13.00* | | | | *0.82* | *1.00* | | *7.00* | *23.67* | |
| 8.67 | 11.12 | 19.79 | | | | 1.04 | 1.26 | 3.99 | | 22.48 | 39742 |
| *8.00* | *5.00* | *13.00* | | | | *0.82* | *1.00* | *4.00* | | *18.47* | |
| 7.61 | 7.51 | 15.12 | | 1.02 | 1.78 | 2.80 | 3.40 | 0.78 | 5.09 | 28.82 | 39743 |
| *7.00* | *5.00* | *12.00* | | | | *2.47* | *3.00* | | *6.00* | *26.25* | |
| 6.22 | 6.07 | 12.29 | | 1.61 | 1.81 | 3.42 | 4.15 | 1.38 | 9.51 | 34.65 | 39744 |
| *6.00* | *4.00* | *10.00* | | | | *3.29* | *4.00* | | *10.00* | *32.32* | |
| 7.75 | 8.25 | 16.00 | | | | 1.90 | 2.31 | 2.04 | | 21.29 | 39745 |
| 9.16 | 7.80 | 16.96 | | | | 1.74 | 2.11 | 2.13 | | 22.33 | 42557 |
| *8.00* | *5.00* | *13.00* | | | | *1.65* | *2.00* | *2.00* | | *19.38* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Mt. Pleasant Fertilizer Co.** | |
| 39746 | Black Patch Grain and Seeding Down | Manufacturer |
| 39747 | Black Patch Best by Test | Manufacturer |
| 39748 | Black Patch Tobacco Special | Manufacturer |
| 42558 | | Logan Co. Hdw. Co., Russellville |
| 39750 | Tenn. and Ky. Tobacco Grower | Manufacturer |
| 42559 | | Moore & Gilbert, Adairville |
| 39758 | Great Southern Tobacco Special | Manufacturer |
| 42561 | | C. L. Dowdy, Mayfield |
| 39759 | Planters Choice | Manufacturer |
| 39760 | Great Southern Superior Tobacco Grower | Manufacturer |
| 39761 | Great Southern Tobacco Grower | Manufacturer |
| 39762 | Universal Tobacco Grower | Manufacturer |
| 42562 | | C. L. Dowdy, Mayfield |
| 39763 | Great Southern Potato Special | Manufacturer |
| 39764 | Great Southern Corn Special | Manufacturer |
| 39749 | Black Patch Tobacco Grower | Manufacturer |

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate. | | |
| 9.87 | 5.33 | 15.20 | | | | 1.96 | 2.38 | 2.28 | | $23.11 | 39746 |
| *10.00* | *5.00* | *15.00* | | | | *1.65* | *2.00* | *2.00* | | *21.78* | |
| 12.17 | 1.89 | 14.06 | | 1.08 | 0.74 | 1.82 | 2.21 | | 5.86 | 28.76 | 39747 |
| *12.00* | *1.00* | *13.00* | | | | *1.65* | *2.00* | | *6.00* | *27.78* | |
| 8.56 | 6.03 | 14.59 | | 1.05 | 0.78 | 1.83 | 2.22 | 1.04 | 8.87 | 30.77 | 39748 |
| 8.94 | 4.32 | 13.26 | | | | 1.77 | 2.15 | **1.00** | **7.82** | 29.04 | 42558 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | | *10.00* | *28.18* | |
| 8.22 | 10.62 | 18.84 | | 0.84 | 0.78 | 1.62 | 1.97 | | 4.30 | 24.94 | 39750 |
| 8.60 | 7.52 | 16.12 | | | | 1.75 | 2.12 | 0.94 | 2.91 | 23.89 | 42559 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *4.00* | *21.78* | |
| 9.45 | 5.43 | 14.88 | | 1.01 | 0.81 | 1.82 | 2.21 | 0.92 | 9.15 | 31.78 | 39758 |
| 8.66 | 4.04 | 12.70 | | | | 1.75 | 2.12 | **0.94** | **8.36** | 29.11 | 42561 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | | *10.00* | *28.18* | |
| 10.43 | 4.95 | 15.38 | | | | 1.93 | 2.34 | 1.87 | | 23.13 | 39759 |
| *10.00* | *5.00* | *15.00* | | | | *1.65* | *2.00* | *2.00* | | *21.78* | |
| 9.13 | 9.61 | 18.74 | | 0.98 | 0.70 | 1.68 | 2.04 | | 3.93 | 25.40 | 39760 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *4.00* | *21.78* | |
| 9.03 | 10.49 | 19.52 | | | | 0.96 | 1.17 | | 3.87 | 23.04 | 39761 |
| *8.00* | *6.00* | *14.00* | | | | *0.82* | *1.00* | | *4.00* | *19.67* | |
| 9.05 | 8.88 | 17.93 | | 0.93 | 0.73 | 1.66 | 2.02 | 0.74 | 5.06 | 27.03 | 39762 |
| 9.51 | 6.96 | 16.47 | | | | 1.46 | 1.77 | **0.66** | **4.68** | 25.58 | 42562 |
| *8.00* | *7.00* | *15.00* | | | | *1.65* | *2.00* | | *6.00* | *25.38* | |
| 7.32 | 8.29 | 15.61 | | 0.88 | 1.53 | 2.41 | 2.93 | 0.84 | 5.26 | 27.69 | 39763 |
| *7.00* | *5.00* | *12.00* | | | | *2.47* | *3.00* | | *6.00* | *26.25* | |
| 8.98 | 8.55 | 17.53 | | | | 1.71 | 2.08 | 1.85 | | 22.04 | 39764 |
| *8.00* | *5.00* | *13.00* | | | | *1.65* | *2.00* | *2.00* | | *19.38* | |
| 8.48 | 11.05 | 19.53 | | | | 0.90 | 1.09 | | 3.70 | 22.19 | 39749 |
| *8.00* | *6.00* | *14.00* | | | | *0.82* | *1.00* | | *4.00* | *19.67* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The Queen City Fertilizer Co., Cincinnati, Ohio.** | |
| 42223 | Miami Valley Grain Grower | Manufacturer |
| 42224 | Valley Gem Phosphate | Manufacturer |
| 42565 | | A. H. Dawson, Owingsville |
| 42225 | Big Bonanza Tobacco and Potato Grower | Manufacturer |
| 42566 | | A. H. Dawson, Owingsville |
| 42227 | Lion Truck Grower | Manufacturer |
| 42568 | | Hughes & Douglass, Rectorville |
| | **Read Phosphate Co., Nashville, Tenn.** | |
| 39937 | Read's Standard Tobacco Grower | Manufacturer |
| 42569 | | J. C. Cowherd & Co., Greensburg |
| 39938 | Read's High Grade Tobacco Grower | Manufacturer |
| 42570 | | Hatter Hardware Co., Franklin |
| 39939 | Read's High Grade Tobacco Special | Manufacturer |
| 42571 | | W. T. Kirkman, Elkton |
| 39940 | Read's Complete Tobacco Grower | Manufacturer |
| 39941 | Read's Red Diamond Tobacco Special | Manufacturer |
| 39942 | Read's Perfect Tobacco Fertilizer | Manufacturer |
| 42572 | | Hobdy & Read, Scottsville |

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | | POTASH. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate. | Estimated Value Per Ton. | Station Number. |
| 9.14 | 1.06 | 10.20 | | 0.45 | 0.92 | 1.37 | 1.66 | 2.34 | 0.70 | $19.37 | 42223 |
| *8.00* | *1.00* | *9.00* | | | | *1.23* | *1.50* | *2.50* | | *16.81* | |
| 8.67 | 1.16 | 9.83 | | 0.39 | 0.61 | 1.00 | 1.21 | 1.70 | 0.69 | 16.89 | 42224 |
| 8.48 | 0.94 | 9.42 | | | | 0.75 | 0.91 | 2.37 | | 15.56 | 42565 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *2.00* | | *14.87* | |
| 8.60 | 1.33 | 9.93 | | | | 1.16 | 1.41 | 3.08 | 0.87 | $19.03 | 42225 |
| 8.21 | 1.40 | 9.61 | | | | 0.75 | 0.91 | 4.02 | | 17.06 | 42566 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *4.00* | | *16.87* | |
| 8.67 | 1.58 | 10.25 | | | | 1.69 | 2.05 | | 6.27 | 24.47 | 42227 |
| 6.36 | 2.22 | 8.58 | | 0.56 | 1.11 | 1.67 | 2.03 | **0.82** | **4.68** | 20.81 | 42568 |
| *6.00* | *1.00* | *7.00* | | | | *1.65* | *2.00* | | *6.00* | *20.58* | |
| **6.19** | 4.33 | 10.52 | | | | 2.06 | 2.50 | 0.76 | 1.36 | 18.76 | 39937 |
| 8.10 | 3.86 | 11.96 | | 0.83 | 0.74 | 1.57 | 1.91 | 2.31 | | 19.07 | 42569 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| **6.30** | 3.06 | 9.36 | | | | 2.10 | 2.55 | 1.10 | 3.07 | 20.91 | 39938 |
| **7.20** | 6.07 | 13.27 | | | | 1.69 | 2.05 | **0.76** | **2.79** | 21.10 | 42570 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *4.00* | *21.78* | |
| 7.78 | 2.01 | 9.79 | | | | 2.04 | 2.48 | 1.24 | 6.55 | 26.38 | 39939 |
| **6.91** | 5.48 | 12.39 | | | | 1.37 | 1.66 | 0.86 | 8.03 | 25.78 | 42571 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *8.00* | *26.58* | |
| 8.48 | 3.33 | 11.81 | | | | 2.00 | 2.43 | | 10.20 | 30.75 | 39940 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *10.00* | *28.98* | |
| 8.88 | 1.89 | 10.77 | | | | 2.36 | 2.87 | | 11.51 | 33.49 | 39941 |
| *8.00* | *4.00* | *12.00* | | | | *2.47* | *3.00* | | *10.00* | *31.35* | |
| 10.59 | 2.59 | 13.18 | | | | 1.90 | 2.31 | 0.76 | 3.58 | 25.46 | 39942 |
| 10.59 | 2.84 | 13.43 | | | | 1.77 | 2.15 | **1.06** | **0.90** | **22.19** | 42572 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *4.00* | *24.18* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Read Phosphate Co.** | |
| 39943 | Read's Special Potato Grower | Manufacturer |
| 42573 | | G. W. Richardson, Somerset |
| 39944 | Read's Red Diamond Special | Manufacturer |
| 42574 | | W. T. Kirkman, Elkton |
| 39945 | Read's Blood and Bone No. 1 | Manufacturer |
| 39946 | Read's Russell County Special | Manufacturer |
| 39947 | Read'sHigh Grade Ammoniated Dissolved Bone. | Manufacturer |
| 42575 | | Blankenship & Richard, Jamestown. |
| 39948 | Read's Farmers Special Manure | Manufacturer |
| 42576 | | G. W. Richardson, Somerset |
| 39949 | Read's Blood and Bone Special | Manufacturer |
| 39950 | Read's Wheat and Clover Grower | Manufacturer |
| 39951 | Read's Corn and Wheat Grower | Manufacturer |
| 42577 | | T. J. Alexander, Monticello |
| 39953 | Read's Kentucky Tobacco Grower | Manufacturer |
| 39967 | Read's Soluble Bone | Manufacturer |
| 42261 | Read's Special Tomato Grower | *Manufacturer |

*The Manufacturer failed to furnish sample as required by law.

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | | POTASH. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate. | Estimated Value Per Ton. | Station Number. |
| 7.72 | 2.75 | 10.47 | | | | 1.99 | 2.42 | 1.38 | 5.39 | $25.18 | 39943 |
| 9.19 | 3.56 | 12.75 | | 0.62 | 0.70 | 1.32 | 1.60 | **5.38** | | **22.45** | 42573 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *6.00* | *24.18* | |
| 10.47 | 2.83 | 13.30 | | | | 2.97 | 3.61 | | 3.79 | 28.64 | 39944 |
| **8.32** | 3.67 | 11.99 | | 0.86 | 0.69 | **1.55** | 1.88 | 2.63 | | **19.51** | 42574 |
| *10.00* | *4.00* | *14.00* | | | | *2.47* | *3.00* | | *3.00* | *25.85* | |
| **6.68** | 3.99 | 10.67 | | | | 2.12 | 2.57 | 0.82 | 1.29 | 19.41 | 39945 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | *2.00* | | *18.98* | |
| 8.87 | 7.74 | 16.61 | | | | 1.35 | 1.64 | | 3.28 | 22.41 | 39946 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | *3.00* | | *17.07* | |
| 9.77 | 3.01 | 12.78 | | 0.69 | 1.36 | 2.05 | 2.49 | 2.68 | | 22.78 | 39947 |
| **9.09** | 6.76 | 15.85 | | | | 1.47 | 1.78 | 2.41 | | 21.17 | 42575 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | *2.00* | | *21.38* | |
| 11.25 | 1.96 | 13.21 | | 0.67 | 0.58 | 1.25 | 1.52 | 3.88 | | 22.54 | 39948 |
| 9.56 | 4.07 | 13.63 | | 0.32 | 0.43 | 0.75 | 0.91 | 3.03 | | 18.76 | 42576 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | *3.00* | | *19.47* | |
| 11.64 | 2.31 | 13.95 | | 0.63 | 0.63 | 1.26 | 1.53 | 1.61 | | 20.91 | 39949 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | *1.00* | | *17.47* | |
| 9.61 | 3.26 | 12.87 | | 0.67 | 0.63 | 1.30 | 1.58 | 2.64 | | 20.02 | 39950 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | *2.00* | | *18.47* | |
| 11.05 | 4.77 | 15.82 | | 0.41 | 0.47 | 0.88 | 1.07 | 1.75 | | 20.00 | 39951 |
| 10.79 | 4.54 | 15.33 | | | | 0.46 | 0.56 | 1.29 | | 17.67 | 42577 |
| *11.00* | *3.00* | *14.00* | | | | *0.41* | *0.50* | *1.00* | | *16.84* | |
| 7.86 | 5.48 | 13.34 | | | | 1.49 | 1.81 | 0.72 | 0.85 | 18.58 | 39953 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *1.00* | *15.27* | |
| 7.91 | 6.40 | 14.31 | | 0.62 | 0.59 | 1.21 | 1.47 | 2.47 | | 18.76 | 39967 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | *2.00* | | *16.03* | |
| | | | | | | | | | | | 42261 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | | *8.00* | *25.78* | |

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Smith Agr'l Chemical Co., Columbus, Ohio.** | |
| 42178 | Ohio Farmers Wheat Maker and Seeding Down. | Manufacturer |
| 42179<br>42595 | Ohio Farmers Corn, Oats and Wheat Fertilizer | Manufacturer<br>G. G. Hardyman, Rectorville |
| 42180<br>42596 | Ohio Farmers Tobacco Grower | Manufacturer<br>Staggs Bros., Vanceburg |
| 42181 | Abbott & Martin Harvest King | Manufacturer |
| | **Southern Fertilizer Co., Louisville, Ky.** | |
| 42064 | Elk Grain Grower | Manufacturer |
| 42065<br>42599 | Elk Special Tobacco Grower | Manufacturer<br>Chas. Ratliff, Princeton |
| 42066<br>42600 | Atlas Tobacco Grower | Manufacturer<br>Chas. Ratliff, Princeton |
| 42299 | Elk Corn and Wheat Grower | Manufacturer |
| 42327 | Elk Raw Bone Mixture | Manufacturer |
| | **Swift & Co., Chicago, Ill.** | |
| 39825<br>42601 | Swift's Superphosphate | Manufacturer<br>Duke & Farris, Cave City |

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate. | | |
| 9.10 | 1.43 | 10.53 | | | | 0.77 | 0.93 | 2.23 | | $16.42 | 42178 |
| *8.00* | | | | | | *0.82* | *1.00* | *2.00* | | *14.47* | |
| 8.36 | 2.22 | 10.58 | | | | 1.53 | 1.86 | 3.59 | | 19.87 | 42179 |
| 8.70 | 3.86 | 12.56 | | | | 1.60 | 1.94 | 2.48 | | 20.06 | 42595 |
| *8.00* | | | | | | *1.65* | *2.00* | *2.00* | | *17.38* | |
| 7.83 | 1.53 | 9.36 | | | | 1.04 | 1.26 | 4.79 | | 20.44 | 42180 |
| 8.58 | 1.67 | 10.25 | | 0.71 | | 0.71 | 0.86 | 4.43 | | 17.89 | 42596 |
| *8.00* | | | | | | *0.82* | *1.00* | *4.00* | | *16.47* | |
| 7.80 | 2.68 | 10.48 | | | | 1.56 | 1.89 | 2.45 | | 18.34 | 42181 |
| *8.00* | | | | | | *1.65* | *2.00* | *2.00* | | *17.38* | |
| 7.99 | 1.49 | 9.48 | 0.21 | | 0.37 | 0.58 | 0.70 | | 5.41 | 18.71 | 42064 |
| *8.00* | *1.00* | *9.00* | | | | *0.41* | *0.50* | | *4.00* | *16.24* | |
| 7.82 | 1.45 | 9.27 | 0.23 | | 0.37 | 0.60 | 0.73 | | 5.41 | 18.55 | 42065 |
| 7.51 | 0.48 | 7.99 | | | | 0.28 | 0.34 | 3.00 | 0.79 | **14.13** | 42599 |
| *8.00* | *1.00* | *9.00* | | | | *0.41* | *0.50* | | *4.00* | *16.24* | |
| 7.28 | 1.20 | 8.48 | 0.50 | | 0.38 | 0.88 | 1.07 | | 8.66 | 22.69 | 42066 |
| 7.64 | 0.59 | 8.23 | 0.23 | | 0.27 | **0.50** | 0.61 | **1.00** | **4.47** | **17.52** | 42600 |
| *7.00* | *1.00* | *8.00* | | | | *0.82* | *1.00* | | *7.00* | *20.07* | |
| 7.16 | 1.34 | 8.50 | 0.54 | | 0.37 | 0.91 | 1.10 | | 1.49 | 14.11 | 42299 |
| *7.00* | *1.00* | *8.00* | | | | *0.82* | *1.00* | | *1.00* | *12.87* | |
| 8.29 | 8.92 | 17.21 | | | | 1.96 | 2.38 | | 1.30 | 21.93 | 42327 |
| *6.00* | *9.00* | *15.00* | | | | *1.65* | *2.00* | | *1.00* | *17.78* | |
| 8.37 | 5.95 | 14.32 | 0.29 | | 1.66 | 1.95 | 2.37 | 2.71 | | 21.96 | 39825 |
| 8.01 | 3.06 | 11.07 | 0.22 | | 1.34 | 1.56 | 1.89 | 2.25 | | 18.54 | 42601 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | *2.00* | | *17.78* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Swift & Co,** | |
| 39826 | Swift's Onion, Potato and Tobacco Fertilizer ..... | Manufacturer ..... |
| 42602 | | Duke & Farris, Cave City ..... |
| 39827 | Swift's Champion Wheat and Corn Grower ..... | Manufacturer ..... |
| 42603 | | E. T. Pence, Jr., Stanford ..... |
| 39828 | Swift's Complete Fertilizer ..... | Manufacturer ..... |
| 42604 | | Barren Co. Grocery & Hardware Co., Glasgow ..... |
| 39829 | Swift's Tobacco and Truck Grower ..... | Manufacturer ..... |
| 42605 | | Line & Webb, Munfordville ..... |
| 39830 | Swift's Kentucky Tobacco Grower ..... | Manufacturer ..... |
| 42606 | | Duke & Farris, Cave City ..... |
| 39831 | Swift's Vegetable and Tobacco Grower ..... | Manufacturer ..... |
| 42607 | | Barren Co. Grocery & Hardware Co., Glasgow ..... |
| 39832 | Swift's Diamond "A" Fertilizer ..... | Manufacturer ..... |
| 39833 | Swift's Diamond "B" Fertilizer ..... | Manufacturer ..... |
| 39834 | Swift's Corn, Wheat and Oats Fertilizer ..... | Manufacturer ..... |
| 42190 | Swift's Pure Special Wheat Grower, Pure Bone and Potash ..... | Manufacturer ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate. | | |
| 8.64 | 0.55 | 9.19 | 0.53 | | 1.24 | 1.77 | 2.15 | 0.88 | 6.66 | $25.66 | 39826 |
| 7.95 | 2.26 | 10.21 | | | | 1.59 | 1.93 | | 6.86 | 24.24 | 42602 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | | *7.00* | *24.18* | |
| 12.66 | 0.97 | 13.63 | 0.20 | | 1.87 | 2.07 | 2.51 | 2.48 | | 25.31 | 39827 |
| 12.17 | 2.52 | 14.69 | 0.40 | | 1.38 | 1.78 | 2.16 | 2.41 | | 24.25 | 42603 |
| *12.00* | *1.00* | *13.00* | | | | *1.65* | *2.00* | *2.00* | | *22.58* | |
| **7.18** | 4.18 | 11.36 | | | | 1.30 | 1.58 | 1.46 | | 16.30 | 39828 |
| 7.52 | 1.70 | 9.22 | 0.30 | | 0.62 | 0.92 | 1.12 | 1.26 | | 14.18 | 42604 |
| *8.00* | *0.50* | *8.50* | | | | *0.82* | *1.00* | *1.00* | | *13.67* | |
| 8.08 | 3.97 | 12.05 | 0.25 | | 1.03 | 1.28 | 1.55 | | 3.95 | 20.51 | 39829 |
| 8.00 | 1.31 | 9.31 | | | | 0.66 | 0.80 | | 3.80 | 16.99 | 42605 |
| *8.00* | *0.50* | *8.50* | | | | *0.82* | *1.00* | | *4.00* | *17.47* | |
| 11.41 | 2.09 | 13.50 | 0.35 | | 1.75 | 2.10 | 2.55 | 2.77 | | 24.65 | 39830 |
| **8.96** | 2.54 | 11.50 | 0.34 | | 1.22 | 1.56 | 1.89 | 2.15 | | 19.38 | 42606 |
| *10.00* | *1.00* | *11.00* | | | | *1.65* | *2.00* | *2.00* | | *20.18* | |
| 9.43 | 0.51 | 9.94 | 0.47 | | 2.42 | 2.89 | 3.51 | | 11.53 | 35.48 | 39831 |
| 7.53 | 1.85 | 9.38 | | | | 2.56 | 3.11 | | 10.02 | 30.76 | 42607 |
| *8.00* | *1.00* | *9.00* | | | | *2.47* | *3.00* | | *10.00* | *30.65* | |
| 9.83 | 0.52 | 10.35 | 1.07 | | 1.54 | 2.61 | 3.17 | 3.75 | | 24.90 | 39832 |
| *8.00* | *1.00* | *9.00* | | | | *2.47* | *3.00* | *3.00* | | *21.65* | |
| 10.16 | 0.19 | 10.35 | 1.07 | | 1.67 | 2.74 | 3.33 | 5.26 | | 27 12 | 39833 |
| *8.00* | *1.00* | *9.00* | | | | *2.47* | *3.00* | *5.00* | | *23.65* | |
| 12.61 | 1.28 | 13.89 | 0.21 | | 0.95 | 1.16 | 1.41 | 4.43 | | 24.13 | 39834 |
| *11.00* | *0.50* | *11.50* | | | | *0.82* | *1.00* | *4.00* | | *20.27* | |
| 10.55 | 10.08 | 20.63 | | | | 1.35 | 1.64 | 3.49 | | 24.91 | 42190 |
| *8.00* | *8.00* | *16.00* | | | | *1.20* | *1.46* | *3.00* | | *20.00* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Taylor & Powell Fertilizer Co., Springfield, Tenn.** | |
| 42302 | No. 4 Tobacco Grower.. | Manufacturer ..... |
| 42307 | Grain Special ..... | Manufacturer ..... |
| 42328 | Money Maker for Wheat. | Manufacturer ..... |
| | **Tennessee Chemical Co., Nashville, Tenn.** | |
| 39706 | Ox Ammoniated Bone ... | Manufacturer ..... |
| 39707 | Ox High Grade Tobacco and Potato Grower ..... | Manufacturer ..... |
| 42613 | | I. K. Miller & Sons, Campbellsville. |
| 39709 | Ox Truck Grower ..... | Manufacturer ..... |
| 42615 | | W. F. Grainger, Franklin ..... |
| 39712 | Ox Special Tobacco Grower ..... | Manufacturer ..... |
| 42617 | | F. A. Yost Co., Hopkinsville ..... |
| 39713 | Ox High Grade Tobacco Grower ..... | Manufacturer ..... |
| 42618 | | W. F. Grainger, Franklin ..... |
| 39721 | Ox Special Corn and Wheat Grower ..... | Manufacturer ..... |
| 42623 | | J. M. Johnson & Sons, Benton ..... |
| 39722 | Ox Pride Tobacco Grower | Manufacturer ..... |
| 42624 | | I. K. Miller & Sons, Campbellsville.. |
| 39723 | Ox Grain Grower ..... | Manufacturer ..... |
| 42625 | | R. E. Moore Hdw. Co., Madisonville. |

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | | POTASH. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate. | Estimated Value Per Ton. | Station Number. |
| 8.70 | 1.98 | 10.68 | 0.47 | | 1.59 | 2.06 | 2.50 | 1.72 | 2.96 | $23.71 | 42302 |
| *8.00* | | | | | | *2.06* | *2.50* | | *4.00* | *21.61* | |
| 11.94 | 3.23 | 15.17 | | | | 1.11 | 1.35 | 3.61 | | 23.12 | 42307 |
| *12.00* | | | | | | *0.82* | *1.00* | *2.00* | | *19.27* | |
| 8.93 | 1.48 | 10.41 | | | | 1.18 | 1.43 | 3.00 | | 18.44 | 42328 |
| *8.00* | | | | | | *1.23* | *1.50* | *2.50* | | *16.41* | |
| 10.89 | 1.58 | 12.47 | | | | 1.64 | 1.99 | 0.68 | 1.85 | 22.34 | 39706 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 7.66 | 1.30 | 8.96 | | | | 1.86 | 2.26 | 1.18 | 3.93 | 22.12 | 39707 |
| 8.02 | 1.08 | 9.10 | | 0.93 | 0.85 | 1.78 | 2.16 | 1.16 | 3.48 | 21.62 | 42613 |
| *7.00* | *4.00* | *11.00* | | | | *1.65* | *2.00* | | *4.00* | *20.58* | |
| 8.19 | 0.91 | 9.10 | | 1.37 | 0.35 | 1.72 | 2.09 | 1.30 | 10.85 | 30.97 | 39709 |
| 8.73 | 2.49 | 11.22 | 0.31 | | 1.19 | 1.50 | 1.82 | **1.54** | **7.08** | **26.77** | 42615 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *10.00* | *28.98* | |
| 10.67 | 0.18 | 10.85 | | | | 1.59 | 1.93 | 1.74 | 9.32 | 31.36 | 39712 |
| **9.41** | 1.87 | 11.28 | 0.24 | | 1.20 | 1.44 | 1.75 | | 10.64 | **29.85** | 42617 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *10.00* | *31.38* | |
| 8.97 | 0.37 | 9.34 | | 1.14 | 0.54 | 1.68 | 2.04 | 2.48 | 3.18 | 23.09 | 39713 |
| 8.71 | 3.66 | 12.37 | 0.25 | | 1.28 | 1.53 | 1.86 | 0.92 | 4.24 | 23.28 | 42618 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *5.00* | *22.98* | |
| 6.97 | 0.88 | 7.85 | | | | 0.82 | 1.00 | 0.74 | 0.44 | **12.85** | 39721 |
| 8.28 | 3.09 | 11.37 | 0.22 | 0.21 | 1.11 | 1.54 | 1.87 | 3.39 | | 19.96 | 42623 |
| *7.00* | *4.00* | *11.00* | | | | *0.82* | *1.00* | | *1.00* | *14.07* | |
| 8.70 | 0.50 | 9.20 | | | | 0.78 | 0.95 | 1.91 | | 15.28 | 39722 |
| 9.56 | 1.03 | 10.59 | 0.39 | | 0.49 | 0.88 | 1.07 | 1.24 | 0.75 | 17.10 | 42624 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | | *1.50* | *15.87* | |
| 8.28 | 0.36 | 8.64 | | | | 0.39 | 0.47 | 0.64 | 3.83 | 16.69 | 39723 |
| 7.95 | 6.82 | 14.77 | | | | 0.37 | 0.45 | | 5.94 | 20.70 | 42625 |
| *8.00* | *4.00* | *12.00* | | | | *0.41* | *0.50* | | *4.00* | *17.44* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Tennessee Chemical Co.** | |
| 39724 | Ox Slaughter House Bone | Manufacturer |
| 42626 | | W. F. Grainger, Franklin |
| 39725 | Ox Special Tobacco Guano | Manufacturer |
| 42627 | | W. F. Grainger, Franklin |
| | **Tuscarora Fertilizer Co., Nashville, Tenn.** | |
| 42110 | Tuscarora Wheat and Corn Grower | Manufacturer |
| 42111 | Tuscarora Dark Tobacco Grower | Manufacturer |
| 42112 | Tuscarora Trucker | Manufacturer |
| 42113 | Tuscarora Tobacco Special | Manufacturer |
| 42114 | Tuscarora Standard | Manufacturer |
| 42115 | Tuscarora Big Four | Manufacturer |
| 42116 | Tuscarora Ammoniated Phosphate | Manufacturer |
| 42125 | Dickinson's Corn, Wheat and Oats Grower | Manufacturer |
| 42126 | Dickinson's Tobacco and Potato Grower | Manufacturer |
| 42633 | | Dickinson Bros., Glasgow |
| 42127 | Dickinson's High Grade Potash Mixture | Manufacturer |
| 42634 | | Dickinson Bros., Glasgow |

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | | POTASH. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate | Estimated Value Per Ton. | Station Number. |
| 8.47 | 0.66 | 9.13 | | 1.05 | 0.73 | 1.78 | 2.16 | 1.38 | 1.32 | $19.61 | 39724 |
| 8.62 | 4.39 | 13.01 | 0.45 | | 1.14 | 1.59 | 1.93 | 1.04 | 2.08 | 21.21 | 42626 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| 11.03 | 1.36 | 12.39 | | | | 1.72 | 2.09 | 0.64 | 1.88 | 22.70 | 39725 |
| 9.60 | 3.48 | 13.08 | 0.34 | | 0.99 | 1.33 | 1.61 | 0.98 | 3.03 | 22.19 | 42627 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 10.00 | 1.35 | 11.35 | | | | 1.77 | 2.15 | 2.14 | | 20.88 | 42110 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | *2.00* | | *21.38* | |
| 7.90 | 1.08 | 8.98 | | | | 1.85 | 2.25 | | 11.00 | 29.59 | 42111 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *10.00* | *28.98* | |
| 7.53 | 1.49 | 9.02 | | 2.61 | 1.85 | 4.46 | 5.41 | 7.50 | | 32.75 | 42112 |
| *8.00* | *4.00* | *12.00* | | | | *4.12* | *5.00* | *7.00* | | *32.62* | |
| 8.13 | 1.52 | 9.65 | | | | 1.77 | 2.15 | 0.68 | 4.52 | 22.67 | 42113 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *5.00* | *22.98* | |
| 8.46 | 1.28 | 9.74 | | | | 1.84 | 2.23 | 2.19 | | 19.29 | 42114 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | *2.00* | | *18.98* | |
| 7.03 | 1.19 | 8.22 | | | | 1.82 | 2.21 | | 4.21 | 20.34 | 42115 |
| *7.00* | *4.00* | *11.00* | | | | *1.65* | *2.00* | | *4.00* | *20.58* | |
| 7.56 | 3.25 | 10.81 | | | | 1.01 | 1.23 | 1.41 | | 15.32 | 42116 |
| *7.00* | *4.00* | *11.00* | | | | *0.82* | *1.00* | *1.00* | | *13.87* | |
| 8.00 | 1.26 | 9.26 | | | | 1.76 | 2.14 | 2.21 | | 18.47 | 42125 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | *2.00* | | *18.98* | |
| 6.97 | 1.49 | 8.46 | | | | 1.78 | 2.16 | | 4.26 | 20.30 | 42126 |
| 7.99 | 4.49 | 12.48 | | | | 1.37 | 1.66 | 0.70 | 4.27 | 22.01 | 42632 |
| *7.00* | *4.00* | *11.00* | | | | *1.65* | *2.00* | | *4.00* | *20.58* | |
| 8.14 | 1.34 | 9.48 | | | | 1.82 | 2.21 | | 10.67 | 29.48 | 42127 |
| 7.91 | 0.99 | 8.90 | 0.23 | | 1.52 | 1.75 | 2.12 | 1.14 | 8.55 | **27.42** | 42634 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *10.00* | *28.98* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Tuscarora Fertilizer Co.** | |
| 42248 | Dickinson's No. 10510 Fertilizer | Manufacturer |
| | **Virginia-Carolina Chemical Co., Cincinnati, Ohio.** | |
| 39797 | Tip Top Tomato Grower | Manufacturer |
| 39798 | Diamond Potash Formula For Wheat and Corn | Manufacturer |
| 39799 | Royal Vegetable Fertilizer | Manufacturer |
| 39800 | Scott's State Standard Guano | Manufacturer |
| 39801 | Game Cock Grain and Grass Grower | Manufacturer |
| 39802 | Game Cock Wheat and Corn Compound | Manufacturer |
| 42635 | | R. H. West, Junction City |
| 39803 | Monarch Ammoniated Dissolved Bone and Potash | Manufacturer |
| 42636 | | R. H. Chrisman, Berea |
| 39804 | Standard Wheat and Corn Grower | Manufacturer |
| 42637 | | W. E. Gravely, Brodhead |
| 39805 | Bright Leaf Tobacco and Truck Grower | Manufacturer |
| 42638 | | Silas Shelburn, Lexington |
| 39806 | Complete Fertilizer | Manufacturer |

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | | POTASH. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate. | Estimated Value Per Ton. | Station Number. |
| 9.74 | 0.91 | 10.65 | | 4.00 | 0.37 | 4.37 | 5.31 | | 12.06 | $41.82 | 42248 |
| *10.00* | *4.00* | *14.00* | | | | *4.12* | *5.00* | | *10.00* | *40.02* | |
| 7.94 | 0.82 | 8.76 | | 2.75 | 0.61 | 3.36 | 4.08 | | 5.05 | 27.68 | 39797 |
| *7.00* | *1.50* | *8.50* | | | | *3.29* | *4.00* | | *5.00* | *26.52* | |
| 10.16 | 0.97 | 11.13 | | 0.35 | 0.29 | 0.64 | 0.78 | 4.75 | | 19.57 | 39798 |
| *9.00* | *1.50* | *10.50* | | | | *0.41* | *0.50* | *5.00* | | *17.84* | |
| 9.42 | 0.73 | 10.15 | | 2.11 | 0.62 | 2.73 | 3.31 | 3.04 | 1.24 | 25.68 | 39799 |
| *8.00* | *1.50* | *9.50* | | | | *2.47* | *3.00* | *4.00* | | *22.85* | |
| 9.25 | 1.56 | 10.81 | | 1.04 | 0.69 | 1.73 | 2.10 | 2.00 | | 19.78 | 39800 |
| *8.00* | *1.50* | *9.50* | | | | *1.65* | *2.00* | *2.00* | | *17.98* | |
| 10.92 | 1.15 | 12.07 | | 0.53 | 0.42 | 0.95 | 1.15 | 3.14 | | 20.03 | 39801 |
| *10.00* | *1.50* | *11.50* | | | | *0.82* | *1.00* | *3.00* | | *18.47* | |
| 10.88 | 1.16 | 12.04 | | 0.55 | 0.40 | 0.95 | 1.15 | 2.24 | | 19.09 | 39802 |
| 11.01 | 2.31 | 13.32 | | 0.32 | 0.81 | 1.13 | 1.37 | 2.95 | | 21.04 | 42635 |
| *10.00* | *1.50* | *11.50* | | | | *0.82* | *1.00* | | *2.00* | *17.87* | |
| 12.21 | 0.66 | 12.87 | | 1.19 | 0.30 | 1.49 | 1.81 | 2.34 | 0.69 | 23.30 | 39803 |
| 12.25 | 1.61 | 13.86 | | 1.14 | 0.35 | 1.49 | 1.81 | 1.94 | 1.67 | 24.50 | 42636 |
| *12.00* | *1.50* | *13.50* | | | | *1.23* | *1.50* | | *3.00* | *22.91* | |
| 11.31 | 1.22 | 12.53 | | 0.58 | 0.41 | 0.99 | 1.20 | 3.25 | | 20.78 | 39804 |
| 11.42 | 1.98 | 13.40 | | 0.46 | 0.42 | 0.88 | 1.07 | 3.05 | | 20.62 | 42637 |
| *11.00* | *1.50* | *12.50* | | | | *0.82* | *1.00* | *3.00* | | *19.67* | |
| 7.25 | 0.79 | 8.04 | | 1.10 | 0.68 | 1.78 | 2.16 | 1.40 | 4.99 | 22.64 | 39805 |
| 5.60 | 2.52 | 8.12 | | 1.00 | 0.96 | 1.96 | 2.38 | 1.16 | 5.66 | 22.58 | 42638 |
| *6.00* | *1.50* | *7.50* | | | | *1.65* | *2.00* | | *6.00* | *20.78* | |
| 9.30 | 1.87 | 11.17 | | 1.07 | 0.67 | 1.74 | 2.11 | 2.10 | | 20.10 | 39806 |
| *8.00* | *1.50* | *9.50* | | | | *1.65* | *2.00* | *2.00* | | *17.98* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Virginia-Carolina Chemical Co.** | |
| 39807 | Wheat, Corn and Tobacco Grower | Manufacturer |
| 42639 | | D. E. Patterson, Hodgenville |
| 39808 | Champion Corn and Wheat Grower | Manufacturer |
| 39809 | Standard Wheat Special | Manufacturer |
| 39810 | Star Brand Grain Grower | Manufacturer |
| 39811 | Royal Tobacco Fertilizer. | Manufacturer |
| 42640 | | R. H. West, Junction City |
| 39812 | National Tobacco Fertilizer | Manufacturer |
| 39813 | Beef, Blood and Bone | Manufacturer |
| 42642 | | Grigsby & Co., Bardstown |
| 39814 | Royal Blood, Bone and Potash | Manufacturer |
| 39901 | Grigsby's Wheat Special | Manufacturer |
| 42648 | | Grigsby & Co., Bardstown |
| 42175 | Kentucky Burley Tobacco Special | Manufacturer |
| 42649 | | R. H. West, Junction City |
| 42260 | High Grade Top Dresser for Wheat, Oats and Corn | Manufacturer |
| 42266 | Miller's Wheat, Corn and Tobacco Special | Manufacturer |

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate. | | |
| 8.96 | 1.62 | 10.58 | | 0.62 | 0.44 | 1.06 | 1.29 | 4.04 | | $19.15 | 39807 |
| 9.36 | 2.11 | 11.47 | | | | 0.88 | 1.07 | 3.76 | | 18.91 | 42639 |
| *8.00* | *1.50* | *9.50* | | | | *0.82* | *1.00* | *4.00* | | *17.07* | |
| 9.62 | 1.26 | 10.88 | | 0.59 | 0.48 | 1.07 | 1.30 | 2.21 | | 18.00 | 39808 |
| *8.00* | *1.50* | *9.50* | | | | *0.82* | *1.00* | *2.00* | | *15.07* | |
| 11.66 | 1.05 | 12.71 | | 0.59 | 0.39 | 0.98 | 1.19 | 3.29 | | 21.13 | 39809 |
| *11.00* | *1.50* | *12.50* | | | | *0.82* | *1.00* | *3.00* | | *19.67* | |
| 9.70 | 1.44 | 11.14 | | 0.80 | 0.60 | 1.40 | 1.70 | 2.19 | | 19.31 | 39810 |
| *8.00* | *1.50* | *9.50* | | | | *1.23* | *1.50* | *2.00* | | *16.51* | |
| 9.32 | 0.92 | 10.24 | | 1.12 | 0.63 | 1.75 | 2.12 | 1.18 | 4.38 | 24.12 | 39811 |
| 9.27 | 1.66 | 10.93 | | 0.95 | 0.76 | 1.71 | 2.08 | | 6.55 | 25.63 | 42640 |
| *8.00* | *1.50* | *9.50* | | | | *1.65* | *2.00* | | *5.00* | *21.98* | |
| 7.71 | 1.02 | 8.73 | | 1.38 | 0.35 | 1.73 | 2.10 | 1.14 | 3.15 | 20.64 | 39812 |
| *7.00* | *1.50* | *8.50* | | | | *1.65* | *2.00* | | *4.00* | *19.58* | |
| 9.04 | 1.76 | 10.80 | | 1.08 | 0.64 | 1.72 | 2.09 | 1.99 | | 19.56 | 39813 |
| 8.61 | 3.12 | 11.73 | | | | 1.58 | 1.92 | 2.54 | | 19.65 | 42642 |
| *8.00* | *1.50* | *9.50* | | | | *1.65* | *2.00* | *2.06* | | *17.98* | |
| 9.00 | 1.99 | 10.99 | | 0.98 | 0.75 | 1.73 | 2.10 | 2.07 | | 19.73 | 39814 |
| *8.00* | *1.50* | *9.50* | | | | *1.65* | *2.00* | *2.00* | | *17.98* | |
| 11.65 | 1.99 | 13.64 | | | | 1.00 | 1.21 | 0.56 | 1.49 | 20.63 | 39901 |
| 10.77 | 2.11 | 12.88 | | | | 0.84 | 1.02 | 1.12 | 2.47 | 20.78 | 42648 |
| *10.00* | *2.00* | *12.00* | | | | *0.82* | *1.00* | | *2.00* | *18.07* | |
| 10.92 | 0.52 | 11.44 | | 1.33 | 0.46 | 1.79 | 2.17 | | 10.24 | 31.87 | 42175 |
| 10.65 | 1.78 | 12.43 | | 1.08 | 0.55 | 1.63 | 1.98 | | **8.12** | **28.94** | 42649 |
| *10.00* | *2.00* | *12.00* | | | | *1.65* | *2.00* | | *10.00* | *30.58* | |
| 9.30 | 4.04 | 13.34 | 2.80 | | 0.43 | 3.23 | 3.92 | 6.88 | | 30.97 | 42260 |
| *8.00* | *1.50* | *9.50* | | | | *3.29* | *4.00* | *6.00* | | *27.72* | |
| 10.94 | 3.00 | 13.94 | | | | 0.9? | 1.13 | | 2.59 | 20.70 | 42266 |
| *10.00* | *2.00* | *12.00* | | | | *0.82* | *1.00* | | *2.00* | *18.07* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Virginia-Carolina Chemical Co.** | |
| 42269 | Champion Tobacco Grower ..... | Manufacturer ..... |
| 42650 | | Silas Shelburn, Lexington ..... |
| | **Virginia-Carolina Chemical Co., Memphis, Tenn.** | |
| 42272 | Beef, Blood and Bone Fertilizer ..... | Manufacturer ..... |
| 42273 | Royal Blood, Bone and Potash ..... | Manufacturer ..... |
| 42274 | Scott's State Standard Guano ..... | Manufacturer ..... |
| 42275 | Royal Vegetable Fertilizer | Manufacturer ..... |
| 42276 | National Tobacco Fertilizer ..... | Manufacturer ..... |
| 42641 | | Eldred Hardware Co., Princeton ... |
| 42277 | Royal Tobacco Fertilizer. | Manufacturer ..... |
| 42278 | Champion Corn and Wheat Grower ..... | Manufacturer ..... |
| 42280 | Eureka Special Fertilizer. | Manufacturer ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | | POTASH. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate. | Estimated Value Per Ton. | Station Number. |
| 5.15 | 1.76 | 6.91 | | 0.81 | 0.84 | 1.65 | 2.00 | 2.28 | 7.91 | $24.43 | 42269 |
| 4.82 | 2.89 | 7.71 | 0.59 | | 1.04 | 1.63 | 1.98 | | 9.89 | 24.62 | 42650 |
| *5.00* | *1.50* | *6.50* | | | | *1.65* | *2.00* | | *10.00* | *24.38* | |
| 8.25 | 1.49 | 9.74 | 0.73 | | 0.91 | 1.64 | 1.99 | 2.97 | | 19.21 | 42272 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |
| 8.13 | 1.52 | 9.65 | 0.84 | | 0.93 | 1.77 | 2.15 | 2.75 | | 19.32 | 42273 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |
| 9.59 | 0.51 | 10.10 | | | | 1.47 | 1.78 | 2.98 | | 19.84 | 42274 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |
| 8.91 | 1.38 | 10.29 | 1.71 | | 1.31 | 3.02 | 3.67 | 4.33 | | 26.14 | 42275 |
| *8.00* | *2.00* | *10.00* | | | | *2.47* | *3.00* | *4.00* | | *23.05* | |
| 7.13 | 1.54 | 8.67 | 0.46 | | 1.30 | 1.76 | 2.14 | 0.78 | 4.26 | 21.23 | 42276 |
| 7.70 | 1.06 | 8.76 | | | | 1.79 | 2.17 | 2.70 | 1.59 | 20.54 | 42641 |
| *7.00* | *2.00* | *9.00* | | | | *1.65* | *2.00* | | *4.00* | *19.78* | |
| 8.49 | 1.40 | 9.89 | 1.37 | | 0.93 | 2.30 | 2.79 | 2.84 | 3.40 | 25.72 | 42277 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | | *5.00* | *21.78* | |
| 7.96 | 1.33 | 9.29 | | | | 0.82 | 1.00 | 1.92 | | 14.87 | 42278 |
| *8.00* | *2.00* | *10.00* | | | | *0.82* | *1.00* | *2.00* | | *15.27* | |
| 10.49 | 1.50 | 11.99 | | | | 0.88 | 1.07 | 5.22 | | 21.49 | 42280 |
| *10.00* | *2.00* | *12.00* | | | | *0.82* | *1.00* | *5.00* | | *20.67* | |

PART I, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Wood, Stubbs & Co., Louisville, Ky.** | |
| 39701 | Acme Brand Potato and Tobacco Fertilizer ..... | Manufacturer ..... |
| 42651 | | Hausgen Fulton Co., Anchorage ... |
| 39702 | Acme Brand High Grade Vegetable Fertilizer .... | Manufacturer ..... |
| 39703 | Acme Brand Special Truckers Fertilizer ..... | Manufacturer ..... |
| 39704 | Acme Brand Blood, Bone and Potash ..... | Manufacturer ..... |
| 39705 | Acme Brand Wheat and Corn Fertilizer ..... | Manufacturer ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | | POTASH. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | From Muriate. | From Sulphate. | Estimated Value Per Ton. | Station Number. |
| 10.14 | 2.35 | 12.49 | 0.99 | | 1.85 | 2.84 | 3.45 | | 7.35 | $31.87 | 39701 |
| 8.15 | 0.88 | 9.03 | 0.63 | | 1.78 | 2.41 | 2.93 | | 7.00 | 26.97 | 42651 |
| *8.00* | *4.00* | *12.00* | | | | *2.47* | *3.00* | | *6.00* | *27.05* | |
| 10.00 | 1.81 | 11.81 | 1.65 | | 1.91 | 3.56 | 4.32 | | 5.40 | 31.66 | 39702 |
| *8.00* | *4.00* | *12.00* | | | | *3.29* | *4.00* | | *4.00* | *27.52* | |
| 9.76 | 6.29 | 16.05 | 0.90 | | 1.59 | 2.49 | 3.02 | | 3.65 | 27.33 | 39703 |
| *8.00* | *4.00* | *12.00* | | | | *2.47* | *3.00* | | *2.00* | *22.25* | |
| 12.18 | 3.25 | 15.43 | | | | 1.98 | 2.40 | | 2.72 | 26.11 | 39704 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 12.37 | 5.21 | 17.58 | | | | 1.28 | 1.55 | | 2.49 | 24.39 | 39705 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | | *2.00* | *18.87* | |

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The American Agr'l Chemical Co., Cincinnati Sales Department, Cincinnati, O.** | |
| 39995 | Pure Ground Bone ..... | Manufacturer ..... |
| 39996 | Fine Raw Bone ..... | Manufacturer ..... |
| | **The American Agr'l Chemical Co., Bowker Fertilizer Works, Cincinnati, Ohio.** | |
| 42011 | Bowker's Pure Bone and Potash Mixture ..... | Manufacturer ..... |
| 42012 | Bowker's Pure Ground Bone ..... | Manufacturer ..... |
| 42349 | | T. E. Richardson, Campbellsville ... |
| | **The American Agr'l Chemical Co., Michigan Carbon Works, Cincinnati, Ohio.** | |
| 42036 | Wolverine Pure Ground Bone ..... | *Manufacturer ..... |
| | **The American Agr'l Chemical Co., Cincinnati Sales Department, Cincinnati, O.** | |
| 42051 | N. W. Horseshoe Brand Pure Ground Bone ..... | Manufacturer ..... |
| 42063 | Packers Boar's Head Brand Chicago Bone Meal | Manufacturer ..... |

*The Manufacturer failed to furnish sample as required by law.

## Bones, Tankage &c.

| PERCENTAGE OF FINENESS | | Total Phosphoric Acid. | Equivalent to Bone Phosphate. | Nitrogen. | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| Fine Bone. | Medium Bone. | | | | | From Muriate. | From Sulphate | | |
| 75 | 25 | 21.12 | 46.13 | 2.44 | 2.96 | | | $24.38 | 39995 |
| | | *20.00* | *43.67* | *2.47* | *3.00* | | | *20.65* | |
| 87 | 13 | 23.38 | 51.06 | 3.64 | 4.42 | | | 30.83 | 39996 |
| | | *22.00* | *48.06* | *3.29* | *4.00* | | | *24.72* | |
| 73 | 27 | 19.76 | 43.15 | 1.02 | 1.24 | 4.31 | | 22.62 | 42011 |
| | | *18.00* | *39.31* | *0.82* | *1.00* | *3.00* | | *16.67* | |
| 75 | 25 | 21.09 | 46.06 | 2.32 | 2.82 | | | 23.94 | 42012 |
| 74 | 26 | 19.91 | 43.47 | 2.61 | 3.17 | | | 24.03 | 42349 |
| | | *20.00* | *43.67* | *2.47* | *3.00* | | | *20.65* | |
| | | *20.00* | *43.67* | *2.47* | *3.00* | | | *20.65* | 42036 |
| 81 | 19 | 21.19 | 46.27 | 2.49 | 3.02 | | | 24.87 | 42051 |
| | | *20.00* | *43.67* | *2.47* | *3.00* | | | *20.65* | |
| 77 | 23 | 20.25 | 44.23 | 2.48 | 3.01 | | | 23.95 | 42063 |
| | | *20.00* | *43.67* | *2.47* | *3.00* | | | *20.65* | |

PART I, TABLE II.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The Armour Fertilizer Wks., Nashville, Tenn.** | |
| 42084 | Armour's Bone Meal .... | Manufacturer ..... |
| 42397 | | Miller, Butler & Cartright, Elkton.. |
| 42519 | | C. C. Woodward, S. Union ..... |
| 42085 | Armour's Raw Bone Meal | Manufacturer ..... |
| 42398 | | Dickey & Martin, Munfordville .... |
| 42319 | Armour's Bone Meal Special ..... | Manufacturer ..... |
| 42104 | Smith's Pure Raw Bone Meal ..... | Manufacturer ..... |
| 42107 | Smith's Bone Meal ..... | Manufacturer ..... |
| | **The Armour Fertilizer Wks., For The T. J. Turley Co., Owensboro, Ky.** | |
| 42093 | Ideal Bone Meal ..... | Manufacturer ..... |
| 42630 | | McAtee-Vickers Hdw. Co., Russellville |
| | **Baugh & Sons Co., Norfolk, Va.** | |
| 42264 | Baugh's Raw Bone Meal, Warranted Pure ..... | Manufacturer ..... |
| | **Central Mfg. Co., Lockland, Ohio.** | |
| 39780 | Equity Bone, Tankage and Potash ..... | Manufacturer ..... |
| 42410 | | Virginia M. Fultz, Grayson ..... |
| 39781 | Equity Raw Bone Meal.. | Manufacturer ..... |
| 42411 | | L. A. Stevens, Beaver Dam ..... |

## Bones, Tankage &c.

| PERCENTAGE OF FINENESS | | Total Phosphoric Acid. | Equivalent to Bone Phosphate. | Nitrogen. | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| Fine Bone. | Medium Bone. | | | | | From Muriate. | From Sulphate | | |
| 87 | 13 | 28.18 | 61.55 | 1.85 | 2.25 | | | $28.30 | 42084 |
| 96 | 4 | 27.84 | 60.80 | 2.47 | 3.00 | | | 30.70 | 42397 |
| 77 | 23 | **24.99** | 54.58 | 2.04 | 2.48 | | | 25.98 | 42519 |
| | | *27.00* | *58.96* | *1.65* | *2.00* | | | *21.98* | |
| 77 | 23 | 24.61 | 53.76 | 3.98 | 4.83 | | | 32.49 | 42085 |
| 60 | 40 | 24.28 | 53.03 | 3.71 | 4.50 | | | 30.48 | 42398 |
| | | *22.00* | *48.06* | *3.71* | *4.50* | | | *26.19* | |
| 82 | 18 | 26.12 | 57.05 | 2.91 | 3.53 | | | 30.15 | 42319 |
| | | *24.00* | *52.42* | *2.47* | *3.00* | | | *23.05* | |
| 84 | 16 | 24.63 | 53.78 | 3.89 | 4.72 | | | 32.53 | 42104 |
| | | *22.00* | *48.06* | *3.71* | *4.50* | | | *26.19* | |
| 89 | 11 | 27.80 | 60.71 | 1.77 | 2.15 | | | 27.83 | 42107 |
| | | *27.00* | *58.96* | *1.65* | *2.00* | | | *21.98* | |
| 88 | 12 | 27.56 | 60.18 | 1.85 | 2.25 | | | 27.87 | 42093 |
| 69 | 31 | 27.56 | 60.18 | 1.94 | 2.36 | | | 27.13 | 42630 |
| | | *27.00* | *58.96* | *1.65* | *2.00* | | | *21.98* | |
| 52 | 48 | 21.45 | 46.86 | 3.66 | 4.44 | | | 27.91 | 42264 |
| | | *21.50* | *46.93* | *3.71* | *4.50* | | | *25.89* | |
| 50 | 50 | 15.78 | 34.46 | 4.68 | 5.68 | 2.02 | | 29.44 | 39780 |
| 77 | 23 | **14.03** | 30.65 | 4.25 | 5.16 | 2.07 | | 27.53 | 42410 |
| | | *15.00* | *32.76* | *3.71* | *4.50* | *2.00* | | *23.99* | |
| 42 | 58 | 23.20 | 50.67 | 3.75 | 4.55 | | | 29.74 | 39781 |
| 70 | 30 | **22.19** | 48.46 | 3.29 | 3.99 | | | 27.94 | 42411 |
| | | *23.00* | *50.24* | *2.88* | *3.50* | | | *23.88* | |

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The Cincinnati Phosphate Co., Cincinnati, Ohio.** | |
| 42210 | Ground Bone ..... | Manufacturer ..... |
| | **Continental Fertilizer Co., Nashville, Tenn.** | |
| 39877<br>42423 | Bear Raw Bone Meal ... | Manufacturer .....<br>Daugherty & Durham, Morgantown. |
| 39881 | Bear Raw Bone ..... | Manufacturer ..... |
| 39882 | Bear Bone Meal ..... | Manufacturer ..... |
| | **The Empire Guano Co., Nashville, Tenn.** | |
| 39984 | Raw Bone Meal ..... | Manufacturer ..... |
| 39986 | Pure Raw Bone Meal ... | Manufacturer ..... |
| | **The Evansville Packing Co., Evansville, Ind.** | |
| 39729 | Pure Raw Bone Meal... | Manufacturer ..... |
| | **Federal Chemical Co., Louisville, Ky.** | |
| 39602 | Daybreak Fine Raw Bone | Manufacturer ..... |
| 39603 | Daybreak Raw Bone .... | Manufacturer ..... |

## Bones, Tankage &c.

| PERCENTAGE OF FINENESS | | Total Phosphoric Acid. | Equivalent to Bone Phosphate. | Nitrogen. | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| Fine Bone. | Medium Bone. | | | | | From Muriate. | From Sulphate | | |
| 83 | 17 | 24.66 | 53.87 | 2.41 | 2.93 | | | $27.33 | 42210 |
| | | *20.00* | *43.67* | *2.47* | *3.00* | | | *20.65* | |
| 92 | 8 | 25.62 | 55.96 | 2.77 | 3.36 | | | 29.79 | 39877 |
| 94 | 6 | 25.80 | 56.35 | 2.37 | 2.88 | | | 28.63 | 42423 |
| | | *24.00* | *52.42* | *2.47* | *3.00* | | | *23.05* | |
| 65 | 35 | 23.28 | 50.85 | 3.97 | 4.82 | | | 30.89 | 39881 |
| | | *22.00* | *48.06* | *3.71* | *4.50* | | | *26.19* | |
| 90 | 10 | 28.00 | 61.16 | 1.74 | 2.11 | | | 27.93 | 39882 |
| | | *27.00* | *58.96* | *1.65* | *2.00* | | | *21.98* | |
| 26 | 74 | 20.83 | 45.49 | 2.92 | 3.54 | | | 23.81 | 39984 |
| | | *20.00* | *43.67* | *2.65* | *3.22* | | | *21.28* | |
| 33 | 67 | **20.02** | 43.73 | 3.76 | 4.56 | | | 26.50 | 39986 |
| | | *23.00* | *50.24* | *3.71* | *4.50* | | | *26.79* | |
| 50 | 50 | 25.70 | 56.13 | 3.84 | 4.66 | | | 31.43 | 39729 |
| | | *23.00* | *50.24* | *3.71* | *4.50* | | | *26.79* | |
| 79 | 21 | 24.28 | 53.03 | 2.72 | 3.30 | | | 27.92 | 39602 |
| | | *24.00* | *52.42* | *2.88* | *3.50* | | | *24.48* | |
| 34 | 66 | 23.66 | 51.67 | 3.89 | 4.72 | | | 29.42 | 39603 |
| | | *22.00* | *48.06* | *3.71* | *4.50* | | | *26.19* | |

PART I, TABLE II.

| Station Number | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Fox Chemical Co., Branch Federal Chemical Co., Louisville, Ky.** | |
| 39636 | Fox Ground Raw Bone .. | Manufacturer ..... |
| 39637 | Fox Raw Bone ..... | Manufacturer ..... |
| | **Globe Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.** | |
| 39673 | Acorn Raw Bone ..... | Manufacturer ..... |
| 39674 | Globe Raw Bone ..... | Manufacturer ..... |
| | **The Groves Co., Cincinnati, Ohio.** | |
| 39929 | Pure Ground Bone ..... | Manufacturer ..... |
| 39930 | Pure Raw Bone ..... | Manufacturer ..... |
| 39931 | Pure Bone and Potash Mixture ..... | Manufacturer ..... |
| 39932 | Half and Half ..... | Manufacturer ..... |
| | **Hirsh, Stein & Co., Chicago Illinois.** | |
| 42162 | Calumet Brand Special Pure Bone Meal and Potash ..... | Manufacturer ..... |
| 42488 | | Grayson Co. Supply Co., Leitchfield.. |

## BONES, TANKAGE &C.

| PERCENTAGE OF FINENESS | | Total Phosphoric Acid. | Equivalent to Bone Phosphate. | Nitrogen. | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| Fine Bone. | Medium Bone. | | | | | From Muriate. | From Sulphate | | |
| 79 | 21 | 23.82 | 52.02 | 2.70 | 3.28 | | | $27.51 | 39636 |
| | | *24.00* | *52.42* | *2.88* | *3.50* | | | *24.48* | |
| 37 | 63 | 23.18 | 50.63 | 3.90 | 4.73 | | | 29.27 | 39637 |
| | | *22.00* | *48.06* | *3.71* | *4.50* | | | *26.19* | |
| 79 | 21 | 23.92 | 52.25 | 2.77 | 3.36 | | | 27.83 | 39673 |
| | | *24.00* | *52.42* | *2.88* | *3.50* | | | *24.48* | |
| 43 | 57 | 23.21 | 50.68 | 3.82 | 4.64 | | | 29.29 | 39674 |
| | | *22.00* | *48.06* | *3.71* | *4.50* | | | *26.19* | |
| 77 | 23 | 23.82 | 52.02 | 3.23 | 3.92 | | | 29.27 | 39929 |
| | | *20.00* | *43.67* | *2.47* | *3.00* | | | *20.65* | |
| 78 | 22 | 21.45 | 46.86 | 4.48 | 5.44 | | | 31.89 | 39930 |
| | | *22.00* | *48.06* | *3.71* | *4.50* | | | *26.19* | |
| 81 | 19 | 21.29 | 46.49 | 1.03 | 1.25 | 6.17 | | 26.00 | 39931 |
| | | *20.00* | *43.67* | *0.82* | *1.00* | *5.00* | | *19.87* | |
| 85 | 15 | 17.47 | 38 15 | 2.03 | 2.46 | 3.43 | | 23.99 | 39932 |
| | | *16.00* | *34.95* | *1.65* | *2.00* | *2.00* | | *17.38* | |
| 50 | 50 | 23.38 | 51.06 | 1.03 | 1.25 | 6.33 | | 26.30 | 42162 |
| 52 | 48 | 21.32 | 46.56 | 1.37 | 1.66 | 5.09 | | 24.90 | 42488 |
| | | *20.00* | *43.67* | *0.82* | *1.00* | *4.00* | | *18.87* | |

PART I, TABLE II.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Hirsh, Stein & Co.** | |
| 42163 | Calumet Brand Extra Bone Meal | Manufacturer |
| 42489 | | I. K. Miller & Sons, Campbellsville |
| 42164 | Calumet Brand Special Pure Bone Meal | Manufacturer |
| 42490 | | I. K. Miller & Sons, Campbellsville |
| 42165 | Calumet Brand Pure Raw Bone Meal | Manufacturer |
| 42491 | | Pearson & Breedlove, Franklin |
| 42320 | Bland and Alberts Pure Raw Bone Meal | Manufacturer |
| | **Hopkins Fertilizer Co., New Albany, Ind.** | |
| 39903 | Old Time Pure Raw Bone | Manufacturer |
| 42291 | | St. Matthews Produce Exchange, St. Matthews |
| 42497 | | Grigsby & Co., Bardstown |
| 39904 | Old Time Special Ground Bone | Manufacturer |
| | **International Agr'l Corporation, (Buffalo Fert. Wks.) Cincinnati, Ohio.** | |
| 42189 | Bone Meal | Manufacturer |
| 42506 | | R. J. Smith Co., Burnside |
| | **International Agr'l Corp., Nat. Fert. Branch, Nashville, Tenn.** | |
| 42323 | Old Hickory Nitrogen, Bone and Potash | Manufacturer |

## Bones, Tankage &c.

| PERCENTAGE OF FINENESS | | Total Phosphoric Acid. | Equivalent to Bone Phosphate. | Nitrogen. | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| Fine Bone. | Medium Bone. | | | | | From Muriate. | From Sulphate | | |
| 77 | 23 | 29.12 | 63.59 | 2.06 | 2.50 | | | $29.17 | 42163 |
| 53 | 47 | 29.94 | 65.38 | **1.55** | 1.88 | | | 26.57 | 42489 |
| | | *28.00* | *61.16* | *2.00* | *2.43* | | | *23.80* | |
| 53 | 47 | 31.62 | 69.07 | 1.16 | 1.41 | | | 26.39 | 42164 |
| 50 | 50 | 30.70 | 67.06 | 1.20 | 1.46 | | | 25.69 | 42490 |
| | | *29.76* | *65.00* | *0.82* | *1.00* | | | *20.73* | |
| 35 | 65 | 22.20 | 48.48 | 3.91 | 4.75 | | | 28.57 | 42165 |
| 37 | 63 | 21.14 | 46.17 | 3.68 | 4.47 | | | 27.13 | 42491 |
| | | *20.00* | *43.67* | *3.71* | *4.50* | | | *24.99* | |
| 60 | 40 | 24.89 | 54.35 | 4.02 | 4.88 | | | 31.99 | 42320 |
| | | *22.00* | *48.06* | *3.71* | *4.50* | | | *26.19* | |
| 57 | 43 | 24.05 | 52.53 | 4.13 | 5.01 | | | 31.63 | 39903 |
| 51 | 49 | 21.88 | 47.78 | **3.61** | 4.38 | | | 28.00 | 42291 |
| 34 | 66 | 23.05 | 50.35 | 3.56 | 4.32 | | | 29.33 | 42497 |
| | | *22.00* | *48.06* | *3.50* | *4.25* | | | *25.45* | |
| 57 | 43 | 22.41 | 48.98 | 3.06 | 3.71 | | | 29.89 | 39904 |
| | | *20.00* | *43.67* | *2.47* | *3.00* | | | *20.65* | |
| 71 | 29 | 24.86 | 54.29 | 2.50 | 3.04 | | | 27.20 | 42189 |
| 84 | 16 | 23.21 | 50.68 | 2.71 | 3.29 | | | 27.32 | 42506 |
| | | *22.00* | *48.06* | *2.47* | *3.00* | | | *21.85* | |
| 85 | 15 | **19.00** | 41.49 | **1.78** | 2.16 | 3.62 | 0.91 | 25.57 | 42323 |
| | | *23.00* | *50.24* | *2.47* | *3.00* | *3.00* | | *25.45* | |

| Station Number | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The Jarecki Chemical Co., Cincinnati, Ohio.** | |
| 42194 | Pure Ground Bone ..... | Manufacturer ..... |
| | **Jones Fertilizer Co., Louisville, Ky.** | |
| 39896 | Jones Raw Bone Meal ... | Manufacturer ..... |
| 39899 | Jones Raw Bone ..... | Manufacturer ..... |
| 39900 | Jones Bone Meal ..... | Manufacturer ..... |
| | **Kaufman Fertilizer Co., Cincinnati, Ohio.** | |
| 42222 | Pure Bone ..... | Manufacturer ..... |
| | **Kentucky Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.** | |
| 39696<br>42540 | O. K. Fine Raw Bone ... | Manufacturer .....<br>L. A. Collins, Campbellsville ..... |
| 39697 | O. K. Raw Bone ..... | Manufacturer ..... |
| | **Louisville Fertilizer Co., Louisville, Ky.** | |
| 39857 | Eagle Raw Bone Meal .. | Manufacturer ..... |
| 39862<br>42550 | Eagle Raw Bone ..... | Manufacturer .....<br>L. S. Brough, Bowling Green ..... |

## BONES, TANKAGE &C.

| PERCENTAGE OF FINENESS. | | Total Phosphoric Acid. | Equivalent to Bone Phosphate. | Nitrogen. | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| Fine Bone. | Medium Bone. | | | | | From Muriate. | From Sulphate. | | |
| 86 | 14 | 23.41 | 51.13 | 2.44 | 2.96 | | | $26.61 | 42194 |
| | | *20.00* | *43.67* | *2.47* | *3.00* | | | *20.65* | |
| 95 | 5 | 26.06 | 56.91 | 2.73 | 3.31 | | | 30.15 | 39896 |
| | | *24.00* | *52.42* | *2.47* | *3.00* | | | *23.05* | |
| 56 | 44 | 23.33 | 50.96 | 4.00 | 4.86 | | | 30.61 | 39899 |
| | | *22.00* | *48.06* | *3.71* | *4.50* | | | *26.19* | |
| 88 | 12 | 28.28 | 61.74 | 1.85 | 2.25 | | | 28.42 | 39900 |
| | | *27.00* | *58.96* | *1.65* | *2.00* | | | *21.98* | |
| 84 | 16 | 24.45 | 53.39 | 2.30 | 2.79 | | | 26.83 | 42222 |
| | | *20.00* | *43.67* | *2.47* | *3.00* | | | *20.65* | |
| 83 | 17 | 24.79 | 54.15 | 2.52 | 3.06 | | | 27.81 | 39696 |
| 80 | 20 | 25.22 | 55.07 | 2.56 | 3.11 | | | 28.12 | 42540 |
| | | *24.00* | *52.42* | *2.88* | *3.50* | | | *24.48* | |
| 40 | 60 | 24.05 | 52.53 | 3.79 | 4.60 | | | 29.63 | 39697 |
| | | *22.00* | *48.06* | *3.71* | *4.50* | | | *26.19* | |
| 93 | 7 | 25.70 | 56.13 | 2.66 | 3.23 | | | 29.51 | 39857 |
| | | *24.00* | *52.42* | *2.47* | *3.00* | | | *23.05* | |
| 71 | 29 | 22.44 | 49.01 | 3.66 | 4.44 | | | 29.46 | 39862 |
| 64 | 36 | 25.78 | 56.30 | 3.89 | 4.72 | | | 32.39 | 42550 |
| | | *22.00* | *48.06* | *3.71* | *4.50* | | | *26.19* | |

PART I, TABLE II.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Louisville Fertilizer Co.** | |
| 39863 | Eagle Special Raw Bone. | Manufacturer |
| 39864 | Eagle Bone Meal | Manufacturer |
| | **Morris & Co., Chicago, Ill.** | |
| 39785 | Big One-Ground Raw Bone | Manufacturer |
| 42551 | | Hatter Hardware Co., Franklin |
| 39786 | Big Two-Pure Bone Meal | Manufacturer |
| 42552 | | Hatter Hardware Co., Franklin |
| 42588 | | G. T. Gilbert, Adairville |
| 42589 | | G. T. Gilbert, Adairville |
| 39790 | Big Six-Special Bone Meal and Potash | Manufacturer |
| | **Pero & Stoecker, Louisville, Kentucky.** | |
| 42244 | Pure Animal Matter Corn and Wheat Grower | Manufacturer |
| 42245 | Pure Animal Matter and Potash | Manufacturer |
| 42246 | Pure Bone Meal | Manufacturer |
| | **Read Phosphate Co., Nashville, Tenn.** | |
| 39936 | Read's Raw Bone Meal | Manufacturer |
| 39952 | Read's Pure Raw Bone Meal | Manufacturer |
| 42578 | | T. J Alexander, Monticello |
| 39966 | Read's Half & Half, Raw Bone Meal and Acid Phosphate | Manufacturer |

## Bones, Tankage &c.

| PERCENTAGE OF FINENESS | | | | | | POTASH. | | | |
|---|---|---|---|---|---|---|---|---|---|
| Fine Bone. | Medium Bone. | Total Phosphoric Acid. | Equivalent to Bone Phosphate. | Nitrogen. | Equivalent to Ammonia. | From Muriate. | From Sulphate | Estimated Value Per Ton. | Station Number. |
| 78 | 22 | 19.48 | 42.55 | 4.16 | 5.05 | | | $29.28 | 39863 |
| | | *20.00* | *43.67* | *3.71* | *4.50* | | | *24.99* | |
| 89 | 11 | 27.92 | 60.98 | 1.82 | 2.21 | | | 28.09 | 39864 |
| | | *27.00* | *58.96* | *1.65* | *2.00* | | | *21.98* | |
| 67 | 33 | 26.48 | 57.84 | 3.10 | 3.76 | | | 30.28 | 39785 |
| 60 | 40 | 25.84 | 56.44 | 3.50 | 4.25 | | | 30.85 | 42551 |
| | | *24.00* | *52.42* | *3.29* | *4.00* | | | *25.92* | |
| 74 | 26 | 29.72 | 64.90 | 1.97 | 2.39 | | | 29.13 | 39786 |
| 69 | 31 | 29.56 | 64.57 | 1.89 | 2.29 | | | 28.44 | 42552 |
| 82 | 18 | **27.16** | 59.32 | 2.62 | 3.18 | | | 29.92 | 42588 |
| 78 | 22 | **26.20** | 57.22 | 2.72 | 3.30 | | | 29.33 | 42589 |
| | | *28.00* | *61.16* | *2.06* | *2.50* | | | *24.01* | |
| 98 | 2 | 15.81 | 34.53 | 0.70 | 0.85 | | 2.42 | 17.93 | 39790 |
| | | *16.00* | *34.95* | *0.41* | *0.50* | | *2.00* | *13.44* | |
| 78 | 22 | 15.94 | 34.81 | 4.43 | 5.38 | | | 27.56 | 42244 |
| | | *10.00* | *21.85* | *4.00* | *4.86* | | | *20.00* | |
| 81 | 19 | 14.88 | 32.49 | 4.16 | 5.05 | | 3.75 | 30.40 | 42245 |
| | | *10.00* | *21.85* | *4.00* | *4.86* | | *4.00* | *24.80* | |
| 59 | 41 | 22.31 | 48.73 | 3.40 | 4.13 | | | 27.92 | 42246 |
| | | *22.00* | *48.06* | *3.50* | *4.25* | | | *25.45* | |
| 30 | 70 | 20.88 | 45.60 | 2.96 | 3.59 | | | 25.82 | 39936 |
| | | *20.00* | *43.67* | *2.65* | *3.22* | | | *21.28* | |
| 34 | 66 | **20.32** | 44.37 | 3.73 | 4.53 | | | 26.64 | 39952 |
| 69 | 31 | **22.21** | 48.50 | 3.79 | 4.60 | | | 29.66 | 42578 |
| | | *23.00* | *50.24* | *3.71* | *4.50* | | | *26.79* | |
| 68 | 32 | 20.91 | 45.64 | 2.01 | 2.44 | | | 22.48 | 39966 |
| | | *18.00* | *39.31* | *2.06* | *2.50* | | | *18.01* | |

PART I, TABLE II.

| Station Number | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Swift & Co., Chicago, Ill.** | |
| 39840<br>42609 | Swift's Pure Bone Meal | Manufacturer<br>N. F. Hill, Bowling Green |
| 39841<br>42610 | Swift's Pure Raw Bone Meal | Manufacturer<br>C. E. Owen, Madisonville |
| 39842 | Swift's Pure Bone Meal and Blood | Manufacturer |
| 39843<br>42290<br>42611 | Swift's Pure Bone Meal and Potash | Manufacturer<br>G. O. Blanford, Irvington<br>W. F. Wilson, Somerset |
| 39844 | Swift's Ground Steamed Bone | Manufacturer |
| 39845 | Swift's Ground Beef Bone | Manufacturer |
| 42265 | Swift's Special Raw Bone Meal | Manufacturer |
| | **Taylor & Powell Fertilizer Co., Springfield, Tenn.** | |
| 42304 | Raw Bone Meal | Manufacturer |
| | **Tennessee Chemical Co., Nashville, Tenn.** | |
| 39708<br>42614 | Ox Raw Bone Meal | Manufacturer<br>I. K. Miller & Sons, Campbellsville |
| 39710 | Ox Raw Bone | Manufacturer |
| 39711<br>42616 | Ox Raw Bone With Potash | Manufacturer<br>W. F. Grainger, Franklin |

## Bones, Tankage &c.

| PERCENTAGE OF FINENESS | | | | | | POTASH. | | | |
|---|---|---|---|---|---|---|---|---|---|
| Fine Bone. | Medium Bone. | Total Phosphoric Acid. | Equivalent to Bone Phosphate. | Nitrogen. | Equivalent to Ammonia. | From Muriate. | From Sulphate | Estimated Value Per Ton. | Station Number. |
| 66 | 34 | 25.09 | 54.79 | 3.89 | 4.72 | | | $31.99 | 39840 |
| 81 | 19 | 23.84 | 52.06 | 2.80 | 3.40 | | | 27.97 | 42609 |
| | | *24.00* | *52.42* | *2.47* | *3.00* | | | *23.05* | |
| 67 | 33 | 25.12 | 54.86 | 3.82 | 4.64 | | | 31.80 | 39841 |
| 61 | 39 | 22.82 | 49.84 | 4.05 | 4.92 | | | 30.66 | 42610 |
| | | *23.00* | *50.24* | *3.71* | *4.50* | | | *26.79* | |
| 80 | 20 | 23.79 | 51.97 | 3.83 | 4.65 | | | 31.49 | 39842 |
| | | *23.00* | *50.24* | *3.71* | *4.50* | | | *26.79* | |
| 66 | 34 | 27.28 | 59.58 | 2.02 | 2.45 | 3.61 | | 30.65 | 39843 |
| 77 | 23 | 26.72 | 58.37 | 1.87 | 2.27 | **2.35** | | 29.05 | 42290 |
| 77 | 23 | 25.74 | 56.22 | 1.68 | 2.04 | 4.08 | | 29.36 | 42611 |
| | | *25.00* | *54.59* | *1.85* | *2.25* | *3.00* | | *24.48* | |
| 86 | 14 | 25.09 | 54.79 | 1.97 | 2.39 | | | 26.27 | 39844 |
| | | *20.00* | *43.67* | *1.65* | *2.00* | | | *17.78* | |
| 79 | 21 | 28.98 | 63.28 | 2.11 | 2.56 | | | 29.35 | 39845 |
| | | *27.00* | *58.96* | *2.06* | *2.50* | | | *23.41* | |
| 57 | 43 | 25.68 | 56.08 | 3.83 | 4.65 | | | 31.74 | 42265 |
| | | *21.00* | *45.86* | *3.50* | *4.25* | | | *24.85* | |
| 47 | 53 | 23.38 | 51.06 | 3.92 | 4.76 | | | 29.94 | 42304 |
| | | *22.00* | *48.06* | *3.71* | *4.50* | | | *26.19* | |
| 90 | 10 | 25.68 | 56.08 | 2.76 | 3.35 | | | 29.69 | 39708 |
| 89 | 11 | 25.52 | 55.74 | 2.25 | 2.73 | | | 27.74 | 42614 |
| | | *24.00* | *52.42* | *2.47* | *3.00* | | | *23.05* | |
| 57 | 43 | 23.13 | 50.52 | 4.00 | 4.86 | | | 30.51 | 39710 |
| | | *22.00* | *48.06* | *3.71* | *4.50* | | | *26.19* | |
| 84 | 16 | 22.01 | 48.07 | 2.31 | 2.80 | 0.60 | 2.92 | 29.09 | 39711 |
| 67 | 33 | 21.62 | 47.22 | 2.08 | 2.53 | | 3.91 | 27.84 | 42616 |
| | | *20.00* | *43.67* | *1.85* | *2.25* | | *3.00* | *22.08* | |

PART I, TABLE II.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Tennessee Chemical Co.** | |
| 39726 | Ox Bone Meal Special ... | Manufacturer ..... |
| 39727 | Ox Bone Meal ..... | Manufacturer ..... |
| | **Tuscarora Fertilizer Co., Nashville, Tenn.** | |
| 42120 | Tuscarora Bone Meal ... | Manufacturer ..... |
| 42121 | Tuscarora Raw Bone Meal | Manufacturer ..... |
| | **Virginia-Carolina Chemical Co., Memphis, Tenn.** | |
| 42287 | Ground Animal Bone ... | Manufacturer ..... |

## Bones, Tankage &c.

| PERCENTAGE OF FINENESS | | Total Phosphoric Acid | Equivalent to Bone Phosphate. | Nitrogen. | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| Fine Bone. | Medium Bone. | | | | | From Muriate. | From Sulphate | | |
| 97 | 3 | 25.50 | 55.68 | 2.68 | 3.25 | | | $29.63 | 39726 |
| | | *24.00* | *52.42* | *2.47* | *3.00* | | | *23.05* | |
| 90 | 10 | 27.72 | 60.55 | 1.80 | 2.19 | | | 27.92 | 39727 |
| | | *27.00* | *58.96* | *1.65* | *2.00* | | | *21.98* | |
| 89 | 11 | 28.20 | 61.58 | 1.83 | 2.22 | | | 28.35 | 42120 |
| | | *27.00* | *58.96* | *1.65* | *2.00* | | | *21.98* | |
| 81 | 19 | 24.76 | 54.04 | 3.91 | 4.75 | | | 32.56 | 42121 |
| | | *22.00* | *48.06* | *3.71* | *4.50* | | | *26.19* | |
| 68 | 32 | 19.28 | 42.11 | 4.50 | 5.46 | | | 29.94 | 42287 |
| | | *20.00* | *43.67* | *3.29* | *4.00* | | | *23.52* | |

## Part I.—Table III.—Acid Phosphates.

| Station Number | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | Phosphoric Acid. Available. | Insoluble. | Total. | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|
| | **A. D. Adair & McCarty Bros. Atlanta, Ga.** | | | | | | |
| 42231 | Adair's High Grade Dissolved Bone ..... | Manufacturer ..... | 15.49<br>*14.00* | 1.16 | 16.65 | $15.49<br>*14.00* | 42231 |
| | **The American Agr'l Chemical Co., Cincinnati Sales Department, Cincinnati, Ohio** | | | | | | |
| 39997 | A. A. C. Acid Phosphate . | Manufacturer ..... | 13.95<br>*12.00* | 2.26<br>*1.50* | 16.21<br>*13.50* | 13.95<br>*12.00* | 39997 |
| 39998 | A. A. C. Co.'s 16% Acid Phosphate ..... | Manufacturer ..... | 17.61 | 2.33 | 19.94 | 17.61 | 39998 |
| 42339 | | Lowry, Hines & Co., Science Hill | 17.71<br>*16.00* | 3.30<br>*1.00* | 21.01<br>*17.00* | 17.71<br>*16.00* | 42339 |
| | **The American Agr'l Chemical Co., Bowker Fertilizer Works, Cincinnati, Ohio.** | | | | | | |
| 42001 | Bowker's Soluble Bone .. | Manufacturer ..... | 14.92 | 2.29 | 17.21 | 14.92 | 42001 |
| 42341 | | J. H. Thurman, Somerset .... | 15.53<br>*14.00* | 2.24<br>*1.50* | 17.77<br>*15.50* | 15.53<br>*14.00* | 42341 |
| 42002 | Bowker's Acid Phosphate | Manufacturer ..... | 14.22 | 1.82 | 16.04 | 14.22 | 42002 |
| 42342 | | L. Smith & Co., Upton ..... | 13.24<br>*12.00* | 2.75<br>*1.50* | 15.98<br>*13.50* | 13.24<br>*12.00* | 42342 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **The American Agr'l Chemical Co., Cincinnati Sales Department, Cincinnati, Ohio.** | | | | | | |
| 42020 | Bradley Fertilizer Works Soluble Dissolved Bone . | Manufacturer ..... | 14.46 | 2.68 | 17.14 | 14.46 | 42020 |
| | | | *14.00* | *2.00* | *16.00* | *14.00* | |
| 42021 | Cleveland Dryer Works Horsehead Phosphate ... | Manufacturer ..... | 11.65 | 1.29 | 12.94 | 11.65 | 42021 |
| 42354 | | W. G. Wesley, Science Hill ... | 13.75 | 2.38 | 16.13 | 13.75 | 42354 |
| | | | *10.00* | *2.00* | *12.00* | *10.00* | |
| 42022 | Cleveland Dryer Works XXX Superphosphate ... | Manufacturer ..... | 14.81 | 2.40 | 17.21 | 14.81 | 42022 |
| 42355 | | C. E. Miller, Fordsville ..... | 15.34 | 1.58 | 16.92 | 15.34 | 42355 |
| | | | *14.00* | *2.00* | *16.00* | *14.00* | |
| | **The American Agr'l Chemical Co., Michigan Carbon Works, Cincinnati, Ohio.** | | | | | | |
| 42026 | Red Line Phosphate .... | Manufacturer ..... | 15.18 | 2.31 | 17.49 | 15.18 | 42026 |
| | | | *14.00* | *2.00* | *16.00* | *14.00* | |
| | **The American Agr'l Chemical Co., Cincinnati Sales Department, Cincinnati, Ohio.** | | | | | | |
| 42049 | N. W. Horseshoe Brand Square Deal Phosphate .. | Manufacturer ..... | 15.39 | 2.46 | 17.85 | 15.39 | 42049 |
| 42375 | | J. A. Shaver, Greenville ..... | 14.10 | 2.73 | 16.83 | 14.10 | 42375 |
| | | | *14.00* | *2.00* | *16.00* | *14.00* | |
| 42050 | N. W. Horseshoe Brand Quick Acting Phosphate . | Manufacturer ..... | 11.15 | 1.45 | 12.60 | 11.15 | 42050 |
| 42376 | | Watkins & Co., Elizabethtown | 12.17 | 2.88 | 15.05 | 12.17 | 42376 |
| | | | *10.00* | *2.00* | *12.00* | *10.00* | |
| 42052 | Packers Boar's Head Brand Soluble Phosphate. | Manufacturer ..... | 10.59 | 1.28 | 11.87 | 10.59 | 42052 |
| 42377 | | W. M. West, Murray ..... | 11.97 | 1.80 | 13.77 | 11.97 | 42377 |
| | | | *10.00* | *2.00* | *12.00* | *10.00* | |

## Part I.—Table III.—Acid Phosphates.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | Phosphoric Acid. Available. | Insoluble. | Total. | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|
| | **The American Agr'l Chemical Co.** | | | | | | |
| 42053 | Packer's Boar's Head Brand Gilt Edge Phosphate | Manufacturer | 15.13 | 2.59 | 17.72 | $15.13 | 42053 |
| 42378 | | Jas. T. Price, Science Hill | 15.12 | 2.07 | 17.19 | 15.12 | 42378 |
| | | | *14.00* | *2.00* | *16.00* | *14.00* | |
| | **The Armour Fertilizer Wks. Nashville, Tenn.** | | | | | | |
| 42086 | Armour's High Grade Phosphate | Manufacturer | 16.55 | 0.54 | 17.09 | 16.55 | 42086 |
| 42399 | | Rubel Hardware Co., Lebanon | 15.72 | 1.21 | 16.93 | 15.72 | 42399 |
| | | | *16.00* | *2.00* | *18.00* | *16.00* | |
| 42087 | Armour's Star Phosphate | Manufacturer | 14.79 | 1.15 | 15.94 | 14.79 | 42087 |
| 42400 | | Simpson Co. Hardware Co., Franklin | 14.31 | 2.24 | 16.55 | 14.31 | 42400 |
| | | | *14.00* | *2.00* | *16.00* | *14.00* | |
| 42088 | Armour's Cereal Phosphate | Manufacturer | 9.08 | 1.91 | 10.99 | 9.08 | 42088 |
| | | | *10.00* | *2.00* | *12.00* | *10.00* | |
| 42105 | Smith's Soluble Phosphate | Manufacturer | 14.90 | 0.78 | 15.68 | 14.90 | 42105 |
| | | | *14.00* | *2.00* | *16.00* | *14.00* | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Central Mfg. Co., Lockland, Ohio.** | | | | | | |
| 39771 | Equity Rock Phosphate .. | Manufacturer ..... | 15.40<br>*14.00* | 1.25 | 16.65 | 15.40<br>*14.00* | 39771 |
| | **The Cincinnati Phosphate Co., Cincinnati, Ohio.** | | | | | | |
| 42207 | Wheat Grower ..... | Manufacturer ..... | 16.15<br>*14.00* | 0.99<br>*1.00* | 17.14<br>*15.00* | 16.15<br>*14.00* | 42207 |
| | **Continental Fertilizer Co., Nashville, Tenn.** | | | | | | |
| 39867 | Bear Phosphate ..... | Manufacturer ..... | 12.84 | 0.66 | 13.50 | 12.84 | 39867 |
| 42414 | | J. M. Gray, Tolesboro ..... | 12.65<br>*12.00* | 0.93<br>*2.00* | 13.58<br>*14.00* | 12.65<br>*12.00* | 42414 |
| 39868 | Bear High Grade Dissolved Bone ..... | Manufacturer ..... | 15.31<br>*14.00* | 0.70<br>*2.00* | 16.01<br>*16.00* | 15.31<br>*14.00* | 39868 |
| | **Duncan & Bro., La Grange, Kentucky.** | | | | | | 42271 |
| 42271 | Tiger Brand Phosphate .. | *Manufacturer ..... | **15.22** | 3.09 | 18.31 | 15.22 | 42429 |
| 42429 | | Manufacturers Warehouse ... | *16.00* | *2.00* | *18.00* | *16.00* | |
| | **The Empire Guano Co., Nashville, Tenn.** | | | | | | |
| 39976 | Climax Acid Phosphate . | Manufacturer ..... | 17.17<br>*16.00* | 1.40<br>*2.00* | 18.57<br>*18.00* | 17.17<br>*16.00* | 39976 |
| 39982 | Acid Phosphate ..... | Manufacturer ..... | 12.15<br>*12.00* | 5.15<br>*2.00* | 17.30<br>*14.00* | 12.15<br>*12.00* | 39982 |
| 39983 | High Grade Acid Phosphate ..... | Manufacturer ..... | 13.48<br>*14.00* | 3.89<br>*2.00* | 17.37<br>*16.00* | 13.48<br>*14.00* | 39983 |
| | **The Evansville Packing Co., Evansville, Ind.** | | | | | | |
| 39739 | High Grade Soluble Phosphate ..... | Manufacturer ..... | 16.76<br>*16.00* | 0.73<br>*2.00* | 17.49<br>*18.00* | 16.76<br>*16.00* | 39739 |

*The manufacturer failed to furnish sample as required by law

## Part I.—Table III.—Acid Phosphates.

| Station Number | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | Phosphoric Acid. Available. | Phosphoric Acid. Insoluble. | Phosphoric Acid. Total. | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|
| | **Federal Chemical Co., Louisville, Ky** | | | | | | |
| 39598 | Daybreak High Grade Acid Phosphate ..... | Manufacturer ..... | 17.88<br>*16.00* | 0.40<br>*2.00* | 18.28<br>*18.00* | $17.88<br>*16.90* | 39598 |
| 39599 | Daybreak Royal Phosphate ..... | Manufacturer ..... | 17.03<br>*14.00* | 2.78<br>*2.00* | 19.81<br>*16.00* | 17.03<br>*14.00* | 39599 |
| 39600 | Daybreak Standard Phosphate ..... | Manufacturer ..... | 14.16<br>*12.00* | 7.31<br>*2.00* | 21.47<br>*14.00* | 14.16<br>*12.00* | 39600 |
| 39601 | Daybreak Star Phosphate | Manufacturer ..... | 12.53<br>*10.00* | 10.36<br>*2.00* | 22.89<br>*12.00* | 12.53<br>*10.00* | 39601 |
| 42228 | Half and Half Phosphate Mixture ..... | Manufacturer ..... | 10.91<br>*10.00* | 13.57<br>*12.00* | 24.48<br>*22.00* | 10.91<br>*10.00* | 42228 |
| | **Fox Chemical Co., Branch Federal Chemical Co., Louisville, Ky.** | | | | | | |
| 39632 | Fox High Grade Acid Phosphate ..... | Manufacturer ..... | 17.53<br>*16.00* | 0.19<br>*2.00* | 17.72<br>*18.00* | 17.53<br>*16.00* | 39632 |
| 39633<br>42459 | Fox Acid Phosphate .... | Manufacturer .....<br>Austin Beaver Dam | 16.89<br>14.05 | 2.59<br>7.19 | 19.48<br>21.24 | 16.89<br>14.05 | 39633<br>42459 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 39633 | Fox Acid Phosphate .... | Manufacturer ..... | 16.89 | 2.59 | 19.48 | 16.89 | 39633 |
| 42459 | | Harrison Austin, Beaver Dam . | 14.05 | 7.19 | 21.24 | 14.05 | 42459 |
| | | | *14.00* | *2.00* | *16.00* | *14.00* | |
| 39634 | Fox Standard Acid Phosphate ..... | Manufacturer ..... | 14.63 | 6.66 | 21.29 | 14.63 | 39634 |
| | | | *12.00* | *2.00* | *14.00* | *12.00* | |
| 39635 | Fox A. A. Acid Phosphate | Manufacturer ..... | 12.80 | 10.05 | 22.85 | 12.80 | 39635 |
| 42460 | | A. B. Beale & Son, Murray ... | 10.54 | 10.20 | 20.74 | 10.54 | 42460 |
| | | | *10.00* | *2.00* | *12.00* | *10.00* | |
| | **Globe Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.** | | | | | | |
| 39669 | Globe High Grade Acid Phosphate ..... | Manufacturer ..... | 18.03 | 0.13 | 18.16 | 18.03 | 39669 |
| 42479 | | Robert Taylor, Glens Fork ... | **13.03** | 7.93 | 20.96 | **13.03** | 42479 |
| | | | *16.00* | *2.00* | *18.00* | *16.00* | |
| 39670 | Globe Acid Phosphate ... | Manufacturer ..... | 16.96 | 2.73 | 19.69 | 16.96 | 39670 |
| | | | *14.00* | *2.00* | *16.00* | *14.00* | |
| 39671 | Globe Standard Acid Phosphate ..... | Manufacturer ..... | 13.67 | 7.14 | 20.81 | 13.67 | 39671 |
| | | | *12.00* | *2.00* | *14.00* | *12.00* | |
| 39672 | Globe A. A. Acid Phosphate ..... | Manufacturer ..... | 11.06 | 10.96 | 22.02 | 11.06 | 39672 |
| | | | *10.00* | *2.00* | *12.00* | *10.00* | |
| | **The Groves Co., Cincinnati, Ohio.** | | | | | | |
| 39921 | Monarch Brand ..... | Manufacturer ..... | 13.65 | 3.21 | 16.86 | 13.65 | 39921 |
| | | | *14.00* | *2.00* | *16.00* | *14.00* | |
| | **Hopkins Fertilizer Co., New Albany, Ind.** | | | | | | |
| 39917 | Old Time High Grade Acid Phosphate ..... | Manufacturer ..... | 13.36 | 1.38 | 14.74 | 13.36 | 39917 |
| | | | *14.00* | *2.00* | *16.00* | *14.00* | |

## Part I.—Table III.—Acid Phosphates.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained | Phosphoric Acid. Available. | Phosphoric Acid. Insoluble. | Phosphoric Acid. Total. | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|
| | **Hopkins Fertilizer Co.** | | | | | | |
| 39918 | Old Time Quick Action Phosphate | Manufacturer | 11.21<br>*10.00* | 1.43<br>*2.00* | 12.64<br>*12.00* | $11.21<br>*10.00* | 39918 |
| | **International Agr'l Corp., Buffalo Fert. Wks., Cincinnati, Ohio.** | | | | | | |
| 42182 | Dissolved Phosphate | Manufacturer | 14.28 | 0.51 | 14.79 | 14.28 | 42182 |
| 42504 | | R. J. Smith Co., Burnside | 14.66<br>*14.00* | 1.86<br>*1.00* | 16.52<br>*15.00* | 14.66<br>*14.00* | 42504 |
| 42233 | 16% Acid Phosphate | Manufacturer | 16.97<br>*16.00* | 0.75<br>*1.00* | 17.72<br>*17.00* | 16.97<br>*16.00* | 42233 |
| | **International Agr'l Corp. Interstate Phos. Works, Nashville, Tenn.** | | | | | | |
| 42133 | Acid Phosphate | Manufacturer | 12.41<br>*12.00* | 5.93<br>*1.00* | 18.34<br>*13.00* | 12.41<br>*12.00* | 42133 |
| | **International Agr'l Corp., Tenn. Valley Fert. Works, Nashville, Tenn.** | | | | | | |
| 42142 | Tiger Dissolved Bone | Manufacturer | **10.32**<br>*12.00* | 8.31 | 18.63 | **10.32**<br>*12.00* | 42142 |
| 42143 | Tiger High Grade Dissolved Bone | Manufacturer | 14.97<br>*14.00* | 3.63<br>*1.00* | 18.60<br>*15.00* | 14.97<br>*14.00* | 42143 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **International Agr'l Corp., Nat. Fert. Branch, Nashville, Tenn.** | | | | | | |
| 42153 | Old Hickory Acid Phosphate | Manufacturer | 12.47<br>*12.00* | 6.02<br>*1.00* | 18.49<br>*13.00* | 12.47<br>*12.00* | 42153 |
| 42154 | Old Hickory High Grade Acid Phosphate | Manufacturer | 16.57 | 2.22 | 18.79 | 16.57 | 42154 |
| 42516 | | F. A. Yost Co., Hopkinsville | 17.60<br>*16.00* | 1.78<br>*1.00* | 19.38<br>*17.00* | 17.60<br>*16.00* | 42516 |
| 42155 | Old Hickory High Grade Dissolved Bone | Manufacturer | 15.34 | 3.30 | 18.64 | 15.34 | 42155 |
| 42312 | | Mrs. M. J. Dehart, Sewellton | 13.95 | 3.88 | 17.83 | 13.95 | 42312 |
| 42517 | | E. J. Hines & Co., Science Hill | 14.64<br>*14.00* | 4.05<br>*1.00* | 18.69<br>*15.00* | 14.64<br>*14.00* | 42517 |
| 42322 | Old Hickory Ky. Acid Phosphate | Manufacturer | 11.36<br>*10.00* | 6.27 | 17.63 | 11.36<br>*10.00* | 42322 |
| | **The Jarecki Chemical Co., Cincinnati, Ohio.** | | | | | | |
| 42193 | C. O. D. Phosphate | Manufacturer | 15.86<br>*14.00* | 1.05<br>*1.00* | 16.91<br>*15.00* | 15.86<br>*14.00* | 42193 |
| | **Jones Fertilizer Co., Louisville, Ky.** | | | | | | |
| 39883 | Jones Phosphate | Manufacturer | 12.44<br>*12.00* | 0.96<br>*2.00* | 13.40<br>*14.00* | 12.44<br>*12.00* | 39883 |
| 39884 | Jones High Grade Dissolved Bone | Manufacturer | 14.94<br>*14.00* | 1.15<br>*2.00* | 16.09<br>*16.00* | 14.94<br>*14.00* | 39884 |
| | **Kaufman Fertilizer Co., Cincinnati, Ohio.** | | | | | | |
| 42220 | Dissolved Phosphate | Manufacturer | 15.54<br>*14.00* | 1.34<br>*1.00* | 16.88<br>*15.00* | 15.54<br>*14.00* | 42220 |

## Part I.—Table III.—Acid Phosphates.

| Station Number | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | Phosphoric Acid. Available. | Phosphoric Acid. Insoluble. | Phosphoric Acid. Total. | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|
| | **Kentucky Fertilizer Co., Branch Federal Chemical Co., Louiscille, Ky.** | | | | | | |
| 39693 | O. K. Phosphate ..... | Manufacturer ..... | 16.71<br>*14.00* | 2.80<br>*2.00* | 19.51<br>*16.00* | $16.71<br>*14.00* | 39693 |
| 39694 | O. K. Standard Phosphate | Manufacturer ..... | 14.07<br>*12.00* | 6.69<br>*2.00* | 20.76<br>*14.00* | 14.07<br>*12.00* | 39694 |
| 39695 | O. K. Good Luck Phosphate ..... | Manufacturer ..... | 11.87<br>*10.00* | 9.82<br>*2.00* | 21.69<br>*12.00* | 11.87<br>*10.00* | 39695 |
| 42311 | O. K. High Grade Acid Phosphate ..... | Manufacturer ..... | 17.05<br>*16.00* | 0.55<br>*2.00* | 17.60<br>*18.00* | 17.05<br>*16.00* | 42311 |
| | **Louisville Fertilizer Co., Louisville, Ky.** | | | | | | |
| 39846 | Eagle Phosphate ..... | Manufacturer ..... | 12.95<br>*12.00* | 0.45<br>*2.00* | 13.40<br>*14.00* | 12.95<br>*12.00* | 39846 |
| 39847 | Eagle High Grade Dissolved Bone ..... | Manufacturer ..... | 15.08<br>*14.00* | 0.83<br>*2.00* | 15.91<br>*16.00* | 15.08<br>*14.00* | 39847 |
| | **Mt. Pleasant Fertilizer Co., Mt. Pleasant, Tenn.** | | | | | | |
| 39755 | Black Patch Mt. Pleasant Soluble Bone ..... | Manufacturer ..... | 13.82<br>*12.00* | 7.41<br>*4.00* | 21.23<br>*16.00* | 13.82<br>*12.00* | 39755 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 39756 | Big Success Mt. Pleasant Special Acid Phosphate .. | Manufacturer ..... | 15.93<br>*14.00* | 3.58<br>*2.00* | 19.51<br>*16.00* | 15.93<br>*14.00* | 39756 |
| 39757 | Big Success High Grade Dissolved Bone ..... | Manufacturer ..... | 16.71<br>*16.00* | 0.38<br>*1.00* | 17.09<br>*17.00* | 16.71<br>*16.00* | 39757 |
| 39769 | Great Southern Acid Phosphate ..... | Manufacturer ..... | 15.88<br>*14.00* | 3.60<br>*2.00* | 19.48<br>*16.00* | 15.88<br>*14.00* | 39769 |
| 39770 | Great Southern Special Acid Phosphate ..... | Manufacturer ..... | 16.95<br>*16.00* | 1.11<br>*1.00* | 18.06<br>*17.00* | 16.95<br>*16.00* | 39770 |
| | **Read Phosphate Co., Nashville, Tenn.** | | | | | | |
| 39962 | Read's Special High Grade Acid Phosphate ..... | Manufacturer ..... | 18.00 | 2.50 | 20.50 | 18.00 | 39962 |
| 42584 | | M. L. Owen, Owensby ..... | 19.63<br>*16.00* | 1.31<br>*2.00* | 20.94<br>*18.00* | 19.63<br>*16.00* | 42584 |
| 39963 | Read's High Grade Acid Phosphate ..... | Manufacturer ..... | 13.41 | 4.21 | 17.62 | 13.41 | 39963 |
| 42585 | | M. B. Hines, Science Hill .... | **12.73**<br>*14.00* | 5.58<br>*2.00* | 18.31<br>*16.00* | **12.73**<br>*14.00* | 42585 |
| 39964 | Read's XXX Dissolved Bone ..... | Manufacturer ..... | 13.31 | 4.36 | 17.67 | 13.31 | 39964 |
| 42586 | | M. B. Hines, Science Hill .... | **10.21**<br>*13.00* | 5.24<br>*2.00* | 15.45<br>*15.00* | **10.21**<br>*13.00* | 42586 |
| 39965 | Read's Quick Action Phosphate ..... | Manufacturer ..... | 9.92 | 8.63 | 18.55 | 9.92 | 39965 |
| 42587 | | Troutman Bros., Shepherdsville | 9.51<br>*10.00* | 6.68<br>*2.00* | 16.19<br>*12.00* | 9.51<br>*10.00* | 42587 |
| | **Southern Fertilizer Co., Louisville, Ky.** | | | | | | |
| 42326 | Elk Phosphate ..... | Manufacturer ..... | 14.97<br>*14.00* | 2.52<br>*1.00* | 17.49<br>*15.00* | 14.97<br>*14.00* | 42326 |
| | **Swift & Co., Chicago, Ill.** | | | | | | |
| 39836 | Swift's Garden City Phosphate ..... | Manufacturer ..... | 14.03<br>*14.00* | 2.29 | 16.32 | 14.03<br>*14.00* | 39836 |

## Part I.—Table III.—Acid Phosphates.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained | Phosphoric Acid. Available. | Phosphoric Acid. Insoluble. | Phosphoric Acid. Total. | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|
| | **Swift & Co.** | | | | | | |
| 39837 | Swift's High Grade Acid Phosphate | Manufacturer | 16.75<br>*16.00* | 1.33 | 18.08 | $16.75<br>*16.00* | 39837 |
| | **Taylor & Powell Fertilizer Co., Springfield, Tenn.** | | | | | | |
| 42308 | 13% Acid Phosphate | Manufacturer | 13.91<br>*13.00* | 7.36 | 21.27 | 13.91<br>*13.00* | 42308 |
| 42309 | 14% Acid Phosphate | Manufacturer | 15.51<br>*14.00* | 5.76 | 21.27 | 15.51<br>*14.00* | 42309 |
| 42310 | 16% Acid Phosphate | Manufacturer | 16.34<br>*16.00* | 1.59 | 17.93 | 16.34<br>*16.00* | 42310 |
| | **Tennessee Chemical Co., Nashville, Tenn.** | | | | | | |
| 39715 | Ox Tennessee Best Acid Phosphate | Manufacturer | 17.07<br>*16.00* | 0.14<br>*2.00* | 17.21<br>*18.00* | 17.07<br>*16.00* | 39715 |
| 39716 | Ox Phosphate | Manufacturer | 13.16<br>*12.00* | 0.79<br>*2.00* | 13.95<br>*14.00* | 13.16<br>*12.00* | 39716 |
| 39717 | Ox High Grade Dissolved Bone | Manufacturer | 15.35 | 0.56 | 15.91 | 15.35 | 39717 |
| 42620 | | Sexton Brothers, Murray | 14.28<br>*14.00* | 2.60<br>*2.00* | 16.88<br>*16.00* | 14.28<br>*14.00* | 42620 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Tuscarora Fertilizer Co., Nashville, Tenn.** | | | | | | |
| 42118 | Tuscarora Acid Phosphate | Manufacturer | 14.50<br>*14.00* | 0.75<br>*2.00* | 15.25<br>*16.00* | 14.50<br>*14.00* | 42118 |
| 42119 | Tuscarora Bone Phosphate | Manufacturer | 10.28<br>*10.00* | 0.96<br>*2.00* | 11.24<br>*12.00* | 10.28<br>*10.00* | 42119 |
| | **Virginia-Carolina Chemical Co., Cincinnati, Ohio.** | | | | | | |
| 39820 | High Grade Acid Phosphate | Manufacturer | 14.95 | 0.48 | 15.43 | 14.95 | 39820 |
| 42646 | | B. P. Walker, Barbourville | 16.77<br>*14.00* | 0.84 | 17.61 | 16.77<br>*14.00* | 42646 |
| 39821 | Victor High Grade Acid Phosphate | Manufacturer | 15.27<br>*14.00* | 0.46 | 15.73 | 15.27<br>*14.00* | 39821 |
| 39822 | Capital Dissolved S. C. Bone | Manufacturer | 13.13<br>*12.00* | 0.31 | 13.44 | 13.13<br>*12.00* | 39822 |
| 39823 | I. X. L. Acid Phosphate | Manufacturer | 17.69 | 0.59 | 18.28 | 17.69 | 39823 |
| 42647 | | W. E. Gravely, Brodhead | 19.46<br>*16.00* | 0.38 | 19.84 | 19.46<br>*16.00* | 42647 |
| 39824 | Victor High Grade Super-Phosphate | Manufacturer | 17.91<br>*16.00* | 0.55 | 18.46 | 17.91<br>*16.00* | 39824 |
| | **Virginia-Carolina Chemical Co., Memphis, Tenn.** | | | | | | |
| 42284 | Capital Dissolved S. C. Bone | Manufacturer | 12.14<br>*12.00* | 1.06<br>*2.00* | 13.20<br>*14.00* | 12.14<br>*12.00* | 42284 |
| 42285 | Victor High Grade Superphosphate | Manufacturer | 17.27<br>*16.00* | 0.61<br>*2.00* | 17.88<br>*18.00* | 17.27<br>*16.00* | 42285 |
| 42286 | Victor High Grade Acid Phosphate | Manufacturer | 14.79<br>*14.00* | 1.02<br>*2.00* | 15.81<br>*16.00* | 14.79<br>*14.00* | 42286 |

## Part I.—Table IV.—Acid Phosphate and Potash Mixtures.

| Station Number | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained | Phosphoric Acid: Available. | Phosphoric Acid: Insoluble. | Phosphoric Acid: Total. | Potash: From Muriate. | Potash: From Sulphate | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| | **A. D. Adair and McCarty Bros., Atlanta, Ga.** | | | | | | | | |
| 42230 | High Grade Potash Compound | Manufacturer | 9.44 | 1.21 | 10.65 | 4.37 | | $16.18 | 42230 |
| | | | *10.00* | | | *4.00* | | *16.00* | |
| 42237 | Adair's Formula | Manufacturer | 9.54 | 1.21 | 10.75 | 2.24 | | 14.17 | 42237 |
| | | | *10.00* | | | *2.00* | | *14.00* | |
| | **The American Agr'l Chemical Co., Cincinnati Sales Department, Cincinnati, O.** | | | | | | | | |
| 39989 | Ten Four Grade | Manufacturer | 10.11 | 2.69 | 12.80 | 4.50 | | 17.71 | 39989 |
| 42334 | | Hobdy and Read, Scottsville | 10.01 | 2.64 | 12.65 | 4.82 | | 17.89 | 42334 |
| | | | *10.00* | *2.00* | *12.00* | *4.00* | | *16.80* | |
| 39991 | High Grade Bone and Potash | Manufacturer | 10.46 | 2.15 | 12.61 | 5.17 | | 18.58 | 39991 |
| 42335 | | W. G. Wesley, Mangum. | 9.78 | 2.40 | 12.18 | 5.29 | | 17.99 | 42335 |
| | | | *10.00* | *2.00* | *12.00* | *5.00* | | *17.80* | |
| | **The American Agr'l Chem. Co., Bowker Fert. Works, Cincinnati, Ohio.** | | | | | | | | |
| 42003 | Bowker's Dissolved Bone and Potash | Manufacturer | 10.90 | 1.34 | 12.24 | 2.19 | | 15.81 | 42003 |
| 42343 | | L. Smith and Co., Upton. | 9.70 | 2.63 | 12.33 | 1.93 | | 14.62 | 42343 |
| | | | *10.00* | *1.50* | *11.50* | *2.00* | | *14.60* | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 42005 | Bowker's Potash Fertilizer | Manufacturer | 11.46 | 1.05 | 12.51 | 5.04 | 19.22 | 42005 |
| 42344 | | J. H. Thurman, Somerset | 10.42 | 1.82 | 12.24 | 5.17 | 18.40 | 42344 |
| | | | *10.00* | *1.50* | *11.50* | *5.00* | *17.60* | |
| | **The American Agr'l Chem. Co., Cincinnati Sales Department, Cincinnati, O.** | | | | | | | |
| 42019 | Bradley Fert. Wks. Alkaline Bone and Potash | Manufacturer | 9.55 | 2.56 | 12.11 | 2.10 | 14.59 | 42019 |
| | | | *10.00* | *2.00* | *12.00* | *2.00* | *14.80* | |
| 42025 | Cleveland Dryer Works Soluble Bone and Potash | Manufacturer | 9.67 | 2.40 | 12.07 | 2.15 | 14.71 | 42025 |
| 42357 | | W. G. Wesley, Science Hill | 9.72 | 2.97 | 12.69 | 2.00 | 14.85 | 42357 |
| | | | *10.00* | *2.00* | *12.00* | *2.00* | *14.80* | |
| | **The American Agr'l Chem. Co., Michigan Carbon Works, Cincinnati, Ohio.** | | | | | | | |
| 42027 | Red Line Phosphate with Potash | Manufacturer | **9.18** | 2.59 | 11.77 | 2.11 | 14.17 | 42027 |
| 42358 | | Woodson Lewis, Greensburg | 9.84 | 2.31 | 12.15 | 1.93 | 14.66 | 42358 |
| | | | *10.00* | *2.00* | *12.00* | *2.00* | *14.80* | |
| 42029 | High Potash Phosphate | Manufacturer | 10.52 | 1.91 | 12.43 | 5.27 | 18.65 | 42029 |
| 42360 | | Hatter Hardware Co., Franklin | 10.37 | 3.26 | 13.63 | 4.63 | 18.37 | 42360 |
| | | | *10.00* | *2.00* | *12.00* | *5.00* | *17.80* | |
| | **The American Agr'l. Chem. Co., Cincinnati Sales Department, Cincinnati, O.** | | | | | | | |
| 42047 | N. W. Horse Shoe Brand 10-5 Potash Manure | Manufacturer | 10.11 | 2.32 | 12.43 | 5.23 | 18.29 | 42047 |
| | | | *10.00* | *2.00* | *12.00* | *5.00* | *17.80* | |
| 42048 | N. W. Horse Shoe Brand Bone and Potash | Manufacturer | 9.94 | 2.19 | 12.13 | 2.12 | 14.93 | 42048 |
| 42374 | | Watkins & Co., Elizabethtown | 9.87 | 3.00 | 12.87 | 2.23 | 15.27 | 42374 |
| | | | *10.00* | *2.00* | *12.00* | *2.00* | *14.80* | |

## Part I.—Table IV.—Acid Phosphate and Potash Mixtures.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained | Phosphoric Acid | | | Potash | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| | | | Available. | Insoluble. | Total. | From Muriate. | From Sulphate | | |
| | **The Amer. Agr'l Chem. Co.** | | | | | | | | |
| 42054 | Packers Boar's Head Brand Ky. Potash Mixture | Manufacturer ..... | 9.59 | 2.36 | 11.95 | 2.08 | | $14.53 | 42054 |
| 42379 | | T. E. Richardson, Campbellsville ..... | 11.03 | 2.27 | 13.30 | 2.14 | | 16.29 | 42379 |
| | | | *10.00* | *2.00* | *12.00* | *2.00* | | *14.80* | |
| 42056 | Packers Boar's Head Brand Potash Phosphate Fertilizer ..... | Manufacturer ..... | 10.14 | 2.29 | 12.43 | 5.54 | | 18.63 | 42056 |
| 42380 | | J. H. Wyan, London ... | 10.27 | 3.00 | 13.27 | 5.03 | | 18.55 | 42380 |
| | | | *10.00* | *2.00* | *12.00* | *5.00* | | *17.80* | |
| | **The Armour Fertilizer Wks. Nashville, Tenn.** | | | | | | | | |
| 42081 | Armour's High Grade Phosphate and Potash .. | Manufacturer ..... | 12.53 | 0.64 | 13.17 | 2.10 | | 17.40 | 42081 |
| 42394 | | Miller, Butter & Cartright, Elkton ..... | 12.05 | 0.64 | 12.69 | 3.99 | | 18.71 | 42394 |
| | | | *12.00* | *2.00* | *14.00* | *2.00* | | *17.20* | |
| 42082 | Armour's Soluble Phosphate and Potash ..... | Manufacturer ..... | 10.59 | 0.50 | 11.09 | 4.24 | | 17.15 | 42082 |
| 42395 | | Rubel Hardware Co., Lebanon ... ..... | 10.77 | 1.24 | 12.01 | 4.53 | | 17.95 | 42395 |
| | | | *10.00* | *4.00* | *14.00* | *4.00* | | *17.60* | |
| 42083 | Armour's Phosphate and Potash ..... | Manufacturer ..... | 10.62 | 0.40 | 11.02 | 2.06 | | 14.96 | 42083 |
| 42396 | | L. Smith & Co., Upton . | 10.91 | 6.49 | 17.40 | 2.61 | | 18.30 | 42396 |
| | | | *10.00* | *4.00* | *14.00* | *2.00* | | *15.60* | |
| 42106 | Smith's Bone and Potash | Manufacturer ..... | 10.55 | 0.57 | 11.12 | 2.09 | | 14.98 | 42106 |
| | | | *10.00* | *2.00* | *12.00* | *2.00* | | *14.80* | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 42106 | Smith's Bone and Potash | Manufacturer | 10.55 | 0.57 | 11.12 | 2.09 | | 14.98 | 42106 |
| | | | *10.00* | *2.00* | *12.00* | *2.00* | | *14.80* | |
| | **Central Manufacturing Co., Lockland, Ohio.** | | | | | | | | |
| 39775 | Equity Ohio Wonder ... | Manufacturer | 12.95 | 1.31 | 14.26 | 6.52 | | 22.58 | 39775 |
| | | | *12.00* | | | *5.00* | | *19.40* | |
| | **The Cincinnati Phosphate Co., Cincinnati, Ohio.** | | | | | | | | |
| 42205 | Dissolved Phosphate and Potash | Manufacturer | 9.36 | 0.99 | 10.35 | 3.46 | 1.26 | 16.60 | 42205 |
| | | | *10.00* | *1.00* | *11.00* | *4.00* | | *16.40* | |
| 42206 | Alkaline Phosphate .... | Manufacturer | 10.45 | 1.89 | 12.34 | 2.02 | | 15.32 | 42206 |
| | | | *10.00* | *1.00* | *11.00* | *2.00* | | *14.40* | |
| | **Continental Fertilizer Co., Nashville, Tenn.** | | | | | | | | |
| 39869 | Bear Potash Mixture ... | Manufacturer | 9.99 | 0.57 | 10.56 | 2.16 | | **14.38** | 39869 |
| 42415 | | Daugherty and Durham, Morgantown | 11.82 | 0.97 | 12.79 | 2.40 | | 16.97 | 42415 |
| | | | *10.00* | *4.00* | *14.00* | *2.00* | | *15.60* | |
| 39902 | Bear Bone and Potash .. | Manufacturer | 10.22 | 0.48 | 10.70 | 4.38 | | 16.83 | 39902 |
| | | | *10.00* | *4.00* | *14.00* | *4.00* | | *17.60* | |
| | **The Empire Guano Co., Nashville, Tenn.** | | | | | | | | |
| 39978 | Climax Bone and Potash. | Manufacturer | 11.54 | 5.15 | 16.69 | 2.13 | | 18.04 | 39978 |
| | | | *12.00* | *2.00* | *14.00* | *2.00* | | *17.20* | |
| 39980 | Potash Mixture ..... | Manufacturer | 10.50 | 6.32 | 16.82 | 3.65 | | 18.78 | 39980 |
| 42430 | | Medaris and Selby, Esto | 9.84 | 8.13 | 17.97 | 4.21 | | 19.27 | 42430 |
| | | | *10.00* | *4.00* | *14.00* | *4.00* | | *17.60* | |
| 39981 | Bone and Potash ..... | Manufacturer | 10.68 | 6.94 | 17.62 | 3.58 | | 19.18 | 39981 |
| 42431 | | J. S. Durham, Greensburg | 9.55 | 5.83 | 15.38 | 2.92 | 0.99 | 17.90 | 42431 |
| | | | *10.00* | *4.00* | *14.00* | *2.00* | | *15.60* | |

## Part I.—Table IV.—Acid Phosphate and Potash Mixtures.

| Station Number | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained | Phosphoric Acid: Available. | Phosphoric Acid: Insoluble. | Phosphoric Acid: Total. | Potash: From Muriate. | Potash: From Sulphate | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| | **The Empire Guano Co.** | | | | | | | | |
| 39985 | Climax Potash Acid .... | Manufacturer ..... | 10.25 | 5.41 | 15.66 | 5.91 | | $20.37 | 39985 |
| | | | *10.00* | *4.00* | *14.00* | *6.00* | | *19.60* | |
| | **The Evansville Packing Co., Evansville, Ind.** | | | | | | | | |
| 39736 | Grain Grower ..... | Manufacturer ..... | 10.31 | 1.61 | 11.92 | 4.01 | | 17.02 | 39736 |
| 42437 | | Eldred Hardware Co., Princeton ..... | 10.57 | 0.79 | 11.36 | 3.93 | | 16.93 | 42437 |
| | | | *10.00* | *2.00* | *12.00* | *4.00* | | *16.80* | |
| | **The Federal Chemical Co., Louisville, Ky.** | | | | | | | | |
| 39594 | Daybreak Bone and Potash ..... | Manufacturer ..... | 11.54 | 8.08 | 19.62 | | 2.69 | 20.31 | 39594 |
| | | | *10.00* | *2.00* | *12.00* | | *2.00* | *15.20* | |
| 39595 | Daybreak Potash Fertilizer ..... | Manufacturer ..... | 12.14 | 8.02 | 20.16 | | 5.40 | 24.27 | 39595 |
| | | | *9.00* | *2.00* | *11.00* | | *5.00* | *17.60* | |
| 39596 | Daybreak Potash Mixture ..... | Manufacturer ..... | 12.94 | 7.37 | 20.31 | | 4.78 | 24.22 | 39596 |
| 42445 | | O. T. Pickerill, Hodgenville ..... | 10.54 | 3.30 | 13.84 | 3.72 | | 17.69 | 42445 |
| | | | *10.00* | *2.00* | *12.00* | | *4.00* | *17.60* | |
| 39597 | Daybreak Phosphate and Potash ..... | Manufacturer ..... | 14.03 | 5.41 | 19.44 | | 2.88 | 22.46 | 39597 |
| | | | *12.00* | *2.00* | *14.00* | | *2.00* | *17.60* | |
| 42324 | Heads-O-Wheat ..... | Manufacturer ..... | 12.16 | 9.69 | 21.85 | | 3.77 | 22.99 | 42324 |
| | | | *10.00* | *10.00* | *20.00* | | *4.00* | *20.80* | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 42324 | Heads-O-Wheat ..... | Manufacturer ..... | 12.16 | 9.69 | 21.85 | | 3.77 | 22.99 | 42324 |
| | | | *10.00* | *10.00* | *20.00* | | *4.00* | *20.80* | |
| 42464 | Potash Ten ..... | Manufacturer ..... | 9.37 | 6.57 | 15.94 | | **1.06** | **10.08** | 42464 |
| | | | *8.00* | *4.00* | *12.00* | | *10.00* | *23.20* | |
| | **Fox Chemical Co., Branch Federal Chemical Co., Louisville, Ky.** | | | | | | | | |
| 39627 | Fox Alkaline Bone .... | **Manufacturer** ..... | 12.57 | 8.25 | 20.82 | | 2.91 | 21.87 | 39627 |
| 42458 | | J. W. Procter, Brodhead . | 9.79 | 0.82 | 10.61 | 1.84 | | **13.92** | 42458 |
| | | | *10.00* | *2.00* | *12.00* | | *2.00* | *15.20* | |
| 39628 | Fox Phospho Potash ... | Manufacturer ..... | 12.30 | 7.41 | 19.71 | | 4.99 | 23.71 | 39628 |
| | | | *9.00* | *2.00* | *11.00* | | *5.00* | *17.60* | |
| 39629 | Fox Bone Phosphate and Potash ..... | Manufacturer ..... | 12.00 | 7.34 | 19.34 | | 4.80 | 23.10 | 39629 |
| | | | *10.00* | *2.00* | *12.00* | | *4.00* | *17.60* | |
| 39630 | Fox Bone Phosphate ... | Manufacturer ..... | 14.31 | 4.83 | 19.14 | | 3.18 | 22.92 | 39630 |
| | | | *12.00* | *2.00* | *14.00* | | *2.00* | *18.00* | |
| 39631 | Fox Bone and Potash .. | Manufacturer ..... | 11.36 | 9.65 | 21.01 | | 3.52 | 21.71 | 39631 |
| | | | *9.00* | *2.00* | *11.00* | | *1.00* | *12.80* | |
| | **Globe Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.** | | | | | | | | |
| 39664 | Globe Potash Special ... | Manufacturer ..... | 12.14 | 8.39 | 20.53 | | 2.74 | 21.22 | 39664 |
| 42478 | | Robert Taylor, Glens Fork | 11.29 | 9.99 | 21.28 | 1.60 | | 19.15 | 42478 |
| | | | *10.00* | *2.00* | *12.00* | | *2.00* | *15.20* | |
| 39665 | Globe Potash Formula . | Manufacturer ..... | 11.50 | 8.35 | 19.85 | | 5.42 | 23.64 | 39665 |
| | | | *9.00* | *2.00* | *11.00* | | *5.00* | *17.60* | |
| 39666 | Globe Bone Phosphate and Potash ..... | Manufacturer ..... | 11.94 | 7.70 | 19.64 | | 4.59 | 22.92 | 39666 |
| | | | *10.00* | *2.00* | *12.00* | | *4.00* | *17.60* | |
| 39667 | Globe Potash Compound. | Manufacturer ..... | 14.23 | 5.14 | 19.37 | | 2.88 | 22.60 | 39667 |
| | | | *12.00* | *2.00* | *14.00* | | *2.00* | *17.60* | |

## Part I.—Table IV.—Acid Phosphate and Potash Mixtures.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained | Phosphoric Acid: Available. | Phosphoric Acid: Insoluble. | Phosphoric Acid: Total. | Potash: From Muriate. | Potash: From Sulphate | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| 39668 | **Globe Fertilizer Co.**<br>Big Four Phosphate ... | Manufacturer ..... | 11.18<br>*9.00* | 10.39<br>*2.00* | 21.57<br>*11.00* | | 3.12<br>*1.00* | $21.32<br>*12.80* | 39668 |
| | **The Groves Co., Cincinnati, Ohio** | | | | | | | | |
| 39922<br>42484 | Wheat and Oats ..... | Manufacturer .....<br>R. J. McDaniel, Adairville | 9.60<br>9.85<br>*10.00* | 1.34<br>1.66<br>*2.00* | 10.94<br>11.51<br>*12.00* | 1.78<br>1.85<br>*2.00* | | 13.84<br>14.33<br>*14.80* | 39922<br>42484 |
| 39923 | Potash Mixture ..... | Manufacturer ..... | **9.05**<br>*10.00* | 1.62<br>*2.00* | 10.67<br>*12.00* | 5.15<br>*5.00* | | **16.66**<br>*17.80* | 39923 |
| | **Hirsh, Stein & Co., Chicago, Ill.** | | | | | | | | |
| 42160 | Calumet Brand Phosphate and Potash ..... | Manufacturer ..... | 9.94<br>*10.00* | 1.59<br>*1.00* | 11.53<br>*11.00* | 2.94<br>*2.00* | | 15.51<br>*14.40* | 42160 |
| 42161 | Calumet Brand High Gr. Phosphate and Potash .. | Manufacturer ..... | 9.82<br>*10.00* | 1.25<br>*1.00* | 11.07<br>*11.00* | 5.84<br>*5.00* | | 18.12<br>*17.40* | 42161 |
| | **Hopkins Fertilizer Co., New Albany, Ind.** | | | | | | | | |
| 39916 | Old Time Potash Mixture | Manufacturer ..... | 10.62<br>*10.00* | 0.50<br>*2.00* | 11.12<br>*12.00* | 4.53<br>*4.00* | | 17.47<br>*16.80* | 39916 |
| | **International Agr'l Corp.,** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **International Agr'l Corp., Buffalo Fertilizer Works, Cincinnati, Ohio.** | | | | | | | | |
| 42183 | Phosphate and Potash .. | Manufacturer ..... | 9.83 | 1.01 | 10.84 | 2.20 | | 14.40 | 42183 |
| 42505 | | R. J. Smith Co., Burnside ..... | 10.39 | 0.93 | 11.32 | 4.43 | | 17.27 | 42505 |
| | | | *10.00* | *1.00* | *11.00* | *2.00* | | *14.40* | |
| 42284 | Standard Grain Grower.. | Manufacturer ..... | 10.64 | 0.85 | 11.49 | 3.83 | | 16.94 | 42184 |
| | | | *10.00* | *1.00* | *11.00* | *4.00* | | *16.40* | |
| | **International Agr'l Corp., Tennessee Valley Fert. Wks., Nashville, Tenn.** | | | | | | | | |
| 42139 | Tiger Potash Guano .... | Manufacturer ..... | 12.85 | 4.62 | 17.47 | **0.86** | **1.23** | 19.61 | 42139 |
| | | | *10.00* | *1.00* | *11.00* | *4.00* | | *16.40* | |
| 42140 | Tiger Guano ..... | Manufacturer ..... | 11.87 | 6.35 | 18.22 | 2.00 | 0.79 | 19.73 | 42140 |
| | | | *10.00* | *1.00* | *11.00* | *2.00* | | *14.40* | |
| 42141 | Tiger Bone and Potash. | Manufacturer ..... | 9.28 | 6.96 | 16.24 | 6.80 | | 20.72 | 42141 |
| | | | *8.00* | *1.00* | *9.00* | *2.00* | | *12.00* | |
| | **International Agr'l Corp., National Fert. Branch, Nashville, Tenn.** | | | | | | | | |
| 42146 | Old Hickory Anti Trust Bone and Potash ..... | Manufacturer ..... | 8.65 | 4.46 | 13.11 | 4.04 | | **16.20** | 42146 |
| 42510 | | F. A. Yost Co., Hopkinsville ..... | 9.72 | 7.80 | 17.01 | 1.10 | 2.42 | 18.78 | 42510 |
| | | | *10.00* | *1.00* | *11.00* | | *4.00* | *17.20* | |
| 42147 | Old Hickory Bone and Potash ..... | Manufacturer ..... | 10.65 | 4.92 | 15.57 | 2.55 | | 17.30 | 42147 |
| 42511 | | F. A. Yost Co., Hopkinsville ..... | 9.63 | 5.61 | 15.24 | | 2.19 | 16.43 | 42511 |
| | | | *10.00* | *1.00* | *11.00* | *2.00* | | *14.40* | |

## Part I.—Table IV.—Acid Phosphate and Potash Mixtures.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | Phosphoric Acid: Available. | Phosphoric Acid: Insoluble. | Phosphoric Acid: Total. | Potash: From Muriate. | Potash: From Sulphate | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| | **International Agr'l Corp.** | | | | | | | | |
| 42148 | Old Hickory Sadler's Formula | Manufacturer | 13.16 | 4.50 | 17.66 | 1.42 | 0.65 | $19.79 | 42148 |
| 42313 | | Mrs. M. J. Dehart, Sewellton | 11.68 | 6.53 | 18.21 | **1.03** | | 17.66 | 42313 |
| | | | *12.00* | *1.00* | *13.00* | *2.00* | | *16.80* | |
| 42331 | Old Hickory Potash High Grade | Manufacturer | 11.54 | 4.65 | 16.19 | | 7.35 | 24.53 | 42331 |
| | | | *10.00* | *1.00* | *11.00* | *8.00* | | *20.40* | |
| | **The Jarecki Chemical Co., Cincinnati, Ohio.** | | | | | | | | |
| 42195 | Square Brand Phosphate and Potash | Manufacturer | 10.21 | 1.52 | 11.73 | 2.14 | | 15.00 | 42195 |
| | | | *10.00* | *1.00* | *11.00* | *2.00* | | *14.40* | |
| 42198 | Super Phosphate and Potash | Manufacturer | 9.67 | 0.94 | 10.61 | 3.16 | 1.63 | 17.10 | 42198 |
| | | | *10.00* | *1.00* | *11.00* | *4.00* | | *16.40* | |
| | **Jones Fertilizer Co., Louisville, Ky.** | | | | | | | | |
| 39885 | Jones Potash Mixture | Manufacturer | 10.46 | 0.40 | 10.86 | 2.07 | | 14.78 | 39885 |
| | | | *10.00* | *4.00* | *14.00* | *2.00* | | *15.60* | |
| 39886 | Jones Bone and Potash | Manufacturer | 9.47 | 0.77 | 10.24 | 4.40 | | **16.07** | 39886 |
| | | | *10.00* | *4.00* | *14.00* | *4.00* | | *17.60* | |
| 39888 | Jones Potash Formula | Manufacturer | 10.30 | 0.73 | 11.03 | 4.97 | | 17.62 | 39888 |
| | | | *10.00* | *4.00* | *14.00* | *5.00* | | *18.60* | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 39888 | Jones Potash Formula . | Manufacturer ..... | 10.30 | 0.73 | 11.03 | 4.97 | | 17.62 | 39888 |
| | | | *10.00* | *4.00* | *14.00* | *5.00* | | *18.60* | |
| | **Kaufman Fertilizer Co., Cincinnati, Ohio.** | | | | | | | | |
| 42218 | Dissolved Bone and Potash ..... | Manufacturer ..... | 9.70 | 1.02 | 10.72 | 3.62 | 1.15 | 17.05 | 42218 |
| | | | *10.00* | *1.00* | *11.00* | *4.00* | | *16.40* | |
| 42219 | Alkaline Bone and Potash | Manufacturer ..... | 10.58 | 1.58 | 12.16 | 2.16 | | 15.49 | 42219 |
| | | | *10.00* | *1.00* | *11.00* | *2.00* | | *14.40* | |
| | **Kentucky Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.** | | | | | | | | |
| 39691 | O. K. Potash Special .... | Manufacturer ..... | 12.20 | 8.62 | 20.82 | | 2.73 | 21.37 | 39691 |
| | | | *10.00* | *2.00* | *12.00* | | *2.00* | *15.20* | |
| 39692 | O. K. Potash Manure .. | Manufacturer ..... | 11.49 | 8.15 | 19.64 | | 5.51 | 23.66 | 39692 |
| | | | *9.00* | *2.00* | *11.00* | | *5.00* | *17.60* | |
| | **Louisville Fertilizer Co., Louisville, Ky.** | | | | | | | | |
| 39848 | Eagle Potash Mixture .. | Manufacturer ..... | 10.50 | 0.62 | 11.12 | 2.33 | | 15.18 | 39848 |
| 42541 | | E. M. Ford & Sons, Glasgow Junction ..... | 10.84 | 0.28 | 11.12 | 2.27 | | 15.39 | 42541 |
| | | | *10.00* | *4.00* | *14.00* | *2.00* | | *15.60* | |
| 39849 | Eagle Bone and Potash Compound ..... | Manufacturer ..... | **9.32** | 0.60 | 9.92 | 4.29 | | **15.71** | 39849 |
| | | | *10.00* | *4.00* | *14.00* | *4.00* | | *17.60* | |
| 39865 | Eagle Potash Special .... | Manufacturer ..... | 12.15 | 0.52 | 12.67 | 2.26 | | 17.05 | 39865 |
| | | | *12.00* | *2.00* | *14.00* | *2.00* | | *16.20* | |
| 39866 | Eagle Phosphate and Potash ..... | Manufacturer ..... | 10.88 | 0.79 | 11.67 | 8.19 | | 21.57 | 39866 |
| | | | *10.00* | *4.00* | *14.00* | *6.00* | | *19.60* | |

## PART I.—TABLE IV.—ACID PHOSPHATE AND POTASH MIXTURES.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | PHOSPHORIC ACID | | | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| | | | Available. | Insoluble. | Total. | From Muriate. | From Sulphate | | |
| | **Mt. Pleasant Fertilizer Co., Mt. Pleasant, Tenn.** | | | | | | | | |
| 39751 | Big Success Farmers' Choice | Manufacturer | 14.21 | 5.90 | 20.11 | | 3.74 | $23.90 | 39751 |
| | | | *10.00* | *4.00* | *14.00* | | *4.00* | *18.40* | |
| 39752 | Big Success Banner Tobacco Grower | Manufacturer | 11.64 | 9.91 | 21.55 | | 1.77 | 20.05 | 39752 |
| | | | *10.00* | *6.00* | *16.00* | | *2.00* | *16.80* | |
| 39753 | Big Success Banner Grain Grower | Manufacturer | 11.40 | 8.07 | 19.47 | 1.64 | | 18.88 | 39753 |
| 42560 | | Logan County Hardware Co., Russellville | 11.17 | 9.33 | 20.50 | 1.72 | | 18.85 | 42560 |
| | | | *10.00* | *4.00* | *14.00* | *2.00* | | *15.60* | |
| 39754 | Black Patch Wheat Special | Manufacturer | 10.32 | 5.90 | 16.22 | 3.41 | | 18.15 | 39754 |
| | | | *10.00* | *3.00* | *13.00* | *4.00* | | *17.20* | |
| 39765 | Universal Tobacco Special | Manufacturer | 12.37 | 8.49 | 20.86 | 0.68 | 2.87 | 22.36 | 39765 |
| 42563 | | C. L. Dowdy, Mayfield | 10.15 | 6.25 | 16.40 | 3.95 | | 18.63 | 42563 |
| | | | *10.00* | *5.00* | *15.00* | | *4.00* | *18.80* | |
| 39766 | Ever Ready Tobacco Grower | Manufacturer | 11.86 | 9.66 | 21.52 | 0.98 | 0.79 | 20.02 | 39766 |
| 42564 | | C. L. Dowdy, Mayfield | 10.58 | 5.10 | 15.68 | 6.49 | | 21.23 | 42564 |
| | | | *10.00* | *6.00* | *16.00* | | *2.00* | *16.80* | |
| 39767 | Great Southern Wheat Special | Manufacturer | 10.77 | 5.00 | 15.77 | 3.48 | | 18.40 | 39767 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 39767 | Great Southern Wheat Special | Manufacturer | 10.77 | 5.00 | 15.77 | 3.48 | 18.40 | 39767 |
| | | | *10.00* | *3.00* | *13.00* | *4.00* | *17.20* | |
| 39768 | Ever Ready Wheat Grower | Manufacturer | 10.18 | 8.18 | 18.36 | 1.70 | 17.19 | 39768 |
| | | | *10.00* | *4.00* | *14.00* | *2.00* | *15.60* | |
| 42351 | Big Success Wheat Grower | Manufacturer | 15.83 | 1.13 | 16.96 | 8.71 | 28.16 | 42351 |
| | | | *14.00* | *2.00* | *16.00* | *8.00* | *25.60* | |
| | **The Queen City Fertilizer Co., Cincinnati, Ohio.** | | | | | | | |
| 42226 | Phosphate and Potash... | Manufacturer | 10.94 | 1.29 | 12.23 | 2.14 | 15.79 | 42226 |
| 42567 | | Hughes & Douglas, Rectorville | 10.24 | 0.91 | 11.15 | 2.04 | 14.69 | 42567 |
| | | | *10.00* | *1.00* | *11.00* | *2.00* | *14.40* | |
| | **Read Phosphate Co., Nashville, Tenn.** | | | | | | | |
| 39957 | Read's Special Wheat Grower | Manufacturer | 10.21 | 5.42 | 15.63 | 5.87 | 20.29 | 39957 |
| 42580 | | M. B. Hines, Science Hill | **9.35** | 5.25 | 14.60 | **5.06** | **18.38** | 42580 |
| | | | *10.00* | *4.00* | *14.00* | *6.00* | *19.60* | |
| 39958 | Read's H. Gr. Special Potash Mixture | Manufacturer | 10.33 | 6.34 | 16.67 | 3.70 | 18.64 | 39958 |
| 42581 | | Barren Co. Grocery and Hdw. Co., Glasgow.... | 10.06 | 5.39 | 15.45 | **3.30** | 17.53 | 42581 |
| | | | *10.00* | *4.00* | *14.00* | *4.00* | *17.60* | |
| 39959 | Read's Alkaline Bone... | Manufacturer | 10.19 | 7.28 | 17.47 | 3.39 | 18.53 | 39959 |
| 42582 | | J. C. Cowherd & Co,, Greensburg | 10.62 | 4.55 | 15.17 | 2.08 | 16.64 | 42582 |
| | | | *10.00* | *4.00* | *14.00* | *2.00* | *15.60* | |
| 39960 | Read's High Grade Bone and Potash | Manufacturer | 11.59 | 5.05 | 16.64 | 2.08 | 18.01 | 39960 |
| 42583 | | Hatter Hardware Co., Franklin | **11.24** | 4.51 | 15.75 | 2.24 | 17.53 | 42583 |
| | | | *12.00* | *2.00* | *14.00* | *2.00* | *17.20* | |
| 39961 | Read's High Grade Grain Special | Manufacturer | 14.65 | 1.93 | 16.58 | 5.96 | 24.31 | 39961 |
| | | | *14.00* | *2.00* | *16.00* | *5.00* | *22.60* | |

## Part I.—Table IV.—Acid Phosphate and Potash Mixtures.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | Phosphoric Acid: Available. | Phosphoric Acid: Insoluble. | Phosphoric Acid: Total. | Potash: From Muriate. | Potash: From Sulphate | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| | **Smith Agr'l Chemical Co., Columbus, Ohio.** | | | | | | | | |
| 42177 | Ohio Farmers Soluble Phosphate and Potash ... | Manufacturer ..... | 9.87 | 1.87 | 11.74 | 2.23 | | $14.82 | 42177 |
| 42594 | | G. G. Hardyman, Rectorville ..... | 9.85<br>*10.00* | 1.71 | 11.56 | 2.58<br>*2.00* | | 15.09<br>*14.00* | 42594 |
| | **Swift & Co., Chicago, Ill.** | | | | | | | | |
| 39838 | Swift's High Grade Phosphate and Potash ..... | Manufacturer ..... | 10.44<br>*10.00* | 1.31 | 11.75 | 4.79<br>*4.00* | | 17.84<br>*16.00* | 39838 |
| 39839 | Swift's Special Phosphate and Potash ..... | Manufacturer ..... | 11.66 | 0.92 | 12.58 | 1.86 | | 16.22 | 39839 |
| 42608 | | Staggs Bros., Vanceburg. | 10.28<br>*10.00* | 1.07 | 11.35 | 2.27<br>*2.00* | | 15.04<br>*14.00* | 42608 |
| | **Taylor and Powell Fertilizer Co., Springfield, Tenn.** | | | | | | | | |
| 42305 | 10-4 ..... | Manufacturer ..... | 10.49<br>*10.00* | 7.14 | 17.63 | 5.99<br>*4.00* | | 21.44<br>*16.00* | 42305 |
| 42306 | 12-2 ..... | Manufacturer ..... | 12.33 | 6.06 | 18.39 | 3.99 | | 22.21 | 42306 |
| 42612 | | W. S. Harrison, Elkton.. | 13.05<br>*12.00* | 5.46 | 18.51 | *2.00* | 1.74 | 19.93<br>*16.40* | 42612 |
| | **Tennessee Chemical Co., Nashville, Tenn.** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Tennessee Chemical Co., Nashville, Tenn.** | | | | | | | | |
| 39714 | Ox High Grade Potash... | Manufacturer ..... | 9.90 | 0.57 | 10.47 | 5.30 | | 17.41 | 39714 |
| 42619 | | W. F. Grainger, Franklin | **9.41** | 1.34 | 10.75 | **1.00** | **3 34** | **16.84** | 42619 |
| | | | *10.00* | *4.00* | *14.00* | *5.00* | | *18.60* | |
| 39718 | Ox Potash Mixture ..... | Manufacturer ..... | 10.60 | 0.59 | 11.19 | 2.19 | | 15.15 | 39718 |
| 42621 | | Duke & Collier, Crab Orchard ..... | 9.98 | 1.94 | 11.92 | 1.94 | | 14.70 | 42621 |
| | | | *10.00* | *4.00* | *14.00* | *2.00* | | *15.60* | |
| 39719 | Ox Alkaline Bone ..... | Manufacturer ..... | 12.09 | 0.51 | 12.60 | 2.13 | | 16.84 | 39719 |
| | | | *12.00* | *2.00* | *14.00* | *2.00* | | *17.20* | |
| 39720 | Ox Potash Formula .... | Manufacturer ..... | 9.37 | 0.65 | 10.02 | 4.41 | | 15.91 | 39720 |
| 42622 | | W. F. Grainger, Franklin | 12.51 | 3.02 | 15.53 | **0.98** | 1.84 | 19.41 | 42622 |
| | | | *10.00* | *4.00* | *14.00* | *4.00* | | *17.60* | |
| 42318 | Ox Phosphate and Potash. | Manufacturer ..... | 10.34 | 1.31 | 11.65 | 5.36 | | 18.29 | 42318 |
| | | | *10.00* | *4.00* | *14.00* | | *4.00* | *18.40* | |
| | **Tuscarora Fertilizer Co., Nashville, Tenn.** | | | | | | | | |
| 42117 | Tuscarora Bone and Potash ..... | Manufacturer ..... | 10.29 | 0.64 | 10.93 | 2.08 | | 14.69 | 42117 |
| | | | *10.00* | *4.00* | *14.00* | *2.00* | | *15.60* | |
| 42122 | Tuscarora Acid Phosphate and Potash ..... | Manufacturer ..... | 10.83 | 0.61 | 11.44 | 5.50 | | 18.74 | 42122 |
| | | | *10.00* | *4.00* | *14.00* | *5.00* | | *18.60* | |
| 42123 | Dickinson's Potash and Phosphate Mixture ..... | Manufacturer ..... | 10.08 | 0.69 | 10.77 | 2.09 | | **14.47** | 42123 |
| 42631 | | Dickinson Bros., Glasgow | 9.43 | 6.39 | 15.82 | 2.03 | | 15.91 | 42631 |
| | | | *10.00* | *4.00* | *14.00* | *2.00* | | *15.60* | |
| 42124 | Dickinson's Standard Grain Grower ..... | Manufacturer ..... | 10.00 | 0.88 | 10.88 | 4.00 | | **16.35** | 42124 |
| 42632 | | Dickinson Bros., Glasgow | 10.28 | 7.56 | 17.84 | **2.54** | | 17.90 | 42632 |
| | | | *10.00* | *4.00* | *14.00* | *4.00* | | *17.60* | |

## Part I.—Table IV.—Acid Phosphate and Potash Mixtures.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | Phosphoric Acid | | | Potash. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| | | | Available. | Insoluble. | Total. | From Muriate. | From Sulphate | | |
| | **Virginia-Carolina Chemical Co., Cincinnati, Ohio.** | | | | | | | | |
| 39815 | Acid and Potash King ... | Manufacturer ..... | 9.90 | 1.54 | 11.44 | 3.97 | | $16.47 | 39815 |
| | | | *10.00* | *1.50* | *11.50* | *4.00* | | *16.60* | |
| 39816 | Royal Grain Grower .... | Manufacturer ..... | 10.28 | 1.19 | 11.47 | 3.88 | | 16.70 | 39816 |
| | | | *10.00* | *1.50* | *11.50* | *4.00* | | *16.60* | |
| 39817 | Victor Bone and Potash Compound ..... | Manufacturer ..... | 15.62 | 1.13 | 16.75 | 2.80 | | 21.99 | 39817 |
| 42644 | | T. A. Porter & Co., London ..... | 17.41 | 1.64 | 19.05 | 3.81 | | 25.36 | 42644 |
| | | | *15.00* | *1.50* | *16.50* | *3.00* | | *21.60* | |
| 39818 | Grain Food ..... | Manufacturer ..... | 10.62 | 1.48 | 12.10 | 2.25 | | 15.58 | 39818 |
| | | | *10.00* | *1.50* | *11.50* | *2.00* | | *14.60* | |
| 39819 | Capital Bone and Potash Compound ..... | Manufacturer ..... | 10.33 | 1.71 | 12.04 | 2.21 | | 15.29 | 39819 |
| 42645 | | D. E. Patterson, Hodgenville ..... | 11.96 | 2.21 | 14.17 | 2.38 | | 17.61 | 42645 |
| | | | *10.00* | *1.50* | *11.50* | *2.00* | | *14.60* | |
| 42298 | Prolific Grain and Grass Grower ..... | Manufacturer ..... | 9.65 | 1.73 | 11.38 | | 5.44 | 18.80 | 42298 |
| | | | *10.00* | *1.50* | *11.50* | | *5.00* | *18.60* | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Virginia-Carolina Chemical Co., Memphis, Tenn.** | | | | | | | | | | | |
| 42279 | Champion Bone and Potash Compound | Manufacturer | 9.74<br>*10.00* | 1.34<br>*2.00* | 11.08<br>*12.00* | *5.00* | 6.06 | 18.29<br>*17.80* | | | 42279 |
| 42281<br>42643 | Royal Grain Grower | Manufacturer | 10.14 | 1.28 | 11.42 | 4.97 | | 17.65 | | | 42281 |
| | | Eldred Hardware Co., Princeton | 10.21<br>*10.00* | 1.11<br>*2.00* | 11.32<br>*12.00* | 4.50<br>*4.00* | | 17.19<br>*16.80* | | | 42643 |
| 42282 | Capital Bone and Potash Compound | Manufacturer | 9.98<br>*10.00* | 1.28<br>*2.00* | 11.26<br>*12.00* | 2.17<br>*2.00* | | 14.66<br>*14.80* | | | 42282 |
| 42283 | Victor Bone and Potash | Manufacturer | 14.67<br>*15.00* | 1.29<br>*2.00* | 15.96<br>*17.00* | 3.17<br>*3.00* | | 21.29<br>*21.80* | | | 42283 |

PART I, TABLE V.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The Cincinnati Phosphate Co., Cincinnati, Ohio.** | |
| 42209 | "Bonus" A Humus Phosphate | Manufacturer |
| | **Duncan & Bro., La Grange, Ky.** | |
| 42325 | Tiger Brand Phosphate and Tankage | *Manufacturer |
| | **Federal Chemical Co., Louisville, Ky.** | |
| 39592 | Daybreak Harvest Home Bone Meal Mixture | Manufacturer |
| 39593 | Daybreak Harvest Bone | Manufacturer |
| | **Fox Chemical Co., Branch Federal Chemical Co., Louisville, Ky.** | |
| 39625 | Fox Half and Half Bone Meal Mixture | Manufacturer |
| 39626 | Fox Ammoniated Bone | Manufacturer |
| | **Globe Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.** | |
| 39661 | Golden Harvest Bone Meal Mixture | Manufacturer |
| 39662 | Golden Harvest Bone Meal | Manufacturer |
| 42477 | | Morris and Burton, Campbellsville |

*Manufacturer failed to furnish sample as required by law.

## Nitrogenous Superphosphates.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | Equivalent to Ammonia. | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | | |
| 12.71 | 0.97 | 13.68 | | | | 0.52 | 0.63 | $17.46 | 42209 |
| *12.00* | *1.00* | *13.00* | | | | *0.41* | *0.50* | *16.24* | |
| *12.00* | *3.00* | *15.00* | | | | *0.82* | *1.00* | *18.47* | 42325 |
| 13.31 | 9.23 | 22.54 | | | | 1.84 | 2.23 | 26.10 | 39592 |
| *10.00* | *10.00* | *20.00* | | | | *1.65* | *2.00* | *21.78* | |
| 12.28 | 2.79 | 15.07 | 1.10 | | 1.75 | 2.85 | 3.46 | 25.84 | 39593 |
| *10.00* | *4.00* | *14.00* | | | | *2.47* | *3.00* | *22.25* | |
| 12.46 | 10.24 | 22.70 | | | | 1.86 | 2.26 | 25.56 | 39625 |
| *10.00* | *10.00* | *20.00* | | | | *1.65* | *2.00* | *21.78* | |
| 11.91 | 2.19 | 14.10 | 1.08 | | 1.90 | 2.98 | 3.62 | 25.60 | 39626 |
| *10.00* | *4.00* | *14.00* | | | | *2.47* | *3.00* | *22.25* | |
| 13.63 | 9.24 | 22.87 | | | | 1.85 | 2.25 | 26.54 | 39661 |
| *10.00* | *10.00* | *20.00* | | | | *1.65* | *2.00* | *21.78* | |
| 12.50 | 2.44 | 14.94 | 1.27 | | 1.70 | 2.97 | 3.61 | 26.38 | 39662 |
| 11.38 | 3.82 | 15.20 | | 0.42 | 2.13 | 2.55 | 3.10 | 24.12 | 42477 |
| *10.00* | *4.00* | *14.00* | | | | *2.47* | *3.00* | *22.25* | |

PART I, TABLE V.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **International Agr'l. Corp., Tenn. Valley Fert. Wks., Nashville, Tenn.** | |
| 42333 | Monarch Ammoniated Mixture ..... | Manufacturer ..... |
| | **Kentucky Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.** | |
| 39687 | O. K. Special Bone Meal Mixture ..... | Manufacturer ..... |
| 42538 | | L. A. Collins, Campbellsville ..... |
| 39688 | O. K. Bone Meal Mixture. | Manufacturer ..... |
| | **Taylor & Powell Fertilizer Co., Springfield, Tenn.** | |
| 42303 | Half and Half ..... | Manufacturer ..... |

## Nitrogenous Superphosphates.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | Equivalent to Ammonia. | Estimated Value Per Ton. | Station Number. |
| 11.68 | 0.89 | 12.57 | | | | 0.87 | 1.06 | $17.43 | 42333 |
| *11.00* | *1.00* | *12.00* | | | | *0.82* | *1.00* | *16.47* | |
| 12.89 | 9.52 | 22.41 | | | | 2.01 | 2.44 | 26.32 | 39687 |
| 10.62 | 9.19 | 19.81 | 0.55 | | 1.05 | 1.60 | 1.94 | 21.08 | 42538 |
| *10.00* | *10.00* | *20.00* | | | | *1.65* | *2.00* | *21.78* | |
| 11.95 | 2.55 | 14.50 | 1.16 | | 1.80 | 2.96 | 3.59 | 25.72 | 39688 |
| *10.00* | *4.00* | *14.00* | | | | *2.47* | *3.00* | *22.25* | |
| **10.21** | 8.53 | 18.74 | | | | 1.95 | 2.37 | 22.49 | 42303 |
| *12.00* | *3.00* | *15.00* | | | | *1.85* | *2.25* | *22.11* | |

## Part I, Table VI.—Potash Salts.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | POTASH. From Muriate. | POTASH. From Sulphate. | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|
| | **German Kali Works, Inc., New York City, N. Y.** | | | | | |
| 39782 | Muriate of Potash ..... | Manufacturer ..... | 51.95<br>*48.00* | | $51.95<br>*48.00* | 39782 |
| 39783 | Sulphate of Potash ..... | Manufacturer ..... | 3.00 | 47.50<br>*47.00* | 60.00<br>*56.40* | 39783 |
| 39784 | Kainit ..... | Manufacturer ..... | 14.23<br>*12.00* | | 14.23<br>*12.00* | 39784 |
| | **Hopkins Fertilizer Co., New Albany, Ind.** | | | | | |
| 39920 | Old Time Muriate of Potash | Manufacturer ..... | 50.75<br>*50.00* | | 50.75<br>*50.00* | 39920 |
| | **Read Phosphate Co., Nashville, Tenn.** | | | | | |
| 39954 | Read's Muriate of Potash. | Manufacturer ..... | 51.85<br>*50.00* | | 51.85<br>*50.00* | 39954 |
| 39955 | Read's Sulphate of Potash. | Manufacturer ..... | 4.00 | 43.80 | 56.56 | 39955 |
| 42579 | | Hatter Hardware Co., Franklin | 3.80 | 46.25<br>*50.00* | 59.30<br>*60.00* | 42579 |
| | **Swift & Company, Chicago, Illinois** | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Swift & Company, Chicago, Illinois.** | | | | | | |
| 39835 | Muriate of Potash ..... | Manufacturer ..... | 50.30<br>*50.00* | | | 50.30<br>*50.00* | 39835 |
| 42131 | Sulphate of Potash ..... | Manufacturer ..... | 3.20 | 46.55<br>*48.00* | | 59.06<br>*57.60* | 42131 |

## Part I, Table VII.—Nitrate of Soda and Dried Blood.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | Nitrogen. | Equivalent to Ammonia. | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|
| | **Hopkins Fertilizer Co., New Albany, Ind.** | | | | | |
| 39919 | Old Time Nitrate of Soda.. | Manufacturer ..... | 15.13<br>*15.00* | 18.37<br>*18.22* | $52.96<br>*52.50* | 39919 |
| | **Read Phosphate Co., Nashville, Tenn.** | | | | | |
| 39956 | Read's Nitrate of Soda ... | Manufacturer ..... | 15.55<br>*15.25* | 18.88<br>*18.52* | 54.43<br>*53.38* | 39956 |
| | **Swift & Company, Chicago, Illinois.** | | | | | |
| 42130 | Swift's Ground Dried Blood ..... | Manufacturer ..... | 13.76<br>*13.18* | 16.70<br>*16.00* | 48.16<br>*46.13* | 42130 |
| | **Virginia-Carolina Chemical Co., Cincinnati, Ohio.** | | | | | |
| 42267 | Nitrate of Soda ..... | Manufacturer ..... | 14.68<br>*14.83* | 17.82<br>*18.00* | 51.38<br>*51.91* | 42267 |

# PART II

| Station Number | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The American Agr'l Chemical Co., Cincinnati Sales Dept., Cincinnati, O.** | |
| 42658 | A. A .C. Co's., Wheat and Corn Special ..... | T. E. Richardson, Campbellsville .. |
| | **The American Agr'l Chemical Co., Bowker Fert. Works., Cincinnati, O.** | |
| 42663 | Bowker's Fish Guano .. | J. D. Hammond, Somerset ..... |
| 42664 | Bowker's Grain and Grass Grower ..... | T. E. Richardson, Campbellsville .. |
| 42665 | Bowker's Kentucky Special ..... | J. D. Hammond, Somerset ..... |
| 42666 | Bowker's Tobacco Grower | T. E. Richardson, Campbellsville .. |
| | **The American Agr'l Chemical Co., Michigan Carbon Works, Cincinnati, O.** | |
| 42670 | Red Line Crop Grower .. | Hatter Hardware Co., Franklin ... |
| 42671 | Homestead Bone Black Fertilizer ..... | Hatter Hardware Co., Franklin ... |
| 42672 | Homestead 10% Potash Manure ..... | J. R. Davis and Bro., Campbellsville. |
| | **The American Agr'l Chemical Co., Cincinnati Sales Dept., Cincinnati, O.** | |
| 42673 | N. W. Horseshoe Brand Challenge Corn Grower.. | Grayson County Supply Co., Leitchfield ..... |
| 42674 | N. W. Horseshoe Brand Corn and Wheat Grower | Watkins and Co., Elizabethtown ... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN. | | | | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 7.87 | 1.54 | 9.41 | | 0.90 | 0.99 | 1.89 | 2.29 | 2.29 | | $18.97 | 42658 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |
| 9.17 | 1.16 | 10.33 | | 0.35 | 0.70 | 1.05 | 1.27 | 3.31 | | 18.45 | 42663 |
| *8.00* | *1.50* | *9.50* | | | | *0.82* | *1.00* | *3.00* | | *16.07* | |
| 9.06 | 0.68 | 9.74 | | 0.90 | 0.87 | 1.77 | 2.15 | 2.30 | | 19.64 | 42664 |
| *8.00* | *1.50* | *9.50* | | | | *1.65* | *2.00* | *2.00* | | *17.98* | |
| 8.32 | 2.36 | 10.68 | | 0.21 | 1.22 | 1.43 | 1.74 | 4.26 | | 20.19 | 42665 |
| *8.00* | *1.50* | *9.50* | | | | *1.23* | *1.50* | *4.00* | | *18.51* | |
| 7.66 | 2.83 | 10.49 | | 0.32 | 1.47 | 1.79 | 2.17 | 0.84 | 4.80 | 23.19 | 42666 |
| *8.00* | *1.50* | *9.50* | | | | *1.65* | *2.00* | | *5.00* | *21.98* | |
| 8.62 | 1.06 | 9.68 | | 0.86 | 0.93 | 1.79 | 2.17 | 2.45 | | 19.48 | 42670 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |
| 8.39 | 2.39 | 10.68 | | 1.35 | 0.87 | 2.22 | 2.70 | 1.83 | | 20.59 | 42671 |
| *8.00* | *2.00* | *10.00* | | | | *2.06* | *2.50* | *1.50* | | *19.11* | |
| 5.66 | 1.33 | 6.99 | | 0.44 | 0.54 | 0.98 | 1.19 | 10.61 | | 21.36 | 42672 |
| *5.00* | *2.00* | *7.00* | | | | *0.82* | *1.00* | *10.00* | | *19.67* | |
| 8.49 | 1.03 | 9.52 | | | | 2.21 | 2.68 | 2.32 | | 20.66 | 42673 |
| *8.00* | *2.00* | *10.00* | | | | *2.06* | *2.50* | *1.50* | | *19.11* | |
| 8.70 | 0.48 | 9.18 | | 0.79 | 1.01 | 1.80 | 2.19 | 2.48 | | 19.41 | 42674 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |

PART II, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Armour Fertilizer Works, Nashville, Tenn.** | |
| 42679 | Armour's Bone Meal and Potash ..... | Simpson Co. Hdw. Co., Franklin .. |
| 42680 | Armour's Wheat Special No. 2. ..... | Rubel-Abell Hdw. Co., Lebanon ... |
| 42681 | Armour's Champion .... | Rubel-Abell Hdw. Co., Lebanon ... |
| 42682 | Armour's Grain Grower . | Miller Bros., and Co., LaGrange .. |
| 42683 | Armour's Wheat, Corn and Oats Special ..... | Barren Co. Grocery and Hdw. Co., Glasgow ..... |
| 42689 | Smith's Corn and Wheat Grower ..... | H. H. Dunagan, Burnside ..... |
| 42690 | Smith's Pure Bone Meal with Potash ..... | H. H. Dunagan, Burnside ..... |
| | **Central Mfg. Co., Lockland, O.** | |
| 42692 | Equity Grain Favorite .. | Williams and Powell, Greenville .. |
| 42693 | Equity Clay Land Wheat Special ..... | J. J. Eskridge & Co., Leitchfield . |
| | **Continental Fert. Co., Nashville, Tenn.** | |
| 42695 | Bear Special Corn and Wheat Grower ..... | Prichard and Ball, Paris ..... |
| 42696 | Bear Grain Grower .... | J. E. Wallace, Olive Hill ..... |
| 42697 | Bear H. Gr. Tobacco and Potato Grower ..... | J. E. Wallace, Olive Hill ..... |
| 42699 | Bear Tobacco Grower .. | J. E. Wallace, Olive Hill ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN. | | | | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 10.27 | 14.64 | 24.91 | | | | 1.98 | 2.40 | | **1.94** | $27.44 | 42679 |
| *10.00* | *6.00* | *16.00* | | | | *1.23* | *1.50* | | *3.00* | *22.31* | |
| 10.07 | 2.22 | 12.29 | | | | 0.65 | 0.79 | 2.05 | | **17.31** | 42680 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | *2.00* | | *18.47* | |
| 10.18 | 3.21 | 13.39 | | | | 1.87 | 2.27 | | 1.91 | 22.34 | 42681 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 8.79 | 3.34 | 12.13 | 0.43 | | 1.13 | 1.56 | 1.89 | 2.60 | | 19.95 | 42682 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | *2.00* | | *18.98* | |
| 6.89 | 1.01 | 7.80 | | | | 0.80 | 0.97 | 1.44 | | 12.91 | 42683 |
| *7.00* | *4.00* | *11.00* | | | | *0.82* | *1.00* | *1.00* | | *13.87* | |
| 8.07 | 2.51 | 10.58 | | | | **1.20** | 1.46 | 0.82 | 1.00 | **16.90** | 42689 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | *2.00* | | *18.98* | |
| 11.53 | 7.93 | 19.46 | | | | 1.39 | 1.69 | **1.00** | **1.23** | 24.36 | 42690 |
| *10.00* | *8.00* | *18.00* | | | | *0.82* | *1.00* | | *4.00* | *22.87* | |
| 9.15 | 0.87 | 10.02 | | | | 0.63 | 0.76 | 4.57 | | 18.11 | 42692 |
| *9.00* | | | | | | *0.41* | *0.50* | *3.00* | | *15.24* | |
| 11.94 | 1.33 | 13.27 | | | | 1.01 | 1.23 | 1.38 | | 19.78 | 42693 |
| *10.00* | | | | | | *0.82* | *1.00* | *1.00* | | *15.87* | |
| 8.80 | 1.85 | 10.65 | | | | 0.70 | 0.85 | 1.38 | | 15.13 | 42695 |
| *7.00* | *4.00* | *11.00* | | | | *0.82* | *1.00* | | *1.00* | *14.07* | |
| 7.73 | 1.19 | 8.92 | | | | 0.84 | 1.02 | | 4.76 | 18.41 | 42696 |
| *8.00* | *4.00* | *12.00* | | | | *0.41* | *0.50* | | *4.00* | *17.44* | |
| 7.92 | 1.54 | 9.46 | 0.27 | | 1.14 | 1.41 | 1.71 | | 5.06 | 12.13 | 42697 |
| *7.00* | *4.00* | *11.00* | | | | *1.65* | *2.00* | | *4.00* | *20.58* | |
| 9.01 | 1.58 | 10.59 | 0.72 | | 1.05 | **1.77** | 2.15 | | 6.22 | **25.10** | 42699 |
| *8.00* | *4.00* | *12.00* | | | | *2.47* | *3.00* | | *6.00* | *27.05* | |

PART II, TABLE I.

| Station Number | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Duncan and Bro., LaGrange, Ky.** | |
| 42700 | Tiger Brand Grain Grower | Manufacturer's Warehouse ..... |
| 42701 | Tiger Brand Spl. Corn and Wheat Grower ..... | Manufacturer's Warehouse ..... |
| | **The Empire Guano Co., Nashville, Tenn.** | |
| 42704 | Blood, Bone and Potash | J. L. Durham, Greensburg ..... |
| 42706 | Wheat and Corn Grower | J. L. Durham, Greensburg ..... |
| | **The Evansville Packing Co., Evansville, Ind.** | |
| 42710 | Beef, Blood and Bone .. | W. T. Kirkman, Elkton ..... |
| | **Federal Chemical Co., Louisville, Ky.** | |
| 42711 | Daybreak Wheat and Corn Special ..... | A. H. Miller Implement Co., Elizabethtown ..... |
| | **Fox Chem. Co., Branch, Federal Chem. Co., Louisville, Ky.** | |
| 42714 | Fox Bone, Blood and Potash ..... | Harrison Austin, Beaver Dam .... |
| | **Globe Fert. Co., Branch Federal Chem. Co., Louisville, Ky.** | |
| 42719 | Eagle Wheat and Corn Grower ..... | The Jeffries Hdw. Store, Columbia.. |
| 42720 | Big Four Tobacco Grower | E. G. Fristoe and Co., Mayfield ... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN. | | | | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 13.03 | 1.98 | 15.01 | 0.25 | | 0.62 | 0.87 | 1.06 | 0.52 | 0.83 | $21.00 | 42700 |
| *12.00* | *2.00* | *14.00* | | | | *0.82* | *1.00* | | *1.00* | *19.27* | |
| 11.91 | 1.68 | 13.59 | 0.33 | | 0.79 | **1.12** | 1.36 | 1.68 | 0.78 | 21.50 | 42701 |
| *10.00* | *2.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *20.98* | |
| 8.85 | 6.03 | 14.88 | | 0.56 | 0.60 | **1.16** | 1.41 | 2.38 | | 19.47 | 42704 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | *2.00* | | *18.98* | |
| **9.22** | 5.20 | 14.42 | | | | 0.39 | 0.47 | 0.54 | 0.74 | 15.94 | 42706 |
| *11.00* | *3.00* | *14.00* | | | | *0.41* | *0.50* | *1.00* | | *16.84* | |
| 7.80 | 4.08 | 11.88 | | | | 1.95 | 2.37 | 1.12 | 2.39 | 21.81 | 42710 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | | *2.00* | *18.58* | |
| 13.12 | 6.03 | 19.15 | | | | 0.48 | 0.58 | 0.70 | 0.65 | 21.31 | 42711 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *1.00* | *17.44* | |
| 12.56 | 0.98 | 13.54 | | | | 0.55 | 0.67 | 0.74 | 0.56 | 18.80 | 42714 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *1.00* | *17.44* | |
| 8.22 | 1.34 | 9.56 | 1.06 | | 0.39 | 1.45 | 1.76 | 1.96 | 0.98 | 18.62 | 42719 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| 9.43 | 3.24 | 12.67 | 0.65 | | 0.88 | 1.53 | 1.86 | | 2.27 | 20.70 | 42720 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |

PART II, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Globe Fertilizer Co.** | |
| 42722 | Braden Formula ..... | W. E. Gravely, Broadhead ..... |
| 42723 | Progress Corn and Wheat Grower ..... | J. S. Patton, Burnside ..... |
| 42724 | Globe Wheat and Grain Special ..... | E. G. Fristoe and Co., Mayfield ... |
| 42725 | Globe Bone and Potash | J. S. Patton, Burnside ..... |
| 42726 | Globe Grain and Grass Grower ..... | J. W. Cloyd, Campbellsville ..... |
| 42727 | Globe Bone Dust ..... | C. L. Dudley, Flemingsburg ..... |
| 42729 | Globe Ground Tobacco Compound ..... | The Jeffries Hdw. Store, Columbia.. |
| | **Grayson Co. Fert. Co., Leitchfield, Ky.** | |
| 42730 | Grain Grower ..... | Manufacturer's Warehouse ..... |
| | **The Groves Co., Cincinnati, Ohio.** | |
| 42732 | Corn and Tobacco Grower | Minges Hdw. Co., Newport ..... |
| 42733 | Favorite Fertilizer .... | Haselden Bros., Lancaster ..... |
| | **Hirsh, Stein and Co., Chicago, Ill.** | |
| 42736 | Calumet Brand H. Gr. Bone, Blood and Potash | A. F. Vertrees, Vine Grove ..... |
| 42737 | Calumet Brand Bone Black Grain Grower.... | Jas. Pearson & Co., Franklin..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN. | | | | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 12.99 | 2.11 | 15.10 | | | | 0.78 | 0.95 | 2.98 | | $22.14 | 42722 |
| *11.00* | *4.00* | *15.00* | | | | *0.82* | *1.00* | | *3.00* | *21.27* | |
| 12.13 | 4.97 | 17.10 | | | | 0.95 | 1.15 | 1.02 | 0.96 | 22.05 | 42723 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | | *2.00* | *18.87* | |
| 14.69 | 0.51 | 15.20 | | | | 0.61 | 0.74 | 0.68 | 0.48 | 21.23 | 42724 |
| *12.00* | *4.00* | *16.00* | | | | *0.82* | *1.00* | | *1.00* | *20.07* | |
| 13.20 | 6.03 | 19.23 | | | | 0.45 | 0.55 | 0.46 | 0.72 | 21.15 | 42725 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *1.00* | *17.44* | |
| **9.99** | 3.71 | 13.70 | 0.26 | | 0.58 | 0.84 | 1.02 | 1.20 | | 17.61 | 42726 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0.50* | | *1.00* | *17.44* | |
| 9.49 | 4 96 | 14.45 | 0.32 | | 0.57 | 0.89 | 1.08 | 0.78 | 0.72 | 18.16 | 42727 |
| *9.00* | *4.63* | *13.00* | | | | *0.82* | *1.00* | | *1.00* | *16.47* | |
| 12.03 | 0.61 | 12.64 | | | | 0.43 | 0.52 | 0.82 | 2.75 | 20.31 | 42729 |
| *10.00* | *4.00* | *14.00* | | | | *0.21* | *0.25* | | *4.00* | *19.14* | |
| **5.69** | 0.89 | 6.58 | | | | **0.06** | 0.07 | | **0.79** | 8.35 | 42730 |
| *8.00* | | | | | | *1.30* | *1.58* | | *5.00* | *20.15* | |
| 8.60 | 1.19 | 9.79 | | | | 0.70 | 0.85 | 3.65 | | 16.90 | 42732 |
| *8.00* | *2.00* | *10.00* | | | | *0.82* | *1.00* | *4.00* | | *17.27* | |
| 7.58 | 1.13 | 8.71 | | 0.39 | 1.06 | 1.45 | 1.76 | 2.13 | | **16.76** | 42733 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |
| 10.53 | 2.27 | 12.80 | | | | 0.81 | 0.98 | 4.92 | | 21.31 | 42736 |
| *10.00* | *1.00* | *11.00* | | | | *0.82* | *1.00* | *5.00* | | *20.27* | |
| 8.87 | 2.36 | 11.23 | | 0.45 | 1.46 | 1.91 | 2.32 | **2.22** | | **20.49** | 42737 |
| *8.00* | *1.00* | *9.00* | | | | *2.06* | *2.50* | *6.00* | | *23.21* | |

PART II, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Hirsh, Stein & Co.** | |
| 42744 | Calumet Brand Grain Grower ..... | Salsman & New, Clarkson..... |
| 42745 | Calumet Brand Wheat Corn and Oats Special... | A. F. Vertrees, Vine Grove..... |
| | **International Agr'l Corp., National Fert. Branch, Nashville, Tenn.** | |
| 42749 | Old Hickory Guano..... | F. A. Yost Co., Hopkinsville..... |
| | **The Jarecki Chem. Co., Cincinnati, Ohio.** | |
| 42751 | Lake Erie Guano with Phosphate and Potash, | J. P. Thompson, Clarkson..... |
| 42752 | Raw Bone and Phosphate Mixture ..... | J. P. Thompson, Clarkson..... |
| | **Jones Fertilizer Co., Louisville, Ky.** | |
| 42754 | Jones Slaughter House Bone ..... | Grayson Co. Supply Co., Leitchfield.. |
| | **Kentucky Fertilizer Co., Branch Federal Chem. Co., Louisville, Ky.** | |
| 42756 | O. K. Corn, Wheat and Oats Grower ..... | M. Woosley, Elizabethtown..... |
| 42761 | Potash and Tobacco Special ..... | G. B. Taylor, Campbellsville..... |
| 42762 | O. K. Golden Grain Tobacco Mixture ..... | G. B. Taylor, Campbellsville..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN. | | | | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 8.92 | 2.44 | 11.36 | | | | 1.59 | 1.93 | 2.16 | | $19.41 | 42744 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | *2.00* | | *17.78* | |
| 8.82 | 2.78 | 11.60 | | | | 0.77 | 0.93 | 4.29 | | 18.68 | 42745 |
| *8.00* | *1.00* | *9.00* | | | | *0.82* | *1.00* | *4.00* | | *16.87* | |
| 9.33 | 3.11 | 12.44 | | | | 1.72 | 2.09 | 2.13 | | 20.59 | 42749 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | *2.00* | | *17.78* | |
| 8.29 | 1.08 | 9.37 | | | | 1.26 | 1.53 | 2.37 | | 17.16 | 42751 |
| *8.00* | *1.00* | *9.00* | | | | *1.23* | *1.50* | *2.50* | | *16.81* | |
| 9.03 | 7.65 | 16.68 | | | | 1.25 | 1.52 | 2.09 | | 20.37 | 42752 |
| *8.00* | *8.00* | *16.00* | | | | *1.23* | *1.50* | *2.00* | | *19.11* | |
| 8.17 | 2.05 | 10.22 | 0.34 | | 1.27 | 1.61 | 1.95 | | 2.91 | 19.75 | 42754 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| 12.83 | 5.02 | 17.85 | | | | 0.36 | 0.44 | 0.96 | | 19.63 | 42756 |
| *11.00* | *4.00* | *15.00* | | | | *0.41* | *0 50* | | *1.00* | *17.44* | |
| 11.40 | 9.04 | 20.44 | | | | 0.32 | 0.39 | | 1.55 | 20.28 | 42761 |
| *10.00* | *4.00* | *14.00* | | | | *0.21* | *0.25* | | *2.00* | *16.74* | |
| 11.22 | 7.29 | 18.51 | | | | 0.51 | 0.62 | | 3.46 | 22.32 | 42762 |
| *10.00* | *4.00* | *14.00* | | | | *0.21* | *0.25* | | *4.00* | *19.14* | |

PART II, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Louisville Fertilizer Co., Louisville, Ky.** | |
| 42763 | Eagle Special Corn and Wheat Grower ..... | Hogan, Clark & Yates, Elizabethtown |
| 42764 | Eagle Grain Grower .... | Hogan, Clark & Yates, Elizabethtown |
| 42765 | Eagle Slaughter House Bone ..... | M. C. Beam & Son, New Hope..... |
| 42766 | Eagle Guano ..... | Clore & Brown, Crestwood..... |
| 42767 | Eagle H. Gr. Tobacco and Potato Grower ..... | Clore & Brown, Crestwood..... |
| | **Morris & Co., Chicago, Ill.** | |
| 42774 | Big Seven-Spl. Bone Meal and Poatsh ..... | Woodson Lewis, Greensburg..... |
| 42775 | Big Twelve-Prepared Manure with Phosphate and Potash ..... | Woodson Lewis, Greensburg..... |
| | **Read Phosphate Co., Nashville, Tenn.** | |
| 42778 | Read's H. Gr. Tobacco Grower ..... | J. C. Cowherd & Co., Greensburg... |
| 42779 | Read's H. Gr. Ammoniated Dissolved Bone ..... | Hatter Hardware Co., Franklin.... |
| 42780 | Read's Farmers Special Manure ..... | Barren Co. Grocery and Hardware Co., Glasgow ..... |
| 42781 | Read's Corn and Wheat Grower ..... | T. J. Alexander, Monticello..... |
| 42786 | Read's Soluble Bone.... | M. L. Spurling, Campbellsville.... |

## Complete Fertilizers.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate. | | |
| 8.53 | 2.28 | 10.81 | 0.27 | | 0.61 | 0.88 | 1.07 | | 1.25 | $15.73 | 42763 |
| *7.00* | *4.00* | *11.00* | | | | *0.82* | *1.00* | | *1.00* | *14.07* | |
| 8.55 | 1.59 | 10.14 | 0.21 | | 0.38 | 0.59 | 0.72 | 2.64 | 2.11 | 18.14 | 42764 |
| *8.00* | *4.00* | *12.00* | | | | *0.41* | *0.50* | | *4.00* | *17.44* | |
| 9.08 | 3.19 | 12.27 | 0.26 | | 1.28 | 1.54 | 1.87 | | 1.94 | 19.90 | 42765 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.00* | *19.38* | |
| **8.63** | 3.44 | 12.07 | 0.29 | | 1.46 | 1.75 | 2.12 | 3.23 | | 21.10 | 42766 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 8.40 | 2.21 | 10.61 | 0.27 | | 1.09 | 1.36 | 1.65 | 0.86 | 3.09 | 20.29 | 42767 |
| *7.00* | *4.00* | *11.00* | | | | *1.65* | *2.00* | | *4.00* | *20.58* | |
| 10.13 | 6.78 | 16.91 | | | | 1.25 | 1.52 | | 3.37 | 23.29 | 42774 |
| *8.00* | *8.00* | *16.00* | | | | *1.23* | *1.50* | | *3.00* | *20.71* | |
| 7.38 | 2.18 | 9.56 | | | | 0.73 | 0.89 | | **2.14** | 14.86 | 42775 |
| *7.00* | *2.00* | *9.00* | | | | *0.82* | *1.00* | | *3.00* | *15.67* | |
| 8.37 | 6.04 | 14.41 | | 0.89 | 0.63 | 1.52 | 1.85 | 3.00 | 1.03 | 22.02 | 42778 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *4.00* | *21.78* | |
| **8.71** | 5.24 | 13.95 | | 0.88 | 0.72 | 1.60 | 1.94 | 1.54 | 0.53 | **20.33** | 42779 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | *2.00* | | *21.38* | |
| 9.39 | 4.65 | 14.04 | | 0.32 | 0.48 | 0.80 | 0.97 | 3.30 | | 19.23 | 42780 |
| *10.00* | *4.00* | *14.00* | | | | *0.82* | *1.00* | *3.00* | | *19.47* | |
| 10.65 | 4.12 | 14.77 | | | | 0.40 | 0.49 | 0.42 | 0.70 | 17.09 | 42781 |
| *11.00* | *3.00* | *14.00* | | | | *0.41* | *0.50* | *1.00* | | *16.84* | |
| 7.74 | 5.44 | 13.18 | | | | 0.79 | 0.96 | 2.53 | | 16.77 | 42786 |
| *8.00* | *4.00* | *12.00* | | | | *0.82* | *1.00* | *2.00* | | *16.03* | |

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Swift and Co., Chicago, Ill.** | |
| 42655<br>42788 | Swift's Superphosphate . | E. L. Procter, LaGrange .....<br>L. W. Irvin and Son, Greenville ... |
| 42789 | Swift's Champion Wheat and Corn Grower ..... | M. L. Spurling, Campbellsville .... |
| 42794 | Swift's Pure Spl. Wheat Grower, Pure Bone and Potash ..... | M. L. Spurling, Campbellsville .... |
| | **Tennessee Chemical Co., Nashville, Tenn.** | |
| 42795 | Ox Ammoniated Bone | I. K. Miller and Sons, Campbellsville |
| 42804 | Ox Special Corn and Wheat Grower ..... | I. K. Miller and Sons, Campbellsville |
| 42805 | Ox Grain Grower ..... | G. W. Richardson, Somerset ..... |
| 42806 | Ox Slaughter House Bone | G. W. Richardson, Somerset ..... |
| | **Virginia-Carolina Chemical Co., Cincinnati, Ohio.** | |
| 42811 | Monarch Ammoniated Dis. Bone and Potash ..... | I. K. Miller and Sons, Campbellsville |
| 42812 | Standard Wheat and Corn Grower ..... | C. M. Cox, Spurlington ..... |
| 42813 | Wheat, Corn and Tobacco Grower ..... | I. K. Miller and Sons, Campbellsville |
| 42814 | Royal Tobacco Fertilizer | C. M. Cox, Spurlington ..... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN. | | | | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 8.55 | 1.71 | 10.26 | | | | 1.47 | 1.78 | 2.20 | | $18.29 | 42655 |
| 9.12 | 1.72 | 10.84 | | | | 1.71 | 2.08 | 3.03 | | 20.65 | 42788 |
| *8.00* | *1.00* | *9.00* | | | | *1.65* | *2.00* | *2.00* | | *17.78* | |
| 13.09 | 1.90 | 14.99 | | | | 1.63 | 1.98 | 2.07 | | 24.25 | 42789 |
| *12.00* | *1.00* | *13.00* | | | | *1.65* | *2.00* | *2.00* | | *22.58* | |
| 9.96 | 10.90 | 20.86 | | | | 1.44 | 1.75 | 2.73 | | 24.08 | 42794 |
| *8.00* | *8.00* | *16.00* | | | | *1.20* | *1.46* | *3.00* | | *20.00* | |
| 10.11 | 3.37 | 13.48 | 0.22 | | 1.32 | 1.54 | 1.87 | | 2.61 | 22.00 | 42795 |
| *10.00* | *4.00* | *14.00* | | | | *1.65* | *2.00* | | *2.00* | *21.78* | |
| 7.09 | 1.87 | 8.96 | | | | 0.96 | 1.17 | 1.02 | 1.23 | 15.12 | 42804 |
| *7.00* | *4.00* | *11.00* | | | | *0.82* | *1.00* | | *1.00* | *14.07* | |
| 7.91 | 1.94 | 9.85 | | | | 0.60 | 0.73 | 1.06 | 3.11 | 17.16 | 42805 |
| *8.00* | *4.00* | *12.00* | | | | *0.41* | *0.50* | | *4.00* | *17.44* | |
| 8.35 | 3.19 | 11.54 | | | | 1.56 | 1.89 | | 2.35 | 19.58 | 42806 |
| *8.00* | *4.00* | *12.00* | | | | *1.65* | *2.00* | | *2.09* | *19.38* | |
| 14.61 | 1.43 | 16.04 | | 0.60 | 0.43 | 1.03 | 1.25 | 0.94 | 1.71 | 24.70 | 42811 |
| *12.00* | *1.50* | *13.50* | | | | *1.23* | *1.50* | | *3.00* | *22.91* | |
| 11.94 | 2.55 | 14.49 | 0.52 | | 0.37 | 0.89 | 1.08 | 4.47 | | 23.83 | 42812 |
| *11.00* | *1.50* | *12.50* | | | | *0.82* | *1.00* | *3.00* | | *19.67* | |
| 8.18 | 2.44 | 10.62 | | 0.53 | 0.52 | 1.05 | 1.27 | 4.04 | | 18.52 | 42813 |
| *8.00* | *1.50* | *9.50* | | | | *0.82* | *1.00* | *4.00* | | *17.07* | |
| 9.19 | 2.00 | 11.19 | | 1.46 | 0.58 | 2.04 | 2.48 | 1.24 | 4.31 | 25.38 | 42814 |
| *8.00* | *1.50* | *9.50* | | | | *1.65* | *2.00* | | *5.00* | *21.98* | |

PART II, TABLE I.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Virginia-Carolina Chemical Co.** | |
| 42815 | Royal Blood, Bone and Potash ..... | C. M. Cox, Spurlington ..... |
| 42820 | Miller's Wheat, Corn and Tobacco Special ..... | I. K. Miller and Sons, Campbellsville |
| | **Virginia-Carolina Chemical Co., Memphis, Tenn.** | |
| 42821 | Beef, Blood and Bone Fertilizer ..... | Eldred Hardware Co., Princeton ... |

## Complete Fertilizers.

| PHOSPHORIC ACID | | | NITROGEN. | | | | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | From Muriate. | From Sulphate | | |
| 8.38 | 2.07 | 10.45 | 0.20 | 1.15 | 0.52 | 1.87 | 2.27 | 2.41 | | $19.85 | 42815 |
| *8.00* | *1.50* | *9.50* | | | | *1.65* | *2.00* | *2.00* | | *17.98* | |
| 9.63 | 3.39 | 13.02 | | 0.32 | 0.71 | 1.03 | 1.25 | | 2.19 | 19.16 | 42820 |
| *10.00* | *2.00* | *12.00* | | | | *0.82* | *1.00* | | *2.00* | *18.07* | |
| 8.30 | 1.49 | 9.79 | | | | 1.55 | 1.88 | 2.32 | | 18.31 | 42821 |
| *8.00* | *2.00* | *10.00* | | | | *1.65* | *2.00* | *2.00* | | *18.18* | |

PART II, TABLE II.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **The American Agricultural Chemical Co., Cincinnati Sales Dept., Cincinnati, Ohio.** | |
| 42656 | Fine Raw Bone ..... | Miller, Cartwright & Miller, Elkton. |
| | **The American Agr'l Chemical Co., Bowker Fert. Works, Cincinnati, Ohio.** | |
| 42667 | Bowker's Pure Ground Bone ..... | T. E. Richardson, Campbellsville... |
| | **The Armour Fertilizer Works, Nashville, Tenn.** | |
| 42686 | Armour's Bone Meal .... | W. F. Grainger, Franklin..... |
| 42687 | Armour's Raw Bone Meal | Miller, Cartwright & Miller, Elkton. |
| 42691 | Smith's Bone Meal ..... | H. H. Dunagan, Burnside..... |
| | **Central Mfg. Co., Lockland, Ohio.** | |
| 42694 | Equity Raw Bone Meal | Williams & Powell, Greenville..... |
| | **Continental Fert. Co., Nashville, Tenn.** | |
| 42698 | Bear Raw Bone Meal .. | J. E. Wallace, Olive Hill..... |
| | **The Evansville Packing Co., Evansville, Ind.** | |
| 42709 | Pure Raw Bone Meal ... | W. T. Kirkman, Elkton ..... |

## Bones, Tankage, Etc.

| PERCENTAGE OF FINENESS | | Total Phosphoric Acid. | Equivalent to Bone Phosphate. | Nitrogen. | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| Fine Bone. | Medium Bone. | | | | | From Muriate. | From Sulphate | | |
| 85 | 15 | 21.85<br>*22.00* | 47.72<br>*48.06* | 4.29<br>*3.29* | 5.21<br>*4.00* | | | $31.85<br>*24.72* | 42656 |
| 74 | 26 | 22.44<br>*20.00* | 49.01<br>*43.67* | 2.52<br>*2.47* | 3.06<br>*3.00* | | | 25.61<br>*20.65* | 42667 |
| 100 | | 28.84<br>*27.00* | 62.98<br>*58.96* | 1.98<br>*1.65* | 2.40<br>*2.00* | | | 30.00<br>*21.98* | 42686 |
| 82 | 18 | 27.84<br>*22.00* | 60.80<br>*48.06* | **3.27**<br>*3.71* | 3.97<br>*4.50* | | | 32.72<br>*26.19* | 42687 |
| 92 | 8 | 27.80<br>*27.00* | 60.71<br>*58.96* | 2.03<br>*1.65* | 2.46<br>*2.00* | | | 28.90<br>*21.98* | 42691 |
| 68 | 32 | **20.25**<br>*23.00* | 44.23<br>*50.24* | 3.20<br>*2.88* | 3.88<br>*3.50* | | | 26.11<br>*23.88* | 42694 |
| 88 | 12 | 27.16<br>*24.00* | 59.32<br>*52.42* | 2.44<br>*2.47* | 2.96<br>*3.00* | | | 29.62<br>*23.05* | 42698 |
| 52 | 48 | 25.94<br>*23.00* | 56.66<br>*50.24* | 3.69<br>*3.71* | 4.48<br>*4.50* | | | 31.18<br>*26.79* | 42709 |

PART II, TABLE II.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Fox Chemical Co., Branch, Federal Chem. Co., Louisville, Ky.** | |
| 42718 | Fox Raw Bone ..... | Harrison Austin, Beaver Dam..... |
| | **Globe Fert. Co., Branch Federal Chem. Co., Louisville, Ky.** | |
| 42728 | Globe Raw Bone ..... | Clarkson Hardware Co., Clarkson... |
| | **The Groves Co., Cincinnati, Ohio.** | |
| 42734 | Pure Ground Bone..... | W. B. Morris, Absher..... |
| 42735 | Half and Half ..... | Haselden Bros., Lancaster..... |
| | **Hirsh, Stein & Co., Chicago, Ill.** | |
| 42740 | Calumet Brand Special Pure Bone Meal and Potash ..... | I. K. Miller & Sons, Campbellsville.. |
| 42741 | Calumet Brand Extra Bone Meal ..... | I. K. Miller & Sons, Campbellsville.. |
| 42742 | Calumet Brand Special Pure Bone Meal ..... | I. K. Miller & Sons, Campbellsville.. |
| 42743 | Calumet Brand Pure Raw Bone Meal ..... | I. K. Miller & Sons, Campbellsville.. |
| | **Hopkins Fertilizer Co., New Albany, Ind.** | |
| 42746 | Old Time Pure Raw Bone | A. W. and O. T. Pickerill, Hodgenville ..... |

## Bones, Tankage, Etc.

| Percentage of Fineness. | | Total Phosphoric Acid. | Equivalent to Bone Phosphate. | Nitrogen. | Equivalent to Ammonia. | Potash. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| Fine Bone. | Medium Bone. | | | | | From Muriate. | From Sulphate. | | |
| 83 | 17 | 24.17<br>*22.00* | 52.78<br>*48.06* | 3.97<br>*3.71* | 4.82<br>*4.50* | | | $32.42<br>*26.19* | 42718 |
| 47 | 53 | 21.30<br>*22.00* | 46.52<br>*48.06* | 3.75<br>*3.71* | 4.55<br>*4.50* | | | 27.91<br>*26.19* | 42728 |
| 76 | 24 | 24.23<br>*20.00* | 52.92<br>*43.67* | 2.72<br>*2.47* | 3.30<br>*3.00* | | | 27.74<br>*20.65* | 42734 |
| 64 | 36 | 18.90<br>*16.00* | 41.27<br>*34.95* | 1.68<br>*1.65* | 2.04<br>*2.00* | 3.31<br>*2.00* | | 22.95<br>*17.38* | 42735 |
| 57 | 43 | 22.64<br>*20.00* | 49.45<br>*43.67* | 1.43<br>*0.82* | 1.74<br>*1.00* | 4.46<br>*4.00* | | 25.63<br>*18.87* | 42740 |
| 53 | 47 | 28.20<br>*28.00* | 61.58<br>*61.16* | 2.55<br>*2.00* | 3.10<br>*2.43* | | | 28.84<br>*23.80* | 42741 |
| 53 | 47 | 29.56<br>*29.76* | 64.57<br>*65.00* | 1.43<br>*0.82* | 1.74<br>*1.00* | | | 25.88<br>*20.73* | 42742 |
| 37 | 63 | 22.11<br>*20.00* | 48.28<br>*43.67* | 4.07<br>*3.71* | 4.94<br>*4.50* | | | 29.15<br>*24.99* | 42743 |
| 54 | 46 | **19.99**<br>*22.00* | 43.65<br>*48.06* | 3.73<br>*3.50* | 4.53<br>*4.25* | | | 27.21<br>*25.45* | 42746 |

PART II, TABLE II.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Int. Agr'l Corp., National Fert. Branch, Nashville, Tenn.** | |
| 42654 | Old Hickory Nitrogen Bone and Potash ..... | John W. Garnett, Oak Grove..... |
| | **Jones Fertilizer Co., Louisville, Ky.** | |
| 42755 | Jones Raw Bone ..... | W. B. Robards, Shepherdsville..... |
| | **Louisville Fertilizer Co., Louisville, Ky.** | |
| 42768 | Eagle Raw Bone Meal... | M. C. Beam & Son, New Hope..... |
| 42769 | Eagle Raw Bone..... | Hogan, Clark & Yates, Elizabethtown |
| 42770 | Eagle Special Raw Bone | Grayson Co. Supply Co., Leitchfield.. |
| | **Morris & Co., Chicago, Ill.** | |
| 42652 | Big One-Ground Raw Bone | W. H. English, Cecilia ..... |
| 42771 | | M. C. Marion & Son, Elizabethtown. |
| 42653 | Big Two-Pure Bone Meal | J. E. Gossett, Hopkinsville ..... |
| 42772 | | M. C. Marion & Son, Elizabethtown |
| 42773 | Big Six-Special Bone Meal and Potash ..... | Woodson Lewis, Greensburg..... |
| | **Pero & Stoecker, Louisville, Ky.** | |
| 42776 | Pure Animal Matter Corn and Wheat Grower ..... | Watkins & Co., Elizabethtown.... |
| 42777 | Pure Bone Meal ..... | Watkins & Co., Elizabethtown... |

## Bones, Tankage, Etc.

| PERCENTAGE OF FINENESS. | | Total Phosphoric Acid. | Equivalent to Bone Phosphate. | Nitrogen. | Equivalent to Ammonia. | POTASH. | | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| Fine Bone. | Medium Bone. | | | | | From Muriate. | From Sulphate. | | |
| 97 | 3 | **20.78**<br>*23.00* | 45.37<br>*50.24* | **1.65**<br>*2.47* | 2.00<br>*3.00* | 3.65<br>*3.00* | | $25.92<br>*25.45* | 42654 |
| 37 | 63 | 26.34<br>*22.00* | 57.53<br>*48.06* | 3.75<br>*3.71* | 4.55<br>*4.50* | | | 30.88<br>*26.19* | 42755 |
| 97 | 3 | 26.32<br>*24.00* | 57.47<br>*52.42* | 2.69<br>*2.47* | 3.29<br>*3.00* | | | 30.31<br>*23.05* | 42768 |
| 47 | 53 | 25.84<br>*22.00* | 56.44<br>*48.06* | 3.60<br>*3.71* | 4.37<br>*4.50* | | | 30.53<br>*26.19* | 42769 |
| 70 | 30 | 21.40<br>*20.00* | 46.74<br>*43.67* | 3.64<br>*3.71* | 4.42<br>*4.50* | | | 28.57<br>*24.99* | 42770 |
| 54 | 46 | 27.26 | 59.54 | 3.73 | 4.53 | | | 32.16 | 42652 |
| 60 | 40 | 27 64<br>*24.00* | 60.36<br>*52.42* | 3.19<br>*3.29* | 3.87<br>*4.00* | | | 31.07<br>*25.92* | 42771 |
| 100 | | 27.92 | 60.96 | 2.00 | 2.43 | | | 29.34 | 42653 |
| 70 | 30 | 27.70<br>*28.00* | 60.49<br>*61.16* | 2.14<br>*2.06* | 2.60<br>*2.50* | | | 27.99<br>*24.01* | 42772 |
| 79 | 21 | 16.32<br>*16.00* | 35.65<br>*34.95* | 0.56<br>*0.41* | 0.68<br>*0.50* | | 2.36<br>*2.00* | 17.16<br>*13.44* | 42773 |
| 54 | 46 | 17.70<br>*10.00* | 38.66<br>*21.85* | 3.90<br>*4.00* | 4 73<br>*4.86* | | | 26.18<br>*20.00* | 42776 |
| 57 | 43 | 22.82<br>*22.00* | 49.84<br>*48.06* | 3.90<br>*3.50* | 4.73<br>*4 25* | | | 29.95<br>*25.45* | 42777 |

PART II, TABLE II.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Swift & Co., Chicago, Ill.** | |
| 42790 | Swift's Pure Bone Meal.. | M. L. Spurling, Campbellsville..... |
| 42791 | Swift's Pure Raw Bone Meal ..... | L. W. Irvin & Son, Greenville..... |
| 42792 | Swift's Pure Bone Meal and Blood ..... | L. W. Irvin & Son, Greenville..... |
| 42793 | Swift's Pure Bone Meal and Potash ..... | Barren Co. Grocery and Hardware Co., Glasgow ..... |
| | **Tennessee Chemical Co. Nashville, Tenn.** | |
| 42796 | Ox Raw Bone Meal ..... | W. F. Grainger, Franklin..... |
| 42797 | Ox Raw Bone with Potash | W. F. Grainger, Franklin..... |
| | **Tuscarora Fertilizer Co., Nashville, Tenn.** | |
| 42808 | Tuscarora Bone Meal ... | Dickinson Bros., Glasgow ..... |

## Bones, Tankage, Etc.

| PERCENTAGE OF FINENESS. | | | | | | POTASH. | | | |
|---|---|---|---|---|---|---|---|---|---|
| Fine Bone. | Medium Bone. | Total Phosphoric Acid. | Equivalent to Bone Phosphate. | Nitrogen. | Equivalent to Ammonia. | From Muriate. | From Sulphate | Estimated Value Per Ton. | Station Number. |
| 83 | 17 | 24.15 | 52.75 | 2.37 | 2.88 | | | $26.80 | 42790 |
| | | *24.00* | *52.42* | *2.47* | *3.00* | | | *23.05* | |
| 61 | 39 | 25.42 | 55.52 | 3.80 | 4.61 | | | 31.66 | 42791 |
| | | *23.00* | *50.24* | *3.71* | *4.50* | | | *26.79* | |
| 78 | 22 | 24.58 | 53.67 | **3.31** | 4.02 | | | 30.18 | 42792 |
| | | *23.00* | *50.24* | *3.71* | *4.50* | | | *26.79* | |
| 85 | 15 | 26.70 | 58.31 | 1.65 | 2.00 | **2.52** | | 28.86 | 42793 |
| | | *25.00* | *54.59* | *1.85* | *2.25* | *3.00* | | *24.48* | |
| 84 | 16 | **21.93** | 47.89 | 2.95 | 3.58 | | | 27.18 | 42796 |
| | | *24.00* | *52.42* | *2.47* | *3.00* | | | *23.05* | |
| 83 | 17 | 21.45 | 46.86 | 1.78 | 2.16 | 0.58 | 2.76 | 26.55 | 42797 |
| | | *20.00* | *43.67* | *1.85* | *2.25* | | *3.00* | *22.08* | |
| 80 | 20 | 27.28 | 59.58 | 2.05 | 2.49 | | | 27.92 | 42808 |
| | | *27.00* | *58.96* | *1.65* | *2.00* | | | *21.98* | |

## Part II, Table III.—Acid Phosphates.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | Phosphoric Acid. Available. | Phosphoric Acid. Insoluble. | Phosphoric Acid. Total. | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|
| | **The American Agr'l Chemical Co., Cincinnati, Sales Department, Cincinnati, O.** | | | | | | |
| 42657 | A. A. C. Co's. 16% Acid Phosphate ..... | Lowry, Hines & Co., Science Hill ..... | 16.53<br>*16.00* | 3.82<br>*1.00* | 20.35<br>*17.00* | $16.53<br>*16.00* | 42657 |
| | **The American Agr'l Chemical Co., Bowker Fert. Works, Cincinnati, O.** | | | | | | |
| 42659 | Bowker's Soluble Bone.. | J. H. Thurman, Somerset.... | 14.60<br>*14.00* | 1.67<br>*1.50* | 16.27<br>*15.50* | 14.60<br>*14.00* | 42659 |
| 42660 | Bowker's Acid Phosphate | J. H. Thurman, Somerset.... | 12.40<br>*12.00* | 0.96<br>*1.50* | 13.36<br>*13.50* | 12.40<br>*12.00* | 42660 |
| | **The American Agr'l Chemical Co., Cincinnati Sales Department, Cincinnati, O.** | | | | | | |
| 42677 | N. W. Horseshoe Brand Square Deal Phosphate.. | Woodson Lewis, Greensburg.. | 14.39<br>*14.00* | 2.01<br>*2.00* | 16.40<br>*16.00* | 14.39<br>*14.00* | 42677 |
| 42678 | N. W. Horseshoe Brand Quick Acting Phosphate. | Watkins & Co., Elizabethtown | 11.76<br>*10.00* | 2.79<br>*2.00* | 14.55<br>*12.00* | 11.76<br>*10.00* | 42678 |
| | **The Armour Fertilizer Wks.,** | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **The Armour Fertilizer Wks., Nashville, Tenn.** | | | | | | |
| 42688 | Armour's High Grade Phosphate ..... | Simpson Co. Hdw. Co., Franklin | 15.61<br>*16.00* | 3.23<br>*2.00* | 18.84<br>*18.00* | 15.61<br>*16.00* | 42688 |
| | **Duncan & Bro., La Grange, Ky.** | | | | | | |
| 42702 | Tiger Brand Phosphate.. | Manufacturer's Warehouse .. | 18.69<br>*16.00* | 1.91<br>*2.00* | 20.60<br>*18.00* | 18.69<br>*16.00* | 42702 |
| | **The Empire Guano Co., Nashville, Tenn.** | | | | | | |
| 42705 | Climax Acid Phosphate. | J. L. Durham, Greensburg.... | 16.63<br>*16.00* | 3.31<br>*2.00* | 19.94<br>*18.00* | 16.63<br>*16.00* | 42705 |
| 42708 | Acid Phosphate ..... | J. L. Durham, Greensburg.... | 12.19<br>*12.00* | 5.66<br>*2.00* | 17.85<br>*14.00* | 12.19<br>*12.00* | 42708 |
| | **Federal Chemical Co., Louisville, Ky.** | | | | | | |
| 42712 | Half and Half Phosphate Mixture ..... | A. B. Beale & Son. Murray... | 12.00<br>*10.00* | 10.59<br>*12.00* | 22.59<br>*22.00* | 12.00<br>*10.00* | 42712 |
| | **Fox Chemical Co., Branch Federal Chemical Co., Louisville, Ky.** | | | | | | |
| 42715 | Fox Acid Phosphate | Harrison Austin, Beaver Dam. | 14.68<br>*14.00* | 1.28<br>*2.00* | 15.96<br>*16.00* | 14.68<br>*14.00* | 42715 |
| 42716 | Fox Standard Acid Phosphate ..... | Wilmore & Moss, Gradyville.. | 13.23<br>*12.00* | 5.02<br>*2.00* | 18.25<br>*14.00* | 13.23<br>*12.00* | 42716 |
| 42717 | Fox A. A. Acid Phosphate | A. B. Beale & Son, Murray... | 11.09<br>*10.00* | 1.98<br>*2.00* | 13.07<br>*12.00* | 11.09<br>*10.00* | 42717 |

## Part II, Table III.—Acid Phosphates.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | Phosphoric Acid. Available. | Phosphoric Acid. Insoluble. | Phosphoric Acid. Total. | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|
| | **International Agr'l Corp., National Fert. Branch, Nashville, Tenn.** | | | | | | |
| 42750 | Old Hickory H. Gr. Acid Phosphate ..... | F. A. Yost Co., Hopkinsville.. | 17.74<br>*16.00* | 1.28<br>*1.00* | 19.02<br>*17.00* | $17.74<br>*16.00* | 42750 |
| | **Kentucky Fert. Co., Branch Federal Chemical Co., Louisville, Ky.** | | | | | | |
| 42759 | O. K. Phosphate..... | M. Woosley, Elizabethtown... | **12.55**<br>*14.00* | 5.25<br>*2.00* | 17.80<br>*16.00* | **12.55**<br>*14.00* | 42759 |
| 42760 | O. K. Standard Phosphate | G. B. Taylor, Campbellsville.. | 13.90<br>*12.00* | 8.69<br>*2.00* | 22.59<br>*14.00* | 13.90<br>*12.00* | 42760 |
| | **Read Phosphate Co., Nashville, Tenn.** | | | | | | |
| 42785 | Read's XXX Dissolved Bone ..... | Tibbals & Co., Somerset..... | 13.21<br>*13.00* | 5.61<br>*2.00* | 18.82<br>*15.00* | 13.21<br>*13.00* | 42785 |
| | **Tennessee Chemical Co., Nashville, Tenn.** | | | | | | |
| 42799 | Ox Tennessee Best Acid Phosphate ..... | F. A. Yost Co., Hopkinsville. | **14.27**<br>*16.00* | 2.36<br>*2.00* | 16.63<br>*18.00* | **14.27**<br>*16.00* | 42799 |
| 42800 | Ox Phosphate..... | Sexton Bros., Murray..... | 11.79 | 5.24 | 17.03 | 11.79 | 42800 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 42800 | Ox Phosphate..... | Sexton Bros., Murray..... | 11.79<br>*12.00* | 5.24<br>*2.00* | 17.03<br>*14.00* | 11.79<br>*12.00* | 42800 |
| 42801 | Ox High Grade Dissolved Bone ..... | J. J. Shaver & Co., Mayfield.. | 13.67<br>*14.00* | 5.74<br>*2.00* | 19.41<br>*16.00* | 13.67<br>*14.00* | 42801 |
| | **Virginia-Carolina Chemical Co., Cincinnati, Ohio.** | | | | | | |
| 42819 | I. X. L. Acid Phosphate.. | S. McKinley, Columbia ..... | 19.25<br>*16.00* | 0.92 | 20.17 | 19.25<br>*16.00* | 42819 |
| | **Virginia-Carolina Chemical Co., Memphis, Tenn.** | | | | | | |
| 42822 | Capital Dissolved S. C. Bone ..... | E. S. Diuguid & Son, Murray... | 13.11<br>*12.00* | 4.68<br>*2.00* | 17.79<br>*14.00* | 13.11<br>*12.00* | 42822 |

## Part II, Table IV.—Acid Phosphate and Potash Mixtures.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | Phosphoric Acid: Available. | Phosphoric Acid: Insoluble. | Phosphoric Acid: Total. | Potash: From Muriate. | Potash: From Sulphate | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| | **The American Agr'l Chemical Co. Bowker Fert. Works, Cincinnati, Ohio.** | | | | | | | | |
| 42661 | Bowker's Dissolved Bone and Potash | J. T. Lawson, Greenup | 11.72 | 1.22 | 12.94 | 2.11 | | $16.66 | 42661 |
| | | | *10.00* | *1.50* | *11.50* | *2.00* | | *14.60* | |
| 42662 | Bowker's Potash Fertilizer | T. E. Richardson, Campbellsville | 11.99 | 2.09 | 14.08 | 5.24 | | 20.47 | 42662 |
| | | | *10.00* | *1.50* | *11.50* | *5.00* | | *17.60* | |
| | **The American Agr'l Chemical Co., Michigan Carbon Works, Cincinnati, Ohio.** | | | | | | | | |
| 42668 | Red Line Phosphate with Potash | Geo. L. Gillum & Son, Russellville | 9.60 | 2.80 | 12.40 | 2.00 | | 14.64 | 42668 |
| | | | *10.00* | *2.00* | *12.00* | *2.00* | | *14.80* | |
| 42669 | High Potash Phosphate | J. R. Davis & Bro., Campbellsville | 10.36 | 3.84 | 14.20 | 5.72 | | 19.69 | 42669 |
| | | | *10.00* | *2.00* | *12.00* | *5.00* | | *17.80* | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **The American Agr'l Chemical Co., Cincinnati Sales Department, Cincinnati Ohio.** | | | | | | | |
| 42675 | N. W. Horseshoe Brand 10-5 Potash Manure.... | M. L. Spurling, Campbellsville ..... | 11.16<br>*10.00* | 2.68<br>*2.00* | 13.84<br>*12.00* | 4.72<br>*5.00* | 1.10 | 20.50<br>*17.80* | 42675 |
| 42676 | N. W. Horseshoe Brand Bone and Potash ..... | Woodson Lewis, Greensburg ..... | 9.71<br>*10.00* | 1.10<br>*2.00* | 10.81<br>*12.00* | 3.21<br>*2.00* | | 14.30<br>*14.80* | 42676 |
| | **The Armour Fertilizer Wks. Nashville, Tenn.** | | | | | | | |
| 42684 | Armour's Soluble Phosphate and Potash ..... | Simpson Co. Hdw. Co., Franklin ..... | 10.18<br>*10.00* | 1.93<br>*4.00* | 12.11<br>*14.00* | 4.26<br>*4.00* | | 17.25<br>*17.60* | 42684 |
| 42685 | Armour's Phosphate and Potash ..... | Barren Co. Grocery and Hdw. Co., Glasgow ... | 11.02<br>*10.00* | 1.31<br>*4.00* | 12.33<br>*14.00* | 2.15<br>*2.00* | | 15.89<br>*15.60* | 42685 |
| | **The Empire Guano Co., Nashville, Tenn.** | | | | | | | |
| 42707 | Bone and Potash ..... | J. L. Durham, Greensburg ..... | 8.91<br>*10.00* | 4.40<br>*4.00* | 13.31<br>*14.00* | 2.88<br>*2.00* | | 15.33<br>*15.60* | 42707 |
| | **Federal Chemical Co., Louisville, Ky.** | | | | | | | |
| 42713 | Heads-O-Wheat ..... | Clarkson Hardware Co., Clarkson ..... | 11.85<br>*10.00* | 10.79<br>*10.00* | 22.64<br>*20.00* | 3.86 | 0.90<br>*4.00* | 23.48<br>*20.80* | 42713 |

## Part II, Table IV.—Acid Phosphate and Potash Mixtures.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | Phosphoric Acid: Available. | Phosphoric Acid: Insoluble. | Phosphoric Acid: Total. | Potash: From Muriate. | Potash: From Sulphate | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| | **The Groves Co., Cincinnati, Ohio.** | | | | | | | | |
| 42731 | Wheat and Oats ..... | W. B. Morris, Campbellsville ..... | **9.25**<br>*10.00* | 1.26<br>*2.00* | 10.51<br>*12.00* | 2.62<br>*2.00* | | $14.22<br>*14.80* | 42731 |
| | **Hirsh, Stein & Co., Chicago, Ill.** | | | | | | | | |
| 42738 | Calumet Brand Phosphate and Potash ..... | Salsman & New, Clarkson ..... | 11.06<br>*10.00* | 3.37<br>*1.00* | 14.43<br>*11.00* | 2.11<br>*2.00* | | 16.73<br>*14.40* | 42738 |
| 42739 | Calumet Brand H. Gr. Phosphate and Potash.. | Jas. Pearson and Co., Franklin ..... | 10.31<br>*10.00* | 0.69<br>*1.00* | 11.00<br>*11.00* | 4.59<br>*5.00* | | 17.24<br>*17.40* | 42739 |
| | **Hopkins Fertilizer Co., New Albany, Ind.** | | | | | | | | |
| 42747 | Old Time Potash Mixture | A. W. and O. T. Pickerill, Hodgenville ..... | 10.49<br>*10.00* | 1.66<br>*2.00* | 12.15<br>*12.00* | 3.61<br>*4.00* | | 16.86<br>*16.80* | 42747 |
| | **International Agr'l Corp.,** | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **International Agr'l Corp., National Fert. Branch Nashville, Tenn.** | | | | | | | | |
| 42748 | Old Hickory Anti Trust Bone and Potash ..... | F. A. Yost Co., Hopkinsville ..... | 11.30<br>*10.00* | 7.02<br>*1.00* | 18.32<br>*11.00* | | **3.38**<br>*4.00* | 20.43<br>*17.20* | 42748 |
| | **Jones Fertilizer Co., Louisville, Ky.** | | | | | | | | |
| 42753 | Jones Potash Formula.. | Grayson Co. Supply Co., Leitchfield ..... | 11.04<br>*10.00* | 1.36<br>*4.00* | 12.40<br>*14.00* | 4.98<br>*5.00* | | 18.77<br>*18.60* | 42753 |
| | **Kentucky Fert. Co., Branch Federal Chemical Co., Louisville, Ky.** | | | | | | | | |
| 42758 | O. K. Potash Special.... | M. Woosley, Elizabethtown ..... | 13.47<br>*10.00* | 4.04<br>*2.00* | 17.51<br>*12.00* | **0.95** | <br>*2.00* | 18.93<br>*15.20* | 42758 |
| | **Read Phosphate Co., Nashville, Tenn.** | | | | | | | | |
| 42782 | Read's Special Wheat Grower ..... | J. C. Cowherd and Co., Greensburg ..... | 10.45<br>*10.00* | 3.09<br>*4.00* | 13.54<br>*14.00* | 6.89<br>*6.00* | | 20.67<br>*19.60* | 42782 |
| 42783 | Read's H. Gr. Special Potash Mixture ..... | J. C. Cowherd and Co., Greensburg ..... | **7.55**<br>*10.00* | 7.32<br>*4.00* | 14.87<br>*14.00* | 2.94<br>*4.00* | 0.74 | **15.82**<br>*17.60* | 42783 |
| 42784 | Read's Alkaline Bone ... | J. C. Cowherd & Co., Greensburg ..... | **7 29**<br>*10.00* | 5.60<br>*4.00* | 12.89<br>*14.00* | 3.21<br>*2.00* | | **14 20**<br>*15.60* | 42784 |

## Part II, Table IV.—Acid Phosphate and Potash Mixtures.

| Station Number. | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. | Phosphoric Acid: Available. | Phosphoric Acid: Insoluble. | Phosphoric Acid: Total. | Potash: From Muriate. | Potash: From Sulphate | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| | **Smith Agr'l Chem. Co., Columbus, Ohio.** | | | | | | | | |
| 42787 | Ohio Farmers Soluble Phosphate and Potash .. | Staggs Bros., Vanceburg. | **9.88**<br>*10.00* | 1.70 | 11.58 | 1.66<br>*2.00* | 0.52 | $14.82<br>*14.00* | 42787 |
| | **Tennessee Chemical Co., Nashville, Tenn.** | | | | | | | | |
| 42798 | Ox High Grade Potash .. | W. F. Grainger, Franklin | **9.93**<br>*10.00* | **2.13**<br>*4.00* | 12.06<br>*14.00* | **3.44**<br>*5.00* | | **16.21**<br>*18.60* | 42798 |
| 42802 | Ox Potash Mixture ..... | W. F. Grainger, Franklin | 10.53<br>*10.00* | 2.31<br>*4.00* | 12.84<br>*14.00* | <br>*2.00* | 2.93 | 17.08<br>*15.60* | 42802 |
| 42803 | Ox Potash Formula .... | J. S. Duke, Crab Orchard | **8.53**<br>*10.00* | 1.43<br>*4.00* | 9.96<br>*14.00* | 4.91<br>*4.00* | | **15.72**<br>*17.60* | 42803 |
| 42807 | Ox Phosphate and Potash | W. F. Grainger, Franklin | 10.58<br>*10.00* | 2.09<br>*4.00* | 12.67<br>*14.00* | | 4.32<br>*4.00* | 18.72<br>*18.40* | 42807 |
| | **Tuscarora Fertilizer Co., Nashville, Tenn.** | | | | | | | | |
| 42809 | Dickinson's Potash and Phosphate Mixture ..... | Dickinson Bros., Glasgow | 8.64<br>*10.00* | 1.43<br>*4.00* | 10.07<br>*14.00* | 3.72<br>*2.00* | | 14.66<br>*15.60* | 42809 |
| 42810 | Dickinson's Standard | | | | | | | 17.38 | 42810 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 42810 | Dickinson's Standard Grain Grower ..... | Dickinson Bros., Glasgow | 10.18<br>*10.00* | 2.42<br>*4.00* | 12.60<br>*14.00* | 4.19<br>*4.00* | | 17.38<br>*17.60* | 42810 |
| | **Virginia-Carolina Chemical Co., Cincinnati, Ohio.** | | | | | | | | |
| 42816 | Royal Grain Grower ... | I. K. Miller and Sons, Campbellsville ..... | 10.69<br>*10.00* | 1.44<br>*1.50* | 12.13<br>*11.50* | 5.17<br>*4.00* | | 18.58<br>*16.60* | 42816 |
| 42817 | Victor Bone and Potash Compound ..... | C. M. Cox, Spurlington . | **10.04**<br>*15.00* | 1.91<br>*1.50* | 11.95<br>*16.50* | 2.51<br>*3.00* | | **15.32**<br>*21.60* | 42817 |
| 42818 | Capital Bone and Potash Compound ..... | I. K. Miller and Sons, Campbellsville ..... | 10.80<br>*10.00* | 2.14<br>*1.50* | 12.94<br>*11.50* | 2.30<br>*2.00* | | 16.12<br>*14.60* | 42818 |

PART II, TABLE V.

| Station Number | Name and Address of Manufacturer and Name of Brand. | From Whom Obtained. |
|---|---|---|
| | **Duncan and Bro., LaGrange, Ky.** | |
| 42703 | Tiger Brand Phosphate and Tankage ..... | Manufacturer's Warehouse ..... |
| | **Ky. Fert. Co., Branch Federal Chem. Co., Louisville, Ky.** | |
| 42757 | O. K. Bone Meal Mixture | G. B. Taylor, Columbia ..... |

DECEMBER 31st, 1913.

## Nitrogenous Superphosphates.

| PHOSPHORIC ACID. | | | NITROGEN. | | | | Equivalent to Ammonia. | Estimated Value Per Ton. | Station Number. |
|---|---|---|---|---|---|---|---|---|---|
| Available. | Insoluble. | Total. | In Nitrates. | In Ammonia Salts. | Organic. | Total. | | | |
| 13.43 | 2.84 | 16.27 | | | | 9.65 | 0.79 | $19.54 | 42703 |
| *12.00* | *3.00* | *15.00* | | | | *0.82* | *1.00* | *18.47* | |
| 10.10 | 1.39 | 11.49 | 1.63 | | 0.95 | 2.58 | 3.13 | 21.71 | 42757 |
| *10.00* | *4.00* | *14.00* | | | | *2.47* | *3.00* | *22.25* | |

H. E. CURTIS, Chemist.

# DEPARTMENT OF CHEMISTRY

## ANALYSES OF MINERAL AND POTABLE WATERS

BY

A. M. PETER, S. D. AVERITT, J. S. MCHARGUE AND A. S. BEHRMAN.

### BARREN COUNTY.

LABORATORY NO. 36883—Spring water sent by Dr. W. M. Ewing, Cave City, Ky., from spring in the northern end of Barren County, close to the Barren and Hart county line. It is known as "Jones' Spring," was discovered about 1812 and has some reputation locally as a cure for kidney troubles, etc. Sample very slightly turbid, with very little sediment. Received January 29th, 1913.

ANALYSIS—One gallon contains 8.2 grains of solid matter (.14 gram per liter) composed of very small amounts of sodium chlorid, calcium sulfate, magnesium sulfate, iron sulfate and a trace of silica.

It would be classed as a very weak chalybeate water. The water is neutral to litmus paper and contains so little solid matter that it would hardly be called a mineral water.

### BELL COUNTY.

LABORATORY NO. 43299—Water sent by G. M. Asher, Wasioto, Bell County, Ky., from a newly drilled well. Sample colorless with some ferruginous sediment. Received October 14, 1913.

ANALYSIS—One gallon contains 6.2 grains of solid matter (.106 gram per liter) composed of calcium carbonate, mag-

nesium carbonate, sodium chlorid and iron in small quantities, with traces of silica, potassium sulfate and lithium.

This is a weak chalybeate water and should have the usual properties of a water of that class.

## BOYD COUNTY.

LABORATORY NO. 43180—Water sent by Thomas Howard, of the Ashland Bottling Works, Ashland, Ky., July 30, 1913, from a well 800 feet deep. Sample clear and colorless.

ANALYSIS—One gallon contains 317.4 grains of solid matter (5.442 grams per liter) containing much sodium chlorid with small quantities of calcium chlorid, magnesium chlorid, calcium carbonate, calcium sulfate, potassium sulfate and traces of iron, silica, strontium, lithium and iodin.

It is a good salt water and should have medicinal value.

LABORATORY NO. 43350—Well water sent by John Murphy, Ashland, Ky., from a drilled well 135 feet deep. Sample slightly turbid. Received December 3, 1913.

ANALYSIS—One gallon contains 13.3 grains of solid matter (.228 gram per liter) composed of sodium carbonate, sodium chlorid, calcium carbonate, magnesium carbonate and ferrous carbonate, with a small amount of sodium sulfate and traces of silica, potassium sulfate and lithium carbonate.

It is an alkaline chalybeate water and should have the usual medicinal properties.

## CALDWELL COUNTY.

LABORATORY NO. 36978—Water sent by the Princeton Commercial Club, Princeton, Ky., Ralze F. Dorr, Sec'y, from a new source. To be analyzed as to its value for boiler and drinking purposes. Received April 5, 1915.

| ANALYSIS— | Parts per million. | Grains per gallon. |
|---|---|---|
| Total solids at 100° C. | 162. | 9.4 |
| Ignited solids | 139. | 8.1 |

Very little darkening and some odor on burning.

| ANALYSIS— | Parts per million. | Grains per gallon. |
|---|---|---|
| Chlorin | 3. | |
| Nitrite | A trace. | |
| Nitrate nitrogen | 0.4 | |
| Alkalinity, calculated as calcium carbonate, $CaCO_3$ | 103.0 | 6.0 |

Sulfates, faint trace; lime, moderate; magnesia, small.

It should be a very good water for general use. It would form some scale in a boiler, but the proportion of scale-forming substances present is not large.

Two waters sent October 3, 1913, by J. N. Bailey, Fredonia, Ky.

Both colorless with very slight sediment.

LABORATORY NO. 43277—Marked "Bailey's well No. 1," from a well 30 ft. deep in the town of Fredonia.

ANALYSIS—One gallon contains 47.6 grains of solid matter (.816 gram per liter) composed mainly of calcium carbonate, sodium chlorid and magnesium carbonate, with a small quantity of calcium sulfate and traces of iron, silica, potassium sulfate, lithium carbonate and strontium carbonate.

The analysis shows only slightly more mineral matter than is found in ordinary well water.

LABORATORY NO. 43278—Marked "Hill Spring No. 2," from a well 10 feet deep, 7 miles northeast of Fredonia near the Crittenden County line.

ANALYSIS—One gallon contains 69.9 grains of solid matter (1.198 grams per liter) composed mainly of calcium and magnesium sulfates, calcium and magnesium carbonates, sodium chlorid and sodium sulfate, with a small amount of iron and traces of silica, potassium sulfate, lithium carbonate and strontium carbonate.

It is a magnesia water containing a little iron and would doubtless have some medicinal value.

## CASEY COUNTY.

LABORATORY NO. 36877—Well water brought by W. O. Hulett, Yosemite, Ky., from a dug well located a short distance west of Yosemite. It was dug 7 or 8 years ago and is 10 or 15 feet deep. Sample turbid with a little sediment. Received January 20, 1913.

ANALYSIS—One gallon contains 67.1 grains of solid matter (1.15 grams per liter) composed of sodium chlorid, calcium carbonate, calcium sulfate and magnesium carbonate, with traces of iron, silica, potassium and lithium.

The analysis indicates a very weak saline water.

LABORATORY NO. 43267—Well water sent in September, 1913, by Joe McWilliams, Ellisburg, Ky. Sample colorless with very little sediment.

ANALYSIS—One gallon contains 40.9 grains of solid matter (.71 gram per liter) composed mainly of sodium chlorid with some calcium carbonate, magnesium carbonate, sodium sulfate and traces of iron, silica, potassium sulfate, lithium and strontium.

It is a very weak saline water of very usual composition.

## CHRISTIAN COUNTY.

LABORATORY NO. 43071—Mineral water sent by Geoffrey Morgan, County Agent, Hopkinsville, Ky., June 3rd, 1913. Sample contained some brown, flocculent sediment.

ANALYSIS—One gallon contains 398.4 grains of mineral matter (6.83 grams per liter) composed of calcium sulfate, magnesium sulfate, sodium sulfate and ferrous sulfate (copperas), with a small amount of sodium chlorid and distinct traces of potassium and lithium sulfates, strontium and silica.

This is a rather strong sulfated chalybeate water and should have some medicinal value. The sanitary tests show no nitrate or nitrite, but a strong test for free ammonia. Not knowing the source of this water, it would not be possible to say whether the high free ammonia has any significance.

LABORATORY NO. 43165—Water sent by George Wood, Sinking Fork, Ky. Sample clear and colorless. Received July 5, 1913.

ANALYSIS—One gallon contains 191.2 grains of solid matter (3.286 grams per liter) composed mainly of calcium sulfate, magnesium sulfate, sodium chlorid and a little sodium sulfate, with traces of iron, silica, potassium sulfate and lithium sulfate.

It is a saline sulfated water. The magnesium and sodium sulfates would give it laxative qualities.

LABORATORY NO. 43234—Sulfur water from a well 90 feet deep on the farm of R. J. Bryson, two miles south of Pembroke. Sent by McCarley Hardware Company, Pembroke, Ky., in August, 1913.

ANALYSIS—One gallon contains 223.5 grains of solid matter (3.84 grams per liter) composed mainly of sodium chlorid and sodium sulfate with some calcium carbonate, magnesium carbonate and sodium sulfid. There is 1.23 grain of free and combined hydrogen sulfid per gallon (.021 gram per liter), also traces of iron, silica, potassium sulfate, sodium iodid, sodium bromid and lithium carbonate.

It is a good alkaline saline sulfur water.

LABORATORY NO. 43235—Sulfur water sent by Ed Wilkins, Fairview, Ky., in August, 1913. Sample contained a little black sediment.

ANALYSIS—One gallon contains 85.7 grains of solid matter (1.47 grams per liter) composed mainly of sodium chlorid, sodium carbonate, sodium sulfate and sodium sulfid. There are 7.0 grains of free and combined hydrogen sulfid per gallon; also traces of iron, silica, potassium sulfate and lithium carbonate. It is alkaline in reaction due to the sodium carbonate.

It is an alkaline saline sulfur or "black sulfur" water and should have medicinal value.

LABORATORY NO. 43309—Salt sulfur water from a well 137 feet deep, sent by Mrs M. H. Wood, Hopkinsville, Ky. Sample received November 1, 1914.

ANALYSIS—One gallon contains 323.6 grains of solid matter (5.53 grams per liter) composed mainly of sodium chlorid, sodium sulfate, a little calcium sulfate, calcium carbonate, magnesium carbonate and sodium sulfid and traces of sodium iodid and sodium bromid, iron, silica, potassium and lithium. Total hydrogen sulfid, 5 grains per gallon (.085 gram per liter).

This is a strong salt sulfur water and should have medicinal value.

LABORATORY NO. 43324—Salt sulfur water sent by C. E. Sivley, Oak Grove, Ky., from a well 99 feet deep, located 10 miles south of Hopkinsville. Sample slightly yellowish salt sulfur water, with some black sediment. Received November 6, 1913.

ANALYSIS—One gallon contains 584.4 grains of mineral matter (10.02 grams per liter) composed mainly of sodium chlorid, calcium sulfate and magnesium sulfate, with moderate quantities of sodium sulfid and calcium carbonate. A little sodium iodid and sodium bromid and traces of iron, silica, potassium sulfate and lithium sulfate. The free and combined hydrogen sulfid amounts to 7.3 grains per gallon (0.125 gram per liter).

This is a strong salt sulfur water containing large quantities of calcium and magnesium sulfates. Such waters are not unusual in deep wells of south Christian County.

## CRITTENDEN COUNTY.

LABORATORY NO. 43225—Water sent by J. P. Pierce, Marion, Ky., from a bored well. Received August 26th, 1913.

ANALYSIS—One gallon contains 9.5 grains of solid matter (.162 gram per liter) composed of sodium sulfate, calcium sulfate, sodium chlorid, a little calcium carbonate and ferrous

carbonate and traces of magnesium carbonate, silica, potassium and lithium.

It is a weak chalybeate water and should have some medicinal value.

LABORATORY No. 43300—Water sent by W. O. Tucker, Marion, Ky. Sample contained a good deal of ferruginous sediment. Received October 22, 1913.

ANALYSIS—One gallon contains 160.9 grains of solid matter (2.768 grams per liter) composed of calcium sulfate, sodium chlorid, magnesium sulfate, calcium carbonate, a small quantity of ferrous carbonate and traces of silica, potassium sulfate and lithium carbonate.

It is a saline, sulfated water such as is found in many deep wells.

## FAYETTE COUNTY.

LABORATORY No. 36991—Water brought by F. F. Wilson, Lexington, Ky., from a bored well 57 feet deep, located 4 miles out on the Nicholasville pike. Sample very slightly turbid with a slight whitish, flocculent sediment. Received April 18, 1913.

ANALYSIS—One gallon contains 21.5 grains of solid matter (.37 gram per liter) composed of sodium chlorid, calcium carbonate, magnesium carbonate, a small amount of calcium sulfate and traces of iron, silica, potassium, lithium and strontium.

It contains very little more mineral matter than the average well water of this region.

LABORATORY No. 43199—Water from an old bored well 147 feet deep, on the property formerly owned by the Lexington Brick Company. Sample brought in August, 1913, by Mr. Thos. Warren, Lexington. See 43261 for a later sample from this well.

| ANALYSIS— | Parts per million | Grains per gallon |
|---|---|---|
| Total solids | 276. | 16.1 |
| Ignited solids | 234. | 13.6 |
| Chlorin | 4. | |
| Alkalinity, calculated as calcium carbonate | 170. | |

Nitrite, none; nitrate, trace; free ammonia, none. The mineral matter is mainly calcium carbonate with some calcium sulfate, magnesium sulfate, sodium chlorid and traces of iron and zinc.

LABORATORY NO. 43241—Water from a bored well on the farm of Grandison Smith, Lexington, Ky., 1½ miles out on the Harrodsburg Pike. The well is 120 feet deep and was bored about 25 years ago. The water is very cold and always muddy in appearance. It is used for drinking. Stock do not like it at first but soon drink it readily. Sample received September 6, 1913.

ANALYSIS—One gallon contains 47.2 grains of solid matter (.81 gram per liter) composed mainly of sodium chlorid, small amounts of calcium sulfate and calcium carbonate, a little iron and traces of silica and potassium sulfate. The sanitary tests show no nitrite, 12.4 parts per million of nitrate nitrogen and no free amonia.

It is a weak saline water.

LABORATORY NO. 43261—Water from a bored well 147 feet deep on the north corner of Bullock and Ashland Avenues, Lexington, Ky. Collected September 25, 1913, by A. M. Peter for Mr. Thomas Warren, Lexington, Ky. Well bored some years ago by the Lexington Brick Company. Yields abundant supply. Pumped several minutes before taking the sample. Water perfectly clear when drawn. Slight milkiness after standing. See 43199 for an earlier sample from this well.

| ANALYSIS— | Parts per million. | Grains per gallon. |
|---|---|---|
| Total solids at 100° C. | 250. | 14.6 |
| Ignited solids | 214. | 12.5 |
| Very slight charring and odor on heating. | | |
| Chlorin | 6. | |

No nitrite; trace nitrate; no free ammonia. The mineral matter is mainly calcium carbonate with some magnesium carbonate, a little calcium sulfate, sodium chlorid and marked traces of potassium, zinc, iron, strontium, lithium, silica and phosphate.

LABORATORY NO. 43301—Water from a bored well on the farm of W. W. Estill on the Winchester pike. The well is 105 feet deep. Fifteen thousand gallons have been pumped out in one day. Sample contains a very little sediment. Received October 10th, 1913.

ANALYSIS—One gallon contains 41.8 grains of solid matter (.726 gram per liter) composed of calcium carbonate, magnesium carbonate, sodium chlorid, sodium sulfate, and traces of iron, silica, potassium sulfate and lithium carbonate.

The analysis shows very little more mineral matter than is found in the ordinary well water of this region.

## FLOYD COUNTY.

Three samples of water sent September 7th, 1913, by Dr. E. H. Maggard, Allen, Ky., for the Elkhorn Fuel Company of that place. Nos. 2 and 3 show considerable ferruginous sediment.

LABORATORY NO. 43257—Marked "Well No. 1, Bunk House."

ANALYSIS—One gallon contains 24.0 grains of solid matter (.412 gram per liter) composed of sodium chlorid, sodium carbonate, calcium carbonate and magnesium carbonate in moderate quantities, with traces of iron, silica and potassium sulfate.

It is a weak chalybeate water, distinctly alkaline in reaction due to sodium carbonate. It should have some value.

LABORATORY NO. 43258—Marked "Well No. 2, Club House."

ANALYSIS—One gallon contains 10.2 grains of solid matter (.176 gram per liter) composed of small quantities of sodium chlorid, ferrous carbonate and magnesium carbonate, with traces of calcium carbonate, silica and potassium sulfate.

It is a weak chalybeate water.

LABORATORY NO. 43259—Marked "Well No. 3, Store."

ANALYSIS—One gallon contains 7.7 grains solid matter (.132 gram per liter). It is similar to No. 43258 in composition and belongs to the same class.

## GREENUP COUNTY.

LABORATORY NO. 36995—Water from a deep well at Greenup, Ky., sent by Dr. A. I. Brady of that place for a sanitary analysis. On account of the recent flood it is the only water available for drinking and for domestic use. Water clear and colorless and was drawn from the well April 18, 1913.

ANALYSIS—One gallon contains 33.0 grains of solid matter (.566 gram per liter) composed mainly of sodium chlorid with small amounts of sodium carbonate, calcium carbonate and magnesium carbonate and traces of iron, silica, potassium sulfate and lithium carbonate.

It is a weak alkaline saline water. Bacteriological test by Dr. Pinnell gave a very high bacterial count with B. coli abundant, showing that the well is contaminated.

## HARDIN COUNTY.

LABORATORY NO. 43238—Water sent August 27th 1913, by George C. Scheible, Tip Top, Ky., from a well 106 feet deep, ¼ mile from depot. Not a good water for cooking purposes and it is desired to know whether it is a good drinking water. Sample clear and colorless.

ANALYSIS—One gallon contains 117.0 grains of solid matter (200.6 grams per liter) composed mainly of calcium sulfate and magnesium sulfate, some sodium sulfate, small amounts of sodium chlorid and calcium carbonate and traces of iron, silica, zinc and potassium sulfate.

It is a magnesia water, the calcium sulfate present rendering it very hard. It contains too much mineral matter to be wholesome for constant use as a drinking water but should have some medicinal value.

LABORATORY NO. 43290—Well water sent October 2, 1913, by S. C. Barnes, East View, Ky. The sample was full of very finely divided clay. After standing several days the clay settled partly leaving a slightly cloudy water.

ANALYSIS—One gallon contains 16.8 grains of solid matter (.288 gram per liter) composed of sodium chlorid, sodium sulfate, calcium and magnesium carbonates, calcium sulfate and traces of iron, silica, potassium sulfate and lithium carbonate.

The analysis shows the sample is ordinary well water.

## HARLAN COUNTY.

LABORATORY NO. 43163—Water from a stream on the property of the Pine Mountain Settlement School, to determine if fit for the water supply of the school. Brought by Dr. W. O. Bullock, Lexington, Ky., June 25th, 1913. The sample contained a little brownish, flocculent sediment.

| ANALYSIS— | Parts per million. | Grains per gallon. |
|---|---|---|
| Total solids | 140. | 8.16 |
| Ignited solids | 96. | 5.60 |
| Organic and volatile | 44. | 2.56 |
| Sulfate | A trace. | |
| Chlorin | 3. | |
| Nitrite | None. | |
| Nitrate | A trace. | |
| Free ammonia | A trace. | |

| ANALYSIS— | Parts per million. | Grains per gallon. |
|---|---|---|
| Calcium | Small. | |
| Magnesium | Very small. | |
| Alkalinity, calculated as calcium carbonate, $CaCO_3$ | 100. | |

These tests indicate that it is a pure water, good for domestic purposes.

LABORATORY NO. 43200—Water from a chalybeate spring at Pine Mountain Settlement School, Pine Mountain, Ky., brought by Prof. H. D. Easton, July 28, 1913. Bacteriological examination by Dr. Pinnell, who reports the water to be all right.

| ANALYSIS— | Parts per million. | Grains per gallon. |
|---|---|---|
| Total solid matter | 88. | 5.1 |
| Ignited solid matter | 73. | 4,2 |
| Organic and Volatile | 15. | 0.9 |

The mineral matter consists of small amounts of iron, lime and magnesia, mostly in the form of sulfate, and a little sodium chlorid. The sediment contains a good deal of iron. There are no nitrites, nitrates or free ammonia. It is a chalybeate water. The sanitary tests are very satisfactory. As a chalybeate water it should have some value.

## HART COUNTY.

LABORATORY NO. 43240—Sulfur water sent by Dr. P. Hardin, Rowletts, Ky. Received about September 1st, 1913.

ANALYSIS—One gallon contains 166.1 grains of solid matter (2.848 grams per liter) composed mainly of calcium sulfate, magnesium sulfate, sodium sulfate, with small amounts of calcium carbonate, magnesium carbonate, sodium chlorid and sodium sulfid and traces of iodid, bromid, iron, silica, potassium and lithium. Total hydrogen sulfid 0.23 grain per gallon (.0004 gram per liter).

It is a weak sulfur water and should have some medicinal value.

## HICKMAN COUNTY.

LABORATORY NO. 43072—Water from an old spring on the farm of Mrs. Thos. W. Samuel, 2 miles from Columbus, Ky., believed to have medicinal properties. Sample received June 9th, 1913.

ANALYSIS—The water contains very little mineral matter and has no characteristic color or odor. The mineral matter consists of very small amounts of sodium chlorid, calcium and magnesium carbonates and a faint trace of sulfate. The sanitary tests show both nitrite and nitrate, the former in very small quantity, the latter in considerable quantity. The presence of nitrate and nitrite renders it somewhat doubtful if it is safe for drinking and domestic purposes. It has no medicinal properties.

## JEFFERSON COUNTY.

LABORATORY NO. 36932—Water sent by C. T. Duncan, Avoca, Ky., from a bored well 100¼ feet deep, ¼ mile from Avoca. Sample received February 13th, 1913. Salty to taste.

ANALYSIS—One gallon contains 250.7 grains of mineral matter (4.298 grams per liter) composed mainly of sodium chlorid with moderate amounts of calcium carbonate, magnesium carbonate and calcium sulfate, traces of iron, silica, potassium sulfate, lithium carbonate and very faint traces of sodium iodid, sodium bromid and sodium borate.

It is a salt water of moderate strength and should have medicinal value.

LABORATORY NO. 43236—Water sent August 29th 1913, by W. E. Mortimore, Louisville, from a well in Jefferson County 126 feet deep. Water was struck at 124 feet and rose 82 feet.

ANALYSIS—One gallon contains 57.0 grains of solid matter (.978 gram per liter) composed mainly of sodium chlorid,

with a moderate amount of calcium carbonate, a very small quantity of magnesium carbonate and traces of sodium sulfate, potassium sulfate, iron, silica, lithium carbonate and hydrogen sulfid.

It is a saline water with a very little sulfur and might be called a weak salt sulfur water.

## JESSAMINE COUNTY.

LABORATORY NO. 43243—Water brought by J. K. P. Sallee, Keene, Ky., Sept. 8th, 1913, from a well 4 feet deep on his farm on the Nicholasville and Versailles Pike, 1 mile from Keene in bottom of creek. This water was analyzed several years ago. No. 14638. See 17th Ann. Rep., this Station, p. 185.

ANALYSIS—One gallon contains 28.8 grains of solid matter (.408 gram per liter) composed of sodium chlorid and calcium carbonate, with small amounts of magnesium carbonate, sodium sulfate and iron, also traces of iodid and bromid, silica and strontium carbonate.

The water when analyzed in 1904 contained about 3 times as much solid matter as at this time, otherwise the character of the water has not changed to any considerable extent.

## LETCHER COUNTY.

Two samples of water brought August 14th, 1913, by L. W. Fields, Whitesburg, Ky., from two springs about half way up on the north side of Pine Mountain and about six and one half miles southwest from Whitesburg. The lower spring is about 150 yards below the upper spring and independent of it. Samples both colorless, with some ferruginous sediment.

LABORATORY NO. 43220—Labeled "Upper Spring."

ANALYSIS—One gallon contains 12.2 grains of solid matter (.209 gram per liter) composed of small quantities of calcium sulfate, ferrous sulfate, magnesium sulfate and sodium chlorid, with a trace of silica.

It is a weak chalybeate water and should have some medicinal value.

LABORATORY NO. 43221—Labeled "Lower Spring."

ANALYSIS—One gallon contains 30.5 grains of solid matter (.522 gram per liter) composed mainly of sodium sulfate and ferrous sulfate with very small quantities of calcium sulfate, magnesium sulfate and sodium chlorid and a trace of silica.

The water is slightly acid in reaction due to the ferrous sulfate present. It is a chalybeate water, somewhat stronger than No. 43220.

LABORATORY NO. 43268 — Spring water sent September 13th, 1913, by L. W. Fields, Whitesburg, Ky., from spring about 3 miles south of Whitesburg on the north slope of Pine Mountain. Sample colorless with some light red ferruginous sediment.

ANALYSIS—One gallon contains 13.5 grains of solid matter (.232 gram per liter) composed mainly of sodium sulfate and ferrous sulfate with traces of sodium chlorid, calcium sulfate magnesium sulfate and silica.

It is a chalybeate water, almost the same as No. 43220 from the same vicinity, the iron being in the form of ferrous sulfate or copperas. It is acid in reaction and is a so-called alum water.

## LINCOLN COUNTY.

LABORATORY NO. 36984—Chalybeate water from a bored well sent April 15th, 1913, by Norman True, McKinney, Ky. The sample was turbid with a red, ferruginous sediment.

ANALYSIS—One gallon contains 74.9 grains of solid matter (1.284 grams per liter) composed of sodium chlorid, calcium sulfate, magnesium carbonate, calcium carbonate, ferrous carbonate, a notable amount of zinc carbonate and traces of silica, potassium sulfate and lithium carbonate.

It is a good chalybeate water.

LABORATORY NO. 43171 — Sulfur water sent by G. B. Prewitt, Moreland, Ky., from a well 76 feet deep, located just south of the second knob west of the town. Two samples were sent, one taken July 4 (No. 1), the other taken July 5 (No. 2). Both samples had considerable black sediment. Sample No. 2 was examined.

ANALYSIS—One gallon contains 133.7 grains of solid matter (2.299 grams per liter) composed mainly of sodium chlorid, some sodium sulfate, small quantities of calcium carbonate and magnesium carbonate and traces of sodium sulfid, iron, zinc, silica, potassium sulfate, lithium and strontium.

It is a good salt sulfur water and should have medicinal value.

LABORATORY NO. 43184—Water sent by J. M. Hubble, McKinney, Ky., from a drilled well at his residence in McKinney. Sample colorless with some light colored sediment. Received July 30th, 1913.

ANALYSIS—One gallon contains 116.5 grains of solid matter (1.998 grams per liter) composed of calcium sulfate, calcium carbonate, magnesium carbonate and sodium chlorid, with traces of iron, silica and lithium.

LABORATORY NO. 43219—Water sent by E. P. Martin, Stanford, Ky. Sample slightly cloudy with some light brown sediment. Received July 21st, 1913.

ANALYSIS—One gallon contains 415.2 grains of mineral matter (7.118 grams per liter) composed mainly of sodium chlorid, calcium sulfate, magnesium sulfate, small quantities of silica, potassium sulfate and calcium carbonate and traces of iodid, bromid, borate, iron and lithium.

This is a saline water such as is common in deep wells in the limestones of this region. It should have medicinal value.

LABORATORY NO. 43223—Sulfur water sent by Abe Minks, Moreland, Ky., from a bored well 31 feet deep, 150 feet west of the depot at Moreland. Sample received August 22, 1913.

ANALYSIS—One gallon contains 105.0 grains of solid matter (1.80 gram per liter) composed of sodium sulfate, calcium sulfate, magnesium sulfate, some calcium carbonate, a small quantity of iron and traces of lithium, potassium, strontium, silica and hydrogen sulfid.

It is a weak sulfur water.

LABORATORY NO. 43260—Water sent by John Horton, Waynesburg, Ky. Sample colorless with very little sediment. Received August 26th, 1913.

ANALYSIS—One gallon contains 50.6 grains of solid matter (.868 gram per liter) composed mainly of sodium chlorid, calcium carbonate, magnesium carbonate, a little calcium sulfate and traces of iron, silica, potassium sulfate and lithium carbonate.

It is a saline water containing somewhat more solid matter than an ordinary well water.

## LOGAN COUNTY.

LABORATORY NO. 43256—Water sent by Mrs. Olive Mize, Cave Spring, Ky. Received August 21st, 1913.

ANALYSIS—One gallon contains 131.4 grains of solid matter (2.252 grams per liter) composed mainly of sodium chlorid, sodium sulfate, moderate amounts of calcium carbonate and magnesium carbonate and traces of sodium carbonate, iron, silica, sodium iodid, sodium bromid, potassium and lithium.

It is a saline water of moderate strength and should have medicinal value.

## McCRACKEN COUNTY.

LABORATORY NO. 43224—Weak chalybeate water sent by Jos. R. Grogan, Paducah, Ky., from a well 100 feet deep. Sample received August 26th, 1913.

ANALYSIS—One gallon contains 5.3 grains of solid matter (.09 gram per liter) composed of small quantities of sodium chlorid, calcium sulfate and ferrous sulfate with traces of silica, magnesium sulfate, potassium and lithium.

It is a weak chalybeate water and should have some medicinal value.

LABORATORY NO. 43242—Chalybeate water sent by R. L. Ablett, Paducah, Ky. Sample colorless with some light brown sediment. Received August 14th, 1913.

ANALYSIS—One gallon contains 14.6 grains of solid matter (.25 gram per liter) composed of sodium chlorid, calcium carbonate, sodium carbonate, ferrous carbonate and traces of magnesium carbonate, silica, potassium and lithium. The sediment contains a good deal of iron.

It is an alkaline chalybeate water and should have some medicinal value.

LABORATORY NO. S-77—"Sanitola Water," from a well at 1016 South Fifth Street, Paducah, Ky., sent by C. R. Kiener, proprietor, September 8, 1913. Analysis by Mr. H. D. Spears.

| ANALYSIS— | Grams per liter. | Grains per gallon. |
|---|---|---|
| Calcium carbonate, $CaCO_3$ | 0.2105 | 12.27 |
| Magnesium carbonate, $MgCO_3$ | .2894 | 16.87 |
| Ferrous carbonate, $FeCO_3$ | .0035 | .20 |
| Calcium sulfate, anhydrous, $CaSO_4$ | .1141 | 6.65 |
| Magnesium sulfate, anhydrous, $MgSO_4$ | .2838 | 16.55 |
| Potassium sulfate, $K_2SO_4$ | .0783 | 4.56 |
| Sodium sulfate, anhydrous, $Na_2SO_4$ | .3463 | 20.19 |
| Sodium chlorid, NaCl | .6516 | 37.99 |
| Magnesium nitrate, anhydrous, $Mg(NO_3)_2$ | .0296 | 1.72 |
| Silica, $SiO_2$ | .0156 | 0.91 |
| Total | 2.0227 | 117.91 |
| There is some carbon dioxid gas present. | | |
| No iodin, bromin, lithium or strontium detected. | | |
| Total solids, dried at 100° C. | 2.1350 | 124.46 |
| Ignited solids | 1.8100 | 105.00 |
| Specific gravity | 1.002 | |

It is an alkaline, magnesian water and should have medicinal value on account of the magnesium carbonate and magnesium sulfate it contains.

## MARION COUNTY.

LABORATORY NO. 43275—Well water sent by J. F. Dudgeon, Penick, Ky. The water is said to taste of sulfur and to act on the kidneys. Sample very slightly turbid water. Received October 3, 1913.

ANALYSIS—One gallon contains 112.8 grains of solid matter (1.934 gram per liter) composed mainly of sodium chlorid, sodium sulfate, calcium sulfate, small amounts of calcium carbonate and magnesium carbonate and traces of iron, silica, potassium sulfate, iodid, bromid and lithium.

It is a weak saline water and should have some medicinal value.

## MUHLENBERG COUNTY.

LABORATORY NO. 43073—Mineral water sent to Prof. H. D. Easton by the Central Coal and Iron Company, Central City, Ky. Received about June 9, 1913. Contained a slight, brownish ferruginous sediment.

ANALYSIS—One gallon contains 128. grains of mineral matter (2.195 grams per liter) composed mainly of calcium sulfate, magnesium sulfate, sodium chlorid, a little ferrous sulfate and some aluminum sulfate. The water reacts distinctly acid. The acid character and high mineral content of this water render it unfit for use in steam boilers, without purification, as it would both corrode and form scale. It belongs to the class of so-called "alum" waters and should have some medicinal value.

LABORATORY NO. 43158—Mineral water sent June 16, 1913, by W. P. Poole & Bro., Rochester, Ky., from a never failing spring on Mud River, about 4 miles southwest of Rochester.

ANALYSIS—One gallon contains 9.9 grains of solid matter (.17 gram per liter) composed mainly of calcium carbonate, ferrous carbonate and traces of sodium chlorid, silica and potassium sulfate.

It is a very weak chalybeate water and should have some medicinal value.

## NELSON COUNTY.

LABORATORY NO. 43183—Water sent by Mrs. Sarah Daugherty, New Haven, Ky., to determine if it is suitable for domestic use. Received about July 31st, 1913.

ANALYSIS—One gallon contains 100.3 grains of solid matter (1.72 gram per liter) composed of ferrous sulfate, magnesium sulfate, small amounts of calcium sulfate and sodium chlorid and a trace of silica.

It is a so-called alum water. It is acid in reaction due to the ferrous sulfate (copperas) present. It would probably have some medicinal value but is not suitable for domestic purposes.

LABORATORY NO. 43246—Water sent by H. P. Johnson, Boston, Ky. Sample colorless with very little sediment. Received September 7, 1913.

ANALYSIS—One gallon contains 549.7 grains of mineral matter (9.45 grams per liter) composed mainly of magnesium sulfate, calcium sulfate, sodium sulfate and sodium chlorid, some calcium carbonate and traces of iron, silica, potassium sulfate and lithium carbonate.

It is a strong magnesian water and would have the medicinal properties of that class of waters.

## OHIO COUNTY.

LABORATORY NO. 43166—Chalybeate water sent by N. Y. Jones, Beaver Dam, Ky. Sample received July 5, 1913.

ANALYSIS—One gallon contains 154.9 grains of solid matter (2.294 grams per liter) composed of magnesium sulfate, calcium sulfate, ferrous sulfate, sodium chlorid and traces of silica and potassium sulfate.

This is a so-called alum water. It would have the medicinal properties common to waters of that class.

Two waters sent November 6th, 1913, by N. Y. Jones, Beaver Dam, Ky., from two springs very close together.

LABORATORY NO. 43325—Marked No. 1.

ANALYSIS—One gallon contains 147.9 grains of mineral matter (2.536 grams per liter) composed mainly of calcium sulfate and magnesium sulfate, with some sodium sulfate, small quantities of ferrous sulfate and sodium chlorid, and traces of silica, potassium and lithium.

LABORATORY NO. 43326—Marked No. 2, was found to be similar in composition to No. 43325.

These are sulfated saline waters and should have medicinal value.

## OLDHAM COUNTY.

LABORATORY NO. 43291—Spring water sent October 6th, 1913, by A. J. Williams, Pewee Valley, Ky., from a spring about five feet under ground. Sample somewhat yellowish, apparently containing a good deal of organic matter.

ANALYSIS—One gallon contains 106.4 grains of solid matter (1.824 gram per liter) composed of sodium chlorid, sodium sulfate, small amounts of calcium carbonate and magnesium carbonate and traces of iron, silica, potassium and lithium. On burning there was much darkening and odor of organic matter, indicating organic contamination.

It is a saline sulfated water.

Two spring waters sent October 24th, 1913, by F. E. Aspinwall, La Grange, Ky.

LABORATORY NO. 43307—Spring No. 1. Water clear. No sediment.

LABORATORY NO. 43308—Spring No. 2. Very little sediment.

| ANALYSIS— | 43307 Grains per gallon. | 43307 Parts per million. | 43308 Grains per gallon. | 43308 Parts per million. |
|---|---|---|---|---|
| Total solid matter | 18.3 | 315. | 18.7 | 321. |
| Ignited solid matter | 13.5 | 231. | 13.7 | 235. |
| Organic and volatile matter | 4.8 | 84. | 5.0 | 86. |
| Chlorin (Cl) | | 3. | | 5. |
| Nitrite nitrogen | | None | | None |
| Nitrate nitrogen | | None | | 0.9 |
| Free ammonia | | Faint trace | | Faint trace |

Calcium and magnesium very moderate in both samples, mostly as the carbonates. Sulfates small in both samples. These are ordinary spring waters with practically no difference in the composition. The two samples of spring No. 2 were identical in composition.

## POWELL COUNTY.

LABORATORY NO. 43160—Chalybeate water sent by Jake Gentry, Westbend, Ky., June 20th, 1913, from a spring near Westbend. Sample muddy.

ANALYSIS—One gallon contains 21.9 grains of solid matter (.376 gram per liter) composed of calcium carbonate, magnesium carbonate, sodium chlorid, a moderate amount of iron, probably as the carbonate and traces of silica, potassium sulfate and lithium carbonate.

It is a weak chalybeate water.

## SIMPSON COUNTY.

LABORATORY NO. 43162—Mineral water sent by T. J. Meguire, Franklin, Ky., June 24, 1913.

ANALYSIS—One gallon contains 162.1 grains of mineral matter (2.78 grams per liter) composed of sodium chlorid, calcium sulfate, magnesium sulfate, some calcium carbonate

and sodium sulfate, traces of iron, silica, potassium sulfate, lithium and strontium carbonate.

It is a moderately strong sulfated water.

## SPENCER COUNTY.

LABORATORY NO. 43362—Salt water from the Taylorsville Artesian well, sent by J. A. Williamson, Lexington, Ky. The well is about 250 yards from the Court House, was bored in 1905 and is 1037 feet deep. Sample contained some ferruginous sediment. The portions for analysis were taken after thorough shaking. Sample received about the middle of December, 1913. The water was later put on the market as "Cil-i-ko Water" by the Cil-i-ko Mineral Spring Co., Lexington, and is recommended by them for rheumatism.

| ANALYSIS— | Grams per liter | Grains per gallon. |
|---|---|---|
| Ferrous carbonate ($FeCO_3$) | .0421 | 2.46 |
| Calcium carbonate ($CaCO_3$) | .2625 | 15.31 |
| Magnesium carbonate ($MgCO_3$) | .0694 | 4.05 |
| Strontium sulfate ($SrSO_4$) | .1441 | 8.40 |
| Calcium sulfate, anhydrous, ($CaSO_4$) | 2.0485 | 119.49 |
| Potassium sulfate ($K_2SO_4$) | .3202 | 18.63 |
| Sodium borate | trace. | ------ |
| Sodium bromid (NaBr) | .0052 | .30 |
| Sodium iodid | trace. | ------ |
| Lithium chlorid | trace. | ------ |
| Magnesium chlorid, anhydrous ($MgCl_2$) | 1.1250 | 65.62 |
| Sodium chlorid (NaCl) | 11.5250 | 672.26 |
| Silica ($SiO_2$) | .0080 | .47 |
| Total | 15.550 | 906.99 |
| Total solids dried at 105° | 16.576 | 966.88 |
| Ignited solids | 14.884 | 868.16 |

The analysis shows a large amount of sodium chlorid (common salt) and considerable quantities of calcium and magnesium compounds. It is primarily a salt water, con-

taining a considerable quantity of sulfates. It would doubtless be laxative and alterative in effect. It does not contain any sulfids, but the main constituents are present in about twice the amount found in the Blue Lick water, as shown by recent analyses made in this Station. The first water from the well was much more salt, an analysis of a sample sent to this Station in December, 1905, having shown 2127.5 grains of solid matter to the gallon. (See 19th Ann. Rep., p. 275, No. 14894.)

## TODD COUNTY.

LABORATORY No. 43222—Sulfur water sent by Frank Smith, Allensville, Ky., from a bored well. Sample yellowish with odor of hydrogen sulfid and giving a test for metallic sulfids. Received August 4th, 1913.

ANALYSIS—One gallon contains 188.6 grains of mineral matter (3.242 grams per liter) composed of sodium chlorid, calcium sulfate, magnesium sulfate, a small amount of calcium carbonate and traces of iron, silica, potassium and lithium. The free and combined hydrogen sulfid amounts to 2.0 grains per gallon (.034 gram per liter).

It is a saline sulfur water.

## WARREN COUNTY.

LABORATORY No. 36856—Sulfur water brought January 9th, 1913, by Jim Ellis, Smith's Grove, Ky., from a well 210 feet deep, bored about 2 years ago on his place 2 miles north of Smith's Grove. Sample contains a slight black sediment.

ANALYSIS—One gallon contains 36.8 grains of solid matter (.63 gram per liter) composed of sodium chlorid, calcium carbonate, magnesium carbonate and sodium sulfate, distinct traces of sodium sulfid, hydrogen sulfid, iron and silica and faint traces of potassium and lithium.

This is a saline sulfur water, probably a "black sulfur."

LABORATORY No. 43185 — Well water sent January 24th, 1913, by J. F. Davenport, Bowling Green, Ky., from well 125 feet deep, the water standing 60 feet deep. Sample slightly opalescent.

ANALYSIS—One gallon contains 16.0 grains of solid matter (.274 gram per liter) composed of calcium carbonate, magnesium carbonate, sodium chlorid, and traces of iron, silica, potassium sulfate, lithium and strontium carbonates.

It differs from the average well water in containing traces of lithium and strontium.

LABORATORY No. 43239—Water sent September 1st, 1913, by J. C. Perkins, Bowling Green, Ky., from a well 85 feet deep.

ANALYSIS—One gallon contains 19.9 grains of solid matter (.324 gram per liter) composed of calcium carbonate, magnesium carbonate, sodium chlorid and traces of iron, silica, zinc and strontium carbonate.

It contains about as much mineral matter as an average well water but differs in containing traces of zinc and strontium. It should be all right for drinking.

## WASHINGTON COUNTY.

LABORATORY No. 43327—Salt water sent by Thos. Duncan, Springfield, Ky., from a bored well 125 feet deep. Sample clear, colorless water. Received November 24th, 1913.

ANALYSIS—One gallon contains 858. grains of mineral matter (14.718 grams per liter) composed mainly of sodium chlorid, calcium sulfate, magnesium sulfate, with small amounts of calcium carbonate and magnesium carbonate and traces of iron, silica, potassium, lithium and strontium.

It is a strong salt water containing a large amount of calcium sulfate and a considerable amount of magnesium sulfate. The water should have some medicinal value.

## WEBSTER COUNTY.

LABORATORY No. 43186—Sulfur water sent by B. Watson, Providence, Ky. Sample yellowish showing very small quantities of free and combined hydrogen sulfid. Received July 30, 1913.

ANALYSIS—One gallon contains 80.9 grains of solid matter (1.388 gram per liter) composed of sodium sulfate, calcium carbonate, magnesium carbonate, sodium carbonate, small quantities of sodium sulfid and iron and traces of silica, potassium and lithium.

This is an alkaline sulfur water and should have medicinal value.

## WOLFE COUNTY.

LABORATORY No. 43333—Chalybeate water from a well four or five miles southeast of Campton, Ky., brought by Mr. H. E. Curtis, November 22, 1913, for W. G. Proctor, Lexington, Ky. Sample contained some reddish sediment.

ANALYSIS—One gallon contains 8.2 grains of solid matter (.14 gram per liter) composed of sodium chlorid, calcium sulfate and ferrous sulfate with traces of magnesium carbonate, silica and potassium sulfate. The sediment contains iron and silica.

It is a weak chalybeate water and should have some medicinal value.

# METEOROLOGICAL SUMMARIES

## FOR THE YEAR 1913.

Compiled from the records of the U. S. Weather Bureau Station in the main building of State University.

### Monthly and Annual Mean Temperature.

| Year | Jan, | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Annl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1872 | | | | | | | | | | | 37 | 27 | |
| 1873 | 30 | 35 | 42 | 53 | 66 | 74 | 75 | 74 | 67 | 53 | 40 | 39 | 54. 0 |
| 1874 | 36 | 38 | 44 | 46 | 66 | 77 | 78 | 75 | 71 | 57 | 45 | 38 | 56. 0 |
| 1875 | 27 | 29 | 42 | 49 | 64 | 72 | 76 | 71 | 64 | 52 | 43 | 43 | 52. 7 |
| 1876 | 41 | 39 | 41 | 52 | 65 | 72 | 77 | | | | | | |
| 1887 | | | | | | | | | | | 44 | 35 | |
| 1888 | 31 | 36 | 41 | 56 | 63 | 72 | 76 | 74 | 63 | 51 | 46 | 37 | 54. 0 |
| 1889 | 37 | 32 | 46 | 55 | 63 | 69 | 75 | 72 | 65 | 52 | 43 | 50 | 55. 0 |
| 1890 | 44 | 45 | 39 | 56 | 63 | 77 | 76 | 71 | 67 | 56 | 49 | 37 | 56. 6 |
| 1891 | 37 | 41 | 40 | 57 | 62 | 76 | 73 | 73 | 72 | 55 | 43 | 43 | 56. 0 |
| 1892 | 28 | 41 | 39 | 54 | 63 | 76 | 75 | 75 | 68 | 57 | 41 | 33 | 54. 1 |
| 1893 | 23 | 36 | 43 | 57 | 61 | 72 | 79 | 74 | 70 | 57 | 43 | 37 | 54. 4 |
| 1894 | 38 | 34 | 49 | 54 | 62 | 75 | 76 | 76 | 71 | 58 | 41 | 37 | 55. 9 |
| 1895 | 28 | 23 | 43 | 56 | 62 | 75 | 73 | 76 | 73 | 52 | 45 | 37 | 53. 7 |
| 1896 | 34 | 35 | 38 | 62 | 71 | 72 | 75 | 75 | 67 | 54 | 48 | 38 | 55. 9 |
| 1897 | 30 | 37 | 48 | 53 | 59 | 72 | 76 | 74 | 72 | 64 | 46 | 37 | 55. 7 |
| 1898 | 38 | 36 | 49 | 50 | 65 | 74 | 76 | 76 | 72 | 56 | 43 | 33 | 55. 8 |
| 1899 | 34 | 24 | 42 | 56 | 67 | 75 | 77 | 77 | 68 | 61 | 48 | 33 | 55. 1 |
| 1900 | 36 | 31 | 39 | 55 | 66 | 72 | 77 | 79 | 73 | 65 | 45 | 37 | 56. 3 |
| 1901 | 34 | 29 | 44 | 49 | 63 | 74 | 80 | 74 | 67 | 58 | 40 | 31 | 53. 6 |
| 1902 | 32 | 25 | 45 | 53 | 68 | 71 | 77 | 74 | 67 | 59 | 53 | 34 | 54. 8 |
| 1903 | 32 | 36 | 50 | 53 | 68 | 68 | 77 | 74 | 70 | 57 | 40 | 28 | 54. 4 |
| 1904 | 30 | 31 | 46 | 48 | 64 | 72 | 74 | 74 | 69 | 57 | 44 | 34 | 53. 5 |
| 1905 | 24 | 25 | 49 | 54 | 66 | 72 | 75 | 74 | 68 | 55 | 44 | 35 | 53. 5 |
| 1906 | 37 | 32 | 36 | 57 | 64 | 72 | 74 | 76 | 71 | 55 | 45 | 36 | 54. 5 |
| 1907 | 40 | 32 | 52 | 45 | 59 | 69 | 76 | 73 | 68 | 53 | 42 | 37 | 53. 8 |
| 1908 | 33 | 33 | 50 | 55 | 65 | 72 | 76 | 75 | 72 | 58 | 48 | 38 | 56. 1 |
| 1909 | 37 | 41 | 43 | 54 | 62 | 73 | 73 | 74 | 66 | 53 | 53 | 28 | 54. 6 |
| 1910 | 32 | 31 | 54 | 54 | 59 | 69 | 75 | 73 | 70 | 60 | 40 | 29 | 53. 7 |
| 1911 | 38 | 40 | 43 | 52 | 70 | 74 | 76 | 76 | 72 | 58 | 40 | 41 | 56. 6 |
| 1912 | 23 | 28 | 39 | 57 | 65 | 69 | 75 | 72 | 70 | 59 | 44 | 36 | 53. 1 |
| 1913 | 42 | 33 | 44 | 53 | 65 | 73 | 78 | 77 | 69 | 56 | 49 | 38 | 56. 5 |

### Monthly and Annual Precipitation.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1872 | | | | | | | | | | | 1.21 | 3.30 | |
| 1873 | 2.53 | 4.05 | 3.73 | 2.89 | 6.05 | 4.49 | 3.37 | 2.94 | 1.60 | 5.47 | 1.92 | 4.48 | 43.52 |
| 1874 | 5.41 | 4.89 | 5.90 | 6.81 | 0.79 | 3.55 | 6.26 | 1.57 | 2.89 | 0.92 | 4.27 | 3.83 | 47.09 |
| 1875 | 2.61 | 3.12 | 6.18 | 2.06 | 2.43 | 4.16 | 11.24 | 0.62 | 1.72 | 2.37 | 5.87 | 3.68 | 46.06 |
| 1876 | 6.06 | 1.66 | 3.63 | 4.20 | 2.16 | 4.13 | 3.84 | | | | | | |
| 1887 | | | | | | | | | | | 3.02 | 2.71 | |
| 1888 | 4.39 | 2.93 | 5.82 | 3.17 | 3.29 | 2.97 | 4.21 | 8.76 | 1.22 | 3.02 | 5.15 | 1.88 | 46.81 |
| 1889 | 5.66 | 1.78 | 1.63 | 1.52 | 3.53 | 3.49 | 5.82 | 1.15 | 6.79 | 3.06 | 5.34 | 1.73 | 41.50 |
| 1890 | 5.34 | 8.13 | 9.91 | 3.59 | 4.71 | 7.43 | 3.14 | 7.32 | 1.82 | 2.38 | 3.54 | 4.05 | 61.36 |
| 1891 | 4.70 | 4.36 | 7.63 | 1.85 | 1.17 | 5.33 | 3.23 | 6.48 | 1.26 | 1.33 | 5.38 | 2.82 | 45.51 |
| 1892 | 2.35 | 3.10 | 4.01 | 6.57 | 5.32 | 3.81 | 6.22 | 3.28 | 4.10 | 0.45 | 3.72 | 3.03 | 45.96 |
| 1893 | 2.10 | 4.44 | 3.30 | 5.81 | 3.88 | 4.24 | 3.11 | 1.86 | 2.25 | 5.59 | 3.36 | 2.61 | 42.55 |
| 1894 | 3.58 | 3.33 | 2.13 | 4.19 | 3.81 | 4.44 | 0.87 | 3.67 | 4.05 | 1.40 | 1.38 | 3.45 | 36.32 |
| 1895 | 5.60 | 0.52 | 2.79 | 3.17 | 4.05 | 2.93 | 5.07 | 1.56 | 0.33 | 1.28 | 2.52 | 5.50 | 35.32 |
| 1896 | 1.25 | 3.15 | 5.41 | 0.40 | 3.20 | 3.74 | 10.39 | 3.37 | 4.25 | 1.27 | 4.30 | 2.56 | 43.29 |
| 1897 | 2.59 | 6.33 | 6.55 | 5.80 | 4.48 | 4.77 | 4.34 | 3.21 | 0.80 | 0.38 | 4 83 | 5.11 | 49.19 |
| 1898 | 9.56 | 2.20 | 8.18 | 3.29 | 6.13 | 7.94 | 5.72 | 2.99 | 3.55 | 5.27 | 2.89 | 2.80 | 60.52 |
| 1899 | 6.69 | 2.84 | 8.61 | 2.16 | 3.63 | 2.55 | 0.97 | 4.18 | 1.90 | 2.09 | 1.70 | 2.92 | 40.24 |
| 1900 | 2.13 | 3.17 | 1.98 | 1.23 | 3.54 | 2.19 | 2.80 | 5.75 | 1.85 | 0.79 | 6.38 | 1.86 | 33.67 |
| 1901 | 1.49 | 0.62 | 2.23 | 4.52 | 2.67 | 3.70 | 2.61 | 3.74 | 2.18 | 1.33 | 1.73 | 3.50 | 30.32 |
| 1902 | 4.77 | 0.90 | 2.92 | 1.27 | 2.43 | 5.19 | 2.33 | 1.89 | 2.60 | 2.11 | 3.09 | 6.60 | 36.10 |
| 1903 | 1.68 | 6.16 | 3.24 | 3.29 | 1.75 | 2.71 | 2.62 | 1.49 | 0.81 | 2.12 | 2.84 | 1.99 | 30.70 |
| 1904 | 1.92 | 2.38 | 4.75 | 3.08 | 2.60 | 2.51 | 3.13 | 2.44 | 1.71 | 0.57 | 0.53 | 3.10 | 28.72 |
| 1905 | 2.04 | 2.13 | 5.87 | 2.87 | 5.54 | 3.31 | 4.94 | 4.11 | 3.20 | 3.45 | 3.58 | 4.13 | 45.17 |
| 1906 | 2.29 | 1.84 | 6.45 | 1.11 | 3.15 | 4.68 | 3.89 | 4.92 | 5.03 | 0.74 | 3.95 | 4.54 | 42.59 |
| 1907 | 9.06 | 1.89 | 4.13 | 1.83 | 3.89 | 3 65 | 4.42 | 2.07 | 2.72 | 2.76 | 2.67 | 2.28 | 41.37 |
| 1908 | 1.85 | 4.81 | 8.17 | 4.99 | 4.20 | 2.12 | 3.60 | 2.98 | 0.38 | 0.72 | 1.65 | 2.13 | 37.60 |
| 1909 | 3.35 | 6.86 | 3.97 | 6.72 | 4.15 | 5.41 | 5.98 | 1.26 | 4.88 | 2.05 | 1.96 | 2.77 | 49.36 |
| 1910 | 4.46 | 4.11 | 0.46 | 4.22 | 6.24 | 5.92 | 7.66 | 4.15 | 7.92 | 1.67 | 1.72 | 2.81 | 51.34 |
| 1911 | 2.44 | 2.21 | 2.31 | 4.46 | 1.07 | 3.01 | 0.92 | 2.84 | 4.37 | 3.67 | 3.84 | 6.20 | 37.34 |
| 1912 | 1.78 | 2.50 | 4.36 | 6.89 | 5.11 | 2.15 | 4.70 | 3.23 | 2.09 | 0.51 | 1.02 | 3.66 | 38.00 |
| 1913 | 10.35 | 2.61 | 6. 0 | 2.41 | 4.32 | 3.29 | 2.43 | 1.00 | 1.76 | 3.40 | 4.00 | 2.74 | 44.35 |

## Annual Meteorological Summary for the Year 1913.

| Month. | Temperature. Degrees Fahrenheit. | | | | | | | Moisture | | | | | | Per cent of Sunshine. | Wind. | | | | | Number of Days. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean. | | | Extreme | | | | Relative Humidity. Per cent. 7 a. m. | Precipitation. In Inches. | | | | Total Snowfall, Ins. | | Average Hourly Velocity. | Prevailing Direction. | Maximum For five mins. | | | Clear. | Partly Cloudy | Cloudy. | With trace of snow. | Thunderstorms. | Fog. | Freezing or below. | Temp. 90 or above. |
| | Maximum. | Minimum. | Monthly. | Maximum. | Date. | Minimum. | Date. | | Total. | Maximum in 24 hours. | Date. | Days with .01 inch or more. | | | | | Velocity. | Direction. | Date. | | | | | | | | |
| January | 51 | 32 | 42 | 66 | 20 | 19 | 9 | 87 | 10.35 | 3.50 | 11 | 20 | 3.7 | 27 | 13.2 | S | 44 | NW | 3 | 5 | 8 | 18 | 9 | 1 | 3 | 18 | 0 |
| February | 41 | 25 | 33 | 68 | 21 | 6 | 6 | 81 | 2.61 | 0.70 | 3 | 9 | 3.4 | 52 | 10.6 | W | 37 | W | 22 | 11 | 7 | 10 | 4 | 0 | 1 | 19 | 0 |
| March | 54 | 35 | 44 | 75 | 23 | 13 | 2 | 74 | 6.04 | 3.61 | 25–26 | 13 | 0.4 | 48 | 14.7 | S | 52 | W | 25 | 9 | 11 | 11 | 4 | 5 | 2 | 16 | 0 |
| April | 62 | 44 | 53 | 81 | 18 | 35 | 21 | 73 | 2.41 | 0.68 | 10–11 | 15 | 0 | 53 | 12.1 | NW | 40 | S | 3 | 8 | 10 | 12 | 0 | 4 | 0 | 0 | 0 |
| May | 75 | 55 | 65 | 87 | 30 | 35 | 11 | 70 | 4.32 | 1.97 | 21–22 | 9 | 0 | 62 | 8.8 | SW | 37 | SW | 15 | 10 | 12 | 9 | 0 | 8 | 0 | 0 | 0 |
| June | 84 | 63 | 73 | 95 | 30 | 45 | 9 | 72 | 3.29 | 1.18 | 7–8 | 8 | 0 | 74 | 8.0 | SW | 40 | W | 1 | 18 | 8 | 4 | 0 | 12 | 0 | 0 | 11 |
| July | 88 | 68 | 78 | 99 | 30 | 58 | 21 | 76 | 2.43 | 1.09 | 11–12 | 10 | 0 | 68 | 8.4 | SW | 51 | W | 19 | 12 | 16 | 3 | 0 | 16 | 0 | 0 | 12 |
| August | 87 | 67 | 77 | 94 | 18 | 56 | 23 | 75 | 1.00 | 0.29 | 14 | 8 | 0 | 65 | 7.4 | SW | 28 | NW | 18 | 13 | 11 | 7 | 0 | 12 | 0 | 0 | 9 |
| September | 79 | 59 | 69 | 96 | 2 | 40 | 23 | 75 | 1.76 | 0.45 | 7 | 12 | 0 | 47 | 8.6 | NE | 33 | SW | 22 | 6 | 13 | 11 | 0 | 3 | 2 | 0 | 9 |
| October | 66 | 47 | 56 | 88 | 7 | 31 | 30 | 79 | 3.40 | 1.04 | 23–24 | 10 | T | 51 | 9.4 | SE | 45 | W | 2 | 12 | 5 | 14 | 3 | 1 | 3 | 5 | 0 |
| November | 57 | 42 | 49 | 72 | 22 | 19 | 11 | 76 | 4.00 | 1.26 | 15–16 | 10 | 2.2 | 46 | 10.1 | S | 37 | W | 9 | 10 | 4 | 16 | 3 | 1 | 5 | 6 | 0 |
| December | 44 | 32 | 38 | 60 | 2 | 16 | 8 | 86 | 2.74 | 0.98 | 25 | 6 | 4.2 | 31 | 8.7 | W | 41 | NW | 7 | 6 | 6 | 19 | 5 | 0 | 11 | 16 | 0 |
| Year | 66 | 47 | 56 | 99 | July 30 | 6 | Feb. 6 | 77 | 44.35 | 3.61 | Mar. 25–26 | 130 | 13.9 | 52 | 10.0 | S | 52 | W | Mar 25 | 120 | 111 | 134 | 28 | 63 | 27 | 80 | 38 |

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