THIRTY-FIRST ANNUAL REPORT

OF THE

Kentucky Agricultural Experiment Station

OF THE

UNIVERSITY OF KENTUCKY

LEXINGTON, KY.

FOR THE YEAR 1918

PART I.

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THIRTY-FIRST ANNUAL REPORT

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Kentucky Agricultural Experiment Station

FOR THE YEAR 1918

PART I.

Report of Director and Heads of Departments.
Meteorological Observations.

LETTER OF TRANSMITTAL.

To His Excellency,

HON. AUGUSTUS OWSLEY STANLEY,

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, 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, 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 Thirty-First Annual Report of the Kentucky Agricultural Experiment Station.

Very respectfully,

THOMAS COOPER, *Director.*

January 1, 1918.

UNIVERSITY OF KENTUCKY.

Lexington, Ky.

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L. A. Brown, Sp. Analytical Chem.
W. R. Pinnell, Sp. Bact.

* On leave of absence.

THE KENTUCKY AGRICULTURAL EXPERIMENT STATION.

In Account with the United States Appropriations, 1917-18:

	Hatch Fund	Adams Fund
Receipts from the Treasurer of the United States, as per appropriations for fiscal year ended June 30, 1918, 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	$11,090.19	$11,683.91
Labor	503.78	430.45
Publications	888.05	
Postage and stationery	427.72	3.56
Freight and express	87.68	13.36
Heat, light, water and power	682.14	249.40
Chemicals and laboratory supplies	347.98	552.62
Seeds, plants and sundry supplies	194.27	169.25
Fertilizers		727.50
Feeding stuffs		103.90
Library	200.46	25.65
Tools, machinery, appliances	12.97	20.40
Furniture and fixtures	149.40	147.50
Scientific apparatus and specimens	45.00	795.30
Live stock		52.72
Traveling expenses	321.64	1.50
Contingent expenses	20.00	22.98
Buildings and land	28.72	
Total	$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, 1918; 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) P. P. Johnston, Jr.
Wellington Patrick,
Auditors.

(Seal)

Attest: Wellington Patrick,
Custodian.

ANNUAL REPORT

of the

Kentucky Agricultural Experiment Station for the Year 1918.

Report of the Director.

The work of the Agricultural Experiment Station during the year was greatly affected by the war and war activities. Departments lost a good proportion of their active working force and the demands for trained men competent to lead necessary organizations in the State to meet the nation's demands required much of the time of those who remained in the various departments. Research work was, to a large extent, discontinued except as it applied to problems rather directly affecting the prosecution of the war.

It is a noteworthy fact that when the call for information came as to methods of stimulating production or of meeting the wartime demand for crop and animal production, the Kentucky Experiment Station was not only able to furnish information promptly, but its work required very little readjustment to meet the wartime situation. Changed forms of supplies of feeding stuffs, economical methods of meat production and the increased production of wheat and other farm crops, brought out questions of procedure and methods that, to a large extent, had been determined by the Experiment Station. The pre-war program of the Experiment Station had been so well related to the agricultural problems of the State, that additional service in the war emergency was comparatively simple. When the demand came for more pork, beef, poultry, eggs, wheat and corn, the members of the staff were prepared to suggest the most economical methods of production and at the same time point out the possibilities of production and marketing.

Kentucky's response to the call for additional food was immediate. It was requested that hog production be increased 15 per cent.; the State responded with an increase

of 11 per cent., as of January 1, 1919. Wheat prduction was increased 33 per cent. in 1918 and the promise for 1919 is a production of almost 60 per cent. over normal. The work of the agricultural colleges and experiment stations and the efforts of the farmer to meet the nation's demands for food constitute one of the most effective pieces of war work and it is doubtful whether the nation will ever fully appreciate the effort involved. The statistics of agriculture portray in terms of bushels, pounds, etc., the result of the longer hours, the increased activity and the use of more efficient methods by the Kentucky farmer who, with the handicaps of increased cost and decreased labor force, met all requests for increased production.

Additions to Herds. A select herd of purebred Hereford cattle has been added to the Experiment Station stock. It is expected that this will be the foundation breeding herd for this institution and it will be increased from time to time. A small Shorthorn herd, also, has been started. Among the sires, a very fine Berkshire boar, winner of Junior Championship at Illinois, Indiana and Kentucky State Fairs and at the National Swine Show, has been purchased.

A Poland China boar and gilt and a small flock of Cheviot and Hampshire sheep were purchased during the summer.

Some Examples of Station Work That Have Been of Interest During the Year.

An attempt to indicate interesting or important phases of investigational work necessarily involves an arbitrary selection. The examples cited as worthy of attention do not represent all notable work of the institution, but merely those phases which appear to be of special interest at this time.

The study issued by Professor Nicholls on the organization of dairy farms is an important one. The most significant factors from an operating standpoint are the importance of well-stocked farms, the necessity for good pastures and the need of large production per cow. These factors had much to do with farm profits. Well-stocked farms gave increased

crop yields and good-sized herds were more profitable than small ones. Pasture data showed that where pastures carried one cow to 1.3 acres, the farm-labor increase was 20 times as great as on the farms on which the pastures carried one cow to 4.4 acres. This indicates in a striking manner the importance of maintaining the pastures of the State in the best condition.

A scheme of combined planting of corn and soy beans is of much interest to live-stock men. A year's results show that soy beans, planted with the hill of corn or between hills, do not reduce the yield of corn to any extent, and do increase the total value of the grain produced per acre. The mixture makes a well-balanced ration.

A study of the metabolism of the chicken and other animals by Dr. Buckner is yielding interesting results. Calcium, magnesium and phosphorus, mineral elements, are essential to the growth and normal development of an animal, as typified by the rat and chick. The total or partial absence of normal quantities of these elements immediately affects the normal development and growth. This investigation is fundamental to an understanding of what occurs during growth and development to maturity and indicates the possibility of the utilization of these elements in certain instances of malnutrition.

During the year, the control of the food and drug work formerly under the Experiment Station, was transferred to the State Board of Health. The Experiment Station continues to make the analyses that may be required. Its control of inspections and the enforcement of the law ceased June 18, 1918.

Creamery and Tester's License Law.

The last session of the Legislature enacted the Kentucky Creamery and Tester's License Law, Chapter 74, Acts of 1918, the purpose of which is to require that an honest business shall be conducted between the producers of milk and cream and those who buy the same on a butter-fat basis. The

enforcement of the Act is vested in the Director of the Kentucky Agricultural Experiment Station.

The law requires that the person responsible for the butter-fat test upon which the product is bought, shall have sufficient knowledge of the subject to pass an examination; that he shall use only tested glassware and weights, and shall use accurate scales, thermometer, water-bath and other equipment necessary in making a correct reading; and that each and every place of business where milk and cream are so purchased shall be licensed.

The following is a report of work under this law for the first six months, July 1 to December 31, 1918: Owing to the many details needing to be adjusted in the beginning, active work was not begun until about September 1st, and the inspection work was started the latter part of October. Licenses were issued to 41 creamery firms for the operation of 224 stations in the State. Testers' examinations were held in Lexington, Louisville and Paducah, at which licenses were granted to 184 testers. In the glassware-testing laboratory, 10,794 pieces of glassware and weights were tested, 9,869 of which were found to be correct and 929 incorrect, the number of incorrect pieces of glassware and weights becoming fewer as the requirements of the law were better understood. Two circulars were issued during this period, one containing the law and rules and regulations, and the other giving information on the Babcock test for butter-fat, and especially designed to aid beginners in this work.

It has been in the way of inspection that most defects have been found. Of the 111 cream stations inspected only 8 were found to be complying with the law in all respects. The principal deficiencies were the use of untested weights and glassware and the absence of thermometers and water-baths, without either of which the test will be more or less guesswork. All necessary instructions were given in each instance, and there is every reason to believe that a re-inspection will find many improvements.

The fees received under this law for the first six months of its operation are as follows: From cream-station licenses, $1,279.50; testers' licenses, $366.00; glassware-testing fees, $309.28, the total being $1,954.78.

Projects in Force. That the work of the Experiment Station may be carried on in a definite and systematic manner, each department prepares its work on a project basis. The projects constitute the outline of what each experiment is designed to accomplish and the method of approach. A project is dropped when the work is completed and finally reported upon. The following projects have been in force during the year:

Nodule organism of alfalfa and its relation to those of sweet clover and red clover.

The life-history and habits of the corn-ear worm (Chloridea obsoleta).

Immunizing horses and cattle against contagious abortion.

The rendering available of potash in insoluble silicates by the action of soil bacteria.

Sulfur in plants and soils and its significance to permanent soil fertility.

The translocation of the mineral matter in plants.

Occurrence and distribution of manganese in plants.

Clover bloat or tympany of the rumen in cattle and its cure.

The locust borer (Cyllene robiniae).

A study of the life-history and limits of broods of the white-fly (Asterochiton vaporariorum) of greenhouses.

A study of the life-history and limits of broods of the tobacco worm (Phlegethontius sexta).

Metabolism and catabolism in the chicken.

Changes taking place in corn and corn meal when stored under different conditions.

The determination and significance of the amino-acids resulting from the hydrolysis of the proteins contained in seeds, grains, grasses, feeds and foods.

The isolation and cultivation of the specific microorganism of hog cholera and the investigation of methods of treatment based upon a vaccine.

The inspection of imported nursery and florists' stock.

The fall history of the Hessian fly—limits of the brood, or broods, if more than one.

Nursery and orchard inspection.

Seed testing and inspection.

Preliminary tests of different fertilizing substances and mixtures on seeds.

Selective studies and comparisons of varieties and strains of forage plants.

Steer feeding investigations.

The introduction of pure-bred beef cattle.

Experiments in the hogging down of soy beans, cowpeas and corn, and comparing velvet-bean feed, tankage and soy beans as supplements to corn meal in feeding hogs.

Sheep breeding experiments.

A study: 1. Causes of sterility in domestic animals. 2. The morphology and physiology of spermatozoa. 3. Studies in heredity.

The breeding of pure-bred poultry for high egg-production.

Housing pure-bred poultry.

Animal versus vegetable protein in a laying ration.

General research and investigations of animal diseases.

Preparation and distribution of biological products.

Analysis of the agricultural limestones of the State.

Analysis of the agricultural soils of the State.

Analysis of miscellaneous materials.

Growing tobacco continuously on bluegrass soil.

Chemical analyses for the State Department of Geology and Forestry.

An attempt to determine the reason for the superiority of limestone and acid phosphate over limestone and rock phosphate in crop production on certain types of soil.

Feeding-stuffs control.

A study of labor requirements and production costs of farm crops and live stock in representative areas in Kentucky.

The farm-labor program in Kentucky.

Apples: Experiments and demonstration orchard at Lincoln Institute.

Dutch bulbs.

Variety orchard of apples and miscellaneous tree-fruits.

Nursery plantings of trees and shrubs.

Grape investigations, American and hybrid varieties.

Grape investigations, Vinifera varieties.

Strawberries—variety trials and cultural experiments.

Strawberry breeding.

Tomato investigations.

Yellow sweet corn investigations.

Irish potatoes.

Sweet potatoes.

Celery investigations.

Miscellaneous vegetable trials.

Hardy and half-hardy herbaceous perennials.

Head-lettuce investigations.

Investigation of "frenching" disease of corn, together with methods of control for same.

Hemp-marketing investigation.

Cold storage investigation.

Soil experiment fields.

Soil surveys.

The effect of the initial moisture present on movement of water in soil.

General field-crop production experiments and tests.

Operation of VanMeter farm.

Dairy cow feeding experiments.

A comparison of the total calcium content of cultivated and virgin soils, with particular reference to the possible limitation of crop production by deficiency of this element.

Leave of Absence. The following members of the staff were given leave of absence for military service:

A. L. Brueckner, P. L. Blumenthal, C. W. Craig, N. M. Cregor, Elmer Ingram, Roger W. Jones, O. S. Lee, J. B. Hutson, William Rodes.

Changes in staff. The personnel of the several departments, other than clerical assistants and laborers, is given on page 7 of this report. The following represent the appointments and resignations for the year:

Appointments:

L. J. Horlacher, assistant in animal husbandry. June, 1918.

E. J. Wilford, in charge of meats laboratory. June, 1918.

Miss Mabel Roe, assistant plant pathologist. July, 1918.

F. J. Sutton, assistant horticulturist. September, 1918.

Resignations:

W. H. Simmons, meat and slaughter house inspector. April, 1918. Reappointed in the Extension Division.

S. L. Hibberd, assistant in agronomy. May, 1918.

T. G. Yaxis, assistant in animal husbandry. June, 1918.

Angus Gordon, assistant in agronomy. September, 1918.

H. R. Niswonger, assistant in entomology and botany. April, 1918. Transferred to the Extension Division.

Publications. The mailing list of the Experiment Station at the present time includes approximately 20,000 names. Bulletins and circulars as published are sent to all who may request them. The distribution of publications thru the mailing list reached a total of about 60,000. Many circulars

and bulletins are distributed directly to the public thru county agents, teachers and superintendents of schools. The development of county agent work appears to curtail the requests for information and publications formerly sent directly to the Experiment Station. The volume of inquiries taken care of by the county agent is rapidly increasing and indicates that the scheme of using agents to represent the Experiment Station and its work in the field increases greatly the usefulness of the institution.

The following represent the publications of the Experiment Station during the year 1918:

Bulletins:

No.

215. Care and Management of Sheep in Kentucky—E. S. Good and L. B. Mann. January, 1918.
216. Strawberries—A. J. Olney and C. W. Mathews. April, 1918.
217. Profitable Dairy-Farm Organization in Kentucky—W. D. Nicholls and J. B. Hutson. July, 1918.
218. Tomato Investigations—A. J. Olney. December, 1918.
219 Commercial Fertilizers—H. E. Curtis and William Rodes. December, 1918.

Circulars:

No.

20. An Experiment Comparing Velvet-Bean Meal, Tankage and Soy Bean Meal as Supplements to Corn Meal in Feeding Hogs—E. S. Good and L. B. Mann. January, 1918.
21. Live Stock and Other Factors for Profitable Farming in Northern Kentucky—J. B. Hutson. June, 1918.
22. Treatment of Seed Wheat with Formalin—H. Garman and Carrie Lee Hathaway. July, 1918.
23. Feeding Trials of Velvet-Bean Feed, Palm-Kernel Meal and Various Grain Mixtures, for Dairy Cows—J. J. Hooper and J. W. Nutter. November, 1918.

Scientific Publications:

Effect of Time of Digestion on the Hydrolysis of Casein in the Presence of Starch—J. S. McHargue. Journ. Agr. Res. Vol. XII. No. 1. January 7, 1918.

Uniform Nitrogen Determination in Cottonseed Meal—J. S. McHargue. J. Ind. & Eng. Chem. Vol. 10, No. 7, p. 533. July, 1918.

The Effect of Manganese on the Growth of Wheat: A Source of Manganese for Agricultural Purposes—J. S. McHargue. (In press). Read before Div. Agr'l. and Food Chem., Cleveland meeting, Am. Chem. Soc. September 12, 1918.

The Normal Growth of White Leghorn Chickens—G. D. Buckner, R. H. Wilkins and J. H. Kastle. Am. J. Physiology. Vol. 47, No. 3. December, 1918.

The Translocation of the Mineral Constituents of the Jack Bean—G. D. Buckner. (In press).

Salicylic Acid as a Remedy for Chronic Hog Cholera—D. J. Healy. (In press).

A Convenient and Efficient Digestion Apparatus for the Determination of Crude Fiber—H. D. Spears. (In press).

The Effect of Certain Compounds of Barium and Strontium on the Growth of Plants—J. S. McHargue. (In press).

Inheritance of Jersey Coat Colors—J. J. Hooper. Jersey Bulletin, p. 1009. June 26, 1918. Breeders' Gazette, p. 264. August 22, 1918.

Parturient Paresis (Milk Fever).—D. J. Healy. (In press).

Fertility in the Soils of Shelby County and Analysis of Soils of Shelby County—S. D. Averitt. (In press).

Experiment Station Medal Awards. As an encouragement to those engaged in the various lines of agricultural production in the State, the Experiment Station awards a bronze medal for the best exhibit in each great class of products during Farmers' Week. The following were awarded medals in 1918:

Will Roper, Fulton, Kentucky, for the best exhibit of alfalfa.

Four Leaf Produce Farm, Hebbardsville, Kentucky, for the best exhibit of corn.

J. F. Dolan and Thomas Goodman, Paynes Depot, Kentucky, for the best exhibit of tobacco.

Library.

On October 1, 1917, there were 6,415 volumes listed in the accession book. Since that date 560 additional volumes have been added, making a total of 6,975. The Extension Division of the College of Agriculture turned over to the library, December 14, 1918, 101 volumes which are included in the total number of accessions mentioned above. These books have been completely cataloged and placed on the shelves of the library.

There is received in the library a total number of 132 periodicals pertaining to subjects of interest to the various departments of the Experiment Station, and subscribed for by them.

Besides the combined reading room and stack room, on the first floor of Scovell Hall, the library maintains two rooms in the basement; one as a filing room for periodicals and duplicate government documents; the other as a work room for agricultural students for tracing pedigree records. There are some 21 herd records kept to date and in order in this room.

A clipping file has recently been started which in a short time will be of value to agricultural students for reference in writing papers. The main source of material for this file comes from the periodicals not listed in the Agricultural Index, and which are not kept permanently on file. This file at present contains articles by prominent workers along agricultural lines. There may be mentioned also the clipping file of items pertaining to matters relating to the Experiment Station.

During the past year there has been a minimum amount of borrowing from the library of the Department of Agriculture, Washington; also a minimum amount of correspondence with persons wishing bibliographical aid and material on various agricultural subjects.

REPORTS OF DEPARTMENT HEADS.

Reports from the several department heads are given in the following pages. These reports are necessarily brief and deal only with the more important phases of the work for the past year.

AGRONOMY.

By George Roberts.

The work of the Department of Agronomy for the calendar year 1918, consisted chiefly in a continuation of projects in effect last year, upon which a rather full report was published in the annual report for 1917.

Soil Experiment Fields. The work on the soil experiment fields located in various parts of the State has been continued and the results are in general harmony with those reported for 1917. The addition of a single year's results to the average of a number of years does not materially change the average, and for this reason the yields for 1918 are not included in this report.

Taylor County completed arrangements for deeding to the University some 23 acres of land for the purpose of establishing a permanent soil experiment field similar to those already in operation in other parts of the State. This field represents the Waverly Area, a large and important soil area of the State. The establishment of this field is in pursuance of the policy of placing a soil experiment field upon each of the important soil areas of the State. Only two of the larger areas are now without such fields, the Chester sandstone area, which surrounds the Western Coal Measures, and the eastern part of the Eastern Coal Measures.

The tobacco results on the Greenville experiment field are of particular interest at this time. Tobacco is grown in a three-year rotation with wheat (first two years potatoes were grown) and clover. The average yields per acre of 5 crops of tobacco, 2 crops of wheat and 4 crops of clover are as follows:

Tobacco:

	Yield	Value	Wheat bu.	Clover lbs.
Untreated soil	456	$ 31.55	7.7	598
Limestone and acid phosphate	1119	107.60	23.2	4313
Limestone, acid phosphate, nitrate of soda	1047	92.47	28.2	4040
Limestone, acid phosphate, nitrate of soda, potash	1108	101.82	22.7	4228
Acid phosphate, nitrate of soda, potash.	1209	117.69	25.9	3395

Limestone is used at the rate of two tons per acre, per rotation; acid phosphate, 600 lbs. per acre, per rotation, and sulfate of potash, 150 lbs. per acre, per rotation, all applied to the tobacco crop, the other crops receiving the residual effect of the treatments. Nitrate of soda is used at the rate of 100 lbs. per acre on tobacco and wheat.

Reference was made in the 1917 annual report to a demonstration in growing sweet clover at the Berea experiment field, which is a very wet soil with a high lime requirement. It was stated that this soil was limed and treated with phosphate and seeded to sweet clover in the spring of 1916. The sweet clover was harvested in 1917 for seed and produced 278 lbs. per acre of marketable seed, in the hull, worth about $50. The sweet clover straw was spread on the ground and plowed under in the fall. The ground was planted to corn in 1918 and, altho the season was dry, the corn yielded 40 bushels per acre against 20 bushels per acre on the untreated soil on which sweet clover would not grow.

There is a large area of similar land at the base of the knobs surrounding the Bluegrass region which could be made productive by similar treatment.

Soil Surveys.—The field work in the soil survey of Logan county was almost completed during the year and the field

work on the survey of Muhlenberg county was about two-fifths finished.

Cultivation Experiments on Corn.—Reference was made in the annual report for 1917 to cultivation experiments on corn. Below is an average of the yields for the various methods of cultivation, for a period of 8 years:

Method of Cultivation.	Yield per Acre.
No cultivation, weeds scraped	52.0 bus.
Shallow 3 to 4 times	54.5 bus.
Deep, 3 to 4 times	54.3 bus.
Shallow 7 to 8 times	54.6 bus.
Deep 7 to 8 times	55.2 bus.

It will be noted that there is practically no variation in the yield from the different methods of cultivation, and that where the weeds are scraped without disturbing the soil appreciably the yield is only 3.2 bushels lower than the best yield. This difference is due chiefly to two or three years when dry weather set in about the time corn was coming up, and continued for some time. It appears that if the corn gets a fair start before dry weather begins, cultivation has little effect in conserving moisture, for the reason that the plant roots have occupied the ground and take up the moisture as fast as it rises from the subsoil, thus preventing its escape from the surface. However, if weeds are allowed to grow in the corn they take out moisture and plant food at the expense of the corn, as well as injuring it in other ways. Hence it would appear that the chief effect of cultivation is to destroy weeds and that form of cultivation is most effective which most effectively controls weeds, and that it is not profitable to cultivate corn frequently and deep when there is no necessity for doing so to destroy weeds.

In these experiments weeds were kept cut in all the methods of cultivation in order to get the effect of cultivation.

The shallow cultivation was about 2 inches deep and the deep cultivation was about 4 inches deep. No attempt was made to cultivate excessively deep, but an attempt was made

to cultivate about the depth that farmers usually call deep cultivation.

These statements should not be construed as advising no cultivation, but as advising the form of cultivation which will most effectively control weeds. Ground that cracks badly on drying should probably be cultivated frequently, altho weeds may not appear. Shallow cultivation should be done with an implement with a large number of teeth so as to thoroly break up all the surface.

Combined Plantings of Corn and Soy Beans.

All of the field crop experiments reported in the last annual report have been continued. One new project added since the last report is giving some interesting results of much practical importance. It consists of planting soy beans in different ways with corn, in comparison with corn alone and beans alone. The results of this year indicate that when the beans are drilled in the rows with the corn, or in alternate rows, the total value of the grain obtained is less than that obtained from either crop planted alone. A hill of beans planted with the hill of corn or between hills reduced the yield of corn but little, however, and the total value of the grain obtained was greater than that obtained from corn alone. It would therefore seem to be a desirable practis. The yield of beans, in this case, was 4.3 bushels per acre and that of the corn 34.9 bushels. The season was drier than normal and the average for a number of years may be different. This mixture makes practically a balanced ration for hogs.

Nitrogen Fertilization of Wheat.

Results obtained at this Experiment Station gave rise to the belief that nitrogen applied to the wheat crop at seeding time is without effect. For 3 years tests have been made in which nitrogen was applied in the fall and in the spring. The average yield of unfertilized wheat has been 21.7 bushels per acre; fertilized at seeding time with nitrate of soda, 20.3 bushels per

acre; fertilized in the spring with nitrate of soda, 24.3 bushels per acre. The wheat all lodged badly one year. Leaving out this year, the spring application gave an increase of 7.3 bushels per acre, while fall application gave no increase.

No phosphorous or potassium fertilizers were used in the above tests for the reason that many experiments have shown that these elements are not limiting factors in the soils of the Experiment Station farm.

Seeding Tests with Different Width Drill Rows.

For some time claims of superiority have been made for the 4-inch wheat drill over the wider rows.

In 1916 a test was conducted with 4 rates of seeding, varying from 4 to 8 pecks per acre, each rate repeated 3 times, giving 12 tests with a 4-inch drill and the same number with an 8-inch drill. The average for the 4-inch drill was 26.4 bushels per acre and for the 8-inch drill 27.8 bushels per acre. In 1918 duplicate tests with each drill were made at the rate of 6 pecks per acre. The average for the 4-inch drill was 37.1 bushels per acre and for the 8-inch drill 37.1 bushels per acre.

Wheat-Breeding Experiments.

For some time pure-line selections have been made from Jersey Fultz wheat, a variety that has led in a long-time variety test. A strain has been produced which has given an increase of 3 bushels per acre, as compared with the original from which it came, the average yields for 4 years being 38.2 bushels and 35.2 bushels per acre respectively.

The introduction of such a strain would mean much to the wheat growers of the State. However, no satisfactory method has yet been devised for introducing better varieties of crops. It is very difficult to find a farmer who is willing to take the pains necessary to keep varieties pure. Some of the best farmers we can select will call upon us within two or three years to give them another start in pure varieties. Farm-

ers want pure varieties, but want the Experiment Station to keep up the supply of pure seed, which is obviously impossible.

Nitrogen Fertilization of Hemp.

For three years tests have been made with nitrate of soda fertilization of hemp. The average yield of fiber from untreated hemp has been 939 lbs. per acre, whereas from hemp treated with 100 to 150 lbs. of nitrate of soda per acre the yield of fiber has been 1,300 lbs. per acre.

The hemp was grown for three years in succession on land which was infested with wild onions. Apparently the onions are nearly eradicated, as only a few are showing after the third year. One object of the experiment was to determine whether hemp would choke out the onions.

Tobacco Rotation Experiments.

We now have four years' results from the rotation experiments with white Burley tobacco, and some interesting facts have become apparent in this time. On the continous tobacco plots and the two-year rotation plots of sorghum and tobacco the soil has become so thoroly infested with root-rot that the ordinary strains of Burley tobacco cannot be grown, regardless of the large amounts of manure used. As a matter of fact, the manure undoubtedly aggravates the damage from the disease. In 1917 and 1918 these plots were planted in part with a resistant strain of Burley which proved immune to root-rot and a very good growth was made by this strain, tho the quality of leaf was only medium. It is evident, however, that the ordinary strains of white Burley cannot be grown continuously or even in very short rotations, regardless of the treatment given the soil. The Experiment Station is attempting to produce resistant strains of white Burley that will give as good quality leaf as the ordinary strains.

In the four-year rotations root-rot has been present but has not affected the tobacco to a serious extent. The best quality leaf and best yield have been produced after grass sod. Ma-

nure used on grass sod has not seemed to reduce the quality of leaf appreciably. Leaf of fair quality has been produced following corn in the corn-tobacco-wheat and clover rotation and in the alfalfa-corn-tobacco rotation.

In three-year rotations good leaf has been obtained in the three-year rotation of red-top two years and tobacco one year. A poor yield and poor quality of leaf has been secured where soy beans have been grown in the three-year rotations. For some reason soy beans encourage the prevalence of root-rot. The same thing seems to be true of cowpeas, to a less extent, however.

Effect of Initial Moisture Content on Subsequent Moisture Movement in Soil.

The amount of initial moisture present is usually given in the literature on soil moisture as one of the factors affecting movement of moisture in soil, up to a certain point movement increasing with increasing amounts of initial moisture. This has a bearing on the fundamental conceptions as to the mechanics of moisture movement, and on such practical points as the extent to which laboratory data on moisture movement in previously dry soil are applicable to field conditions and the relation between a dry condition of loose earth mulches and their proper functioning.

Experimental work along this line has been limited. Work often referred to by Briggs shows movement in wet sand to be 4½ times as great as in dry sand. The limited amount of work with soils has given conflicting results. An objectionable feature in this work has been the different structural conditions brought about in the soil tubes by filling with soil of the different initial moisture contents.

The experimental work under progress in this laboratory deals both with movement in dry vs. wet sand and in soils of different initial moisure contents. Especially designed tubes, with a removable section their entire length, are being used

for the soil, making possible the filling of all the tubes with soil of the same moisture content and subsequently drying out some of them, to secure the different initial moisture contents desired.

The work has not proceeded far enough to permit definite conclusions, but work with sand has shown movement to be only 1.3 to 1.7 times as great when wet as when dry, and work with soils has shown but very little greater movement in soil containing a small amount of initial free moisture than in soil previously air dry. In a practical way this means that the soil mulches save moisture only to the extent that they are looser than unmulched soil and irrespective of their condition of dryness.

ANIMAL HUSBANDRY I.

By E. S. Good.

The experimental work of the department for the calendar year was carried on along five different lines, namely:

1. A continuation of investigations pertaining to prophylaxis in infectious abortion in cows.
2. A continuation of investigations relative to a preventive or cure for infectious abortion in mares.
3. A continuation of steer feeding experiments.
4. A continuation of breeding experiments with regard to improving native mountain sheep by use of pure-bred bucks of the Hampshire and Southdown breeds.
5. Experimental feeding of hogs, both in the dry lot and on forage crops.

Our work with infectious abortion in cows has been along the line of endeavoring to produce immunity by subcutaneous injections of live cultures of the organism (Bacillus abortus) causing the disease in that animal. Little headway has been made in the use of bacterins for controlling this disease, and we are now turning our attention to the injection of live cultures. Heifers have been purchased by the Experiment Station to be used in connection with this work.

We have done considerable work during the year in diagnosing the disease of infectious abortion among mares. Our results to date show quite conclusively that mares can be immunized against this disease and that at very little cost. We are now producing a serum to be used in connection with the bacterin in studs in which the disease already exists. The Department of Veterinary Science is now co-operating with this department in the work.

During the year we concluded our third consecutive test in determining the relative rapidity and economy of gains in the finishing of two-year-old steers kept closely confined, as

compared with a similar lot of steers allowed the same kind of enclosure and the run of a 20-acre pasture, both lots receiving the same feed. The result each year was in favor of the steers kept in the barn, they making, on the average, .14 lb. greater gain per steer per day than those running out. The gains were made at 89c per cwt. cheaper. Taking into consideration the rating given by experts, the cattle kept confined produced an average greater profit of $9.34 per head than did those allowed range. The manure produced in these two systems of feeding was much in favor of keeping the cattle confined, for an average of over 65 per cent. more manure was made from the steers kept in the barn over those running out. This system of feeding is especially applicable to the western part of the State where more fertilizing constituents are needed for the land than in the central part. Then, too, in western Kentucky grass is not used to the extent that it is in the central region.

Our work in establishing a better grade of sheep for the mountain districts by crossing the mountain ewes with bucks of the improved mutton breeds has shown good results in producing a sheep which shears, on the average, three pounds more wool per head and of a much better mutton conformation.

We continued our experiment this year in the hogging down of soy beans with a full feed of corn; the hogging down of soy beans with an allowance of 2½ per cent. of the body weight of the hogs in corn per day; the hogging down of corn check-rowed with soy beans drilled in the rows one way; and in the hogging down of corn alone. In this experiment the most money was made per acre by the system of hogging down the corn check-rowed and the soy beans planted in the rows one way.

A test was conducted to determine the value of garbage obtained from a cantonment in the feeding of hogs. The average weight of the hogs used in this test at the beginning was 110 lbs. In the first test, the lot which received only garbage

produced an average daily gain of 1.38 lbs., and, figuring the pork produced at $16.50 per cwt., the garbage fed was worth $48.40 a ton. A similar lot of hogs receiving garbage was given in addition a daily feed of 2 per cent. of body weight in corn meal. This lot made a gain of 1.62 lbs. daily. Charging against this lot the corn eaten and crediting the pork produced, the garbage as fed by this method was worth $49.40 a ton. Another lot of hogs fed garbage and 2 per cent. of body weight of a mixture of corn meal 9 parts and tankage 1 part, made an average daily gain of 1.37 lbs. Charging this lot with the corn meal and tankage eaten, the garbage by this system of feeding was worth $50.20 a ton. During the time, however, these different lots were fed the garbage was somewhat limited, the hogs not getting all that they would eat. Had they received all they would have eaten, we believe the results would have been in favor of the lot receiving garbage only. As it is, the difference in profit is so small that it did not pay to supplement the garbage.

A second experiment in determining the value of garbage in pork production was conducted with hogs averaging 160 lbs. at the beginning. This test was run but 20 days when the cantonment closed. In the meantime, however, the hogs were fed all the garbage they would eat. There were 10 hogs in each lot. Lot 1, receiving garbage alone, made 430 lbs. of pork on 3,690 lbs. of garbage. Lot 2, fed garbage and 2 per cent. of the body weight of the hogs of a mixture of corn meal 8 parts and soy bean meal 1 part, made a gain of 335 lbs. of pork on 2,670 lbs. of garbage, 572 lbs. of corn meal and 71.5 lbs. of soy beans. Lot 3, fed garbage and 2 per cent. of the weight of the animals in corn meal per day, made a gain of 350 lbs. of pork on 3,120 lbs. of garbage and 650 lbs. of corn meal. The average daily gain per hog of the different lots was as follows: Lot 1, 2.15 lbs.; lot 2, 1.675 lbs.; lot 3, 1.75 lbs. This experiment, again, showed that it did not pay to supplement the garbage with other feed stuffs. Valuing the pork produced at $16.50 per cwt., the garbage fed lot 1 was worth

$38.45 per ton. It should be stated in connection with both of these tests that the garbage used was very much better than that obtained in cities—it contained a large amount of refuse potatoes, bread, meat and beans.

During the past summer the Department of Chemistry has co-operated with this department in determining the amino-acid distribution in the protein of young forage crops used in our experiments with pigs; also in experiments in determining the value of ash in connection with feeds deficient in ash, in the feeding of pigs.

There has been added to the department an abattoir with a cold storage equipment which will be used in connection with the study of meats derived from different grades of animals as well as animals fed different rations.

Specimens of pure-breed beef animals were introduced at the Experiment Station during the year. So far, six specimens of the Hereford breed and one of the Shorthorn breed have been purchased. Other animals of the Shorthorn breed will be purchased in the near future.

ANIMAL HUSBANDRY II.

By J. J. Hooper.

The activities of this department during the calendar year 1918 have covered a wide field of effort, comprising—

Study of Jersey Coat Colors.—The color markings of 1,145 calves and of their 2,290 sires and dams have been tabulated to determine the inheritance of color markings among Jersey cattle. From these data it is apparent that solid color of coat or body is dominant over broken color; and also that a black tongue and black switch are dominant to white tongues and switches. In this work body, tongue and switch color were studied as separate units. Two hundred and nine matings of broken-colored bulls on broken-colored cows gave 194 broken-colored calves and 15 which were solid in color; but seven of the 15 had either a white or mottled tongue or switch.

Four hundred and thirty-six matings of solid-colored cows and broken-colored bulls produced 257 solid-colored calves and 179 broken-colored ones. Five hundred matings of solid-colored cows and bulls produced 425 solid-colored and 75 broken-colored calves. Certain sires semed to be pure dominant for solid color, one producing 84 calves that were all solid-colored with the exception of two that had white specks on the flanks and a white ring around the tail. In studying the inheritance of tongue color, it was found that mating white-tongued parents produced 71 per cent. of white-tongued calves, while the mating of parents that had white switches produced calves that had white switches in 91 per cent. of the cases. A tabulation of body, tongue and switch color of 1,000 Jersey cattle showed that 660 of them were solid in color and had black tongues and black switches; 120 were broken in color and had white tongues and switches. The other 220 varied widely from the above markings, which are supposed by many to be

the only two color patterns of the breed. While the solid color correlates strongly with black tongue and black switch yet the correlation is not 100 per cent, as commonly supposed, because only 89 solid-colored Jerseys out of a hundred have the customary black tongue and switch, while the other 21 per cent. have mottled or white-tongues and switches. Only 71 per cent. of broken-colored Jerseys have white tongues and only 63 per cent. of them have white switches. Probably this is the first time that the typical color markings of the breed have been presented in definite figures.

In a study of the color markings of calves at the Experiment Station farm, it has been found that the color markings may change slightly as the calf grows. Specks of white on a calf a week old may become white spots the size of a dollar at six months old. A mixed switch at birth may later become lighter or darker. Calves should not be registered until they are six months old, for the above reason, as color markings must be given at time of registry. Up to 1900 the hue of the coat color was given in registering Jerseys but since then they have been registered only as broken or solid in color. This precludes the possibility of gaining data from the herd books with which to study dominance of black over fawn color, etc. The practis of giving coat color should again be revived. Thru data gained from herd books published previous to 1900 it was found, in this study, that roan and gray color among Jerseys, which used to obtain in the breed, was dominant, and appeared in many herds for a long time but when once lost it was lost forever, and it has not reappeared in the herds from which it disappeared, and it will never come back into such herds.

Register of Merit Testing.—Twenty-six Jersey cows and seven Holsteins have been tested for the Register of Merit during the past year. A cow owned by this Experiment Station, named Hebron's Tera B, 348973, is champion junior two-year-old of the State, with a record of 8,759.6 pounds of milk and 425.67 pounds of fat. Almost every cow in this herd now has an official record.

The cows tested for the Register of Merit during the year are as follows:

Jerseys	No. of Cows	Owner
	1	Charles Bright, Eminence, Ky.
	13	R. J. Shipman, Shelbyville, Ky.
	9	Allen Dale Farms, Shelbyville, Ky.
	1	P. L. Atherton, Louisville, Ky.
	2	Agricultural Experiment Station, Lexington, Ky.

Holsteins	No. of Cows	Owner
	4	Joe Lindsey, Winchester, Ky.
	3	Agricultural Experiment Station, Lexington, Ky.

Sorghum Cane as Feed for Cows.—An experiment with four dairy cows to determine the effect of feeding sorghum cane and sorghum tops for a period of four weeks failed to show any detrimental effect on milk yield, altho many people believe sorghum cane will cause milk cows to dry up. Twenty-five pounds of cane and four pounds of heads were fed to each cow, per day, with no appreciable effect on the amount of milk yield.

Sterility in Animals.—Investigations in regard to sterility found occasionally in valuable breeding stock are being made by Prof. W. S. Anderson. Also a study of the heredity of valuable characteristics in improved breeds of stock is under way.

Horse Improvement.—This department has charge of eleven fine thoroughbred stallions that were presented by the Kentucky State Racing Commission in 1915. These stallions have been placed in hilly sections of the State, where they are doing fine service in improving the light horse stock used in such sections. The commission appropriates freely for colt shows each fall, and then the colts are brought together in friendly rivalry between the owners.

Source of Protein for Hens.—An experiment embracing 100 laying hens, divided into four pens, and supplied (a) buttermilk, (b) meat meal, (c) meat meal and shorts, and (d) cottonseed meal, has shown conclusively that the sources of protein stand in value as listed above from a to d.

Type of Poultry Houses for Kentucky.—A study is under way to find what type of house is best adapted to Kentucky conditions. Last winter twenty healthy, vigorous Wyandotte pullets wintered well in the top-heavy, slatted, balloon-shaped poultry house so often found on farms in this locality. No doubt this result was exceptional, but this investigation seems destined to bring to light many ideas not heretofore appreciated in poultry-house architecture. Especially does this work emphasize the advantage of pure-bred fowls, of egg laying capacity, and of cleanliness about the poultry house.

Experiments With Poultry that are being continued relate to (1) the effect of artificial lighting of poultry houses; (2) the proper amount of beef scrap to use in a ration for laying hens, and (3) the effect of exercising in a straw litter, as compared to no exercise for hens in the winter season. Numerous pullets and hens at the poultry yards have produced from 200 to 239 eggs in a year, and such hens are used for foundation stock.

CHEMISTRY

By A. M. Peter.

The following is a short report covering the activities of the Chemistry Department during the calendar year 1918.

Bacteria and Soil Silicates.—The chemical work continued during only about a third of the year because of Dr. Blumenthal's departure in March to enlist in the Chemical Warfare Service. Mr. Shedd finished the experiments which Dr. Blumenthal had in progress at that time. Dr. Healy continued certain bacteriological work connected with this project, making counts of the number of microbes occurring in our bluegrass soil, under various crop conditions, and isolating and identifying many of these organisms.

Sulfur in Plants and Soils.—Mr. Shedd has completed two series of experiments in composting sulfur with soil, phosphate rock and manure, using soil from the Experiment Station farm. The second series, begun early in January, was carried out according to a plan approved by the research branch of the Council of National Defense. The results showed that nearly three-fourths of the phosphate added, or already present in the soil, were finally rendered soluble in ammonium citrate solution, tho the action was slow in beginning and did not progress properly until after the addition of a "starter" containing sulfofying organisms. It is evident, from these experiments, that this is a practical method for producing acid phosphate on the farm, tho the product would be of much lower grade than the commercial article. Laboratory experiments with eight Kentucky soils of different types showed that sulfur added at the rate of 500 parts to the million of soil was nearly all converted into sulfate in a month and there was little difference in the sulfofying power of the several soils, none of them exceeding the Experiment Station farm soil in this property. In connection with this work, Mr. Shedd has made, from time to time, a large num-

ber of determinations of water-soluble, citrate-soluble and total phosphorus, nitrate and nitrite nitrogen, sulfate sulfur, acidity and moisture, upon these experimental composts, the results of which are very interesting. A report of progress upon these experiments has been made to Dr. J. G. Lipman, for the Research Council. Dr. Healy has begun a study of the bacterial flora of the sulfur composts.

Translocation of Mineral Matter in Plants.—Dr. Buckner has continued work on this investigation, using the jack bean, and has submitted a paper entitled "The Translocation of the Mineral Constituents of the Jack Bean," for publication in the Journal of the American Chemical Society. Material is ready for a paper on the food requirements of the isolated embryos of the jack bean. The results obtained, we think, throw further light on the part played by enzymes in the activation of seeds and the translocation of mineral material stored in the cotyledons.

Manganese in Plants.—In this investigation, Mr. McHargue has conducted a number of water-culture and sand-culture experiments and has made chemical analyses of the plants thus grown. He also examined certain fertilizer materials for manganese. The interesting observations were made that wheat does not make normal growth in the absence of manganese, and that basic slag carries a notable percentage of that element. Some of the results were embodied in a paper entitled "The Effect of Manganese on the Growth of Wheat; a Source of Manganese for Agricultural Purposes," read before the Division of Agricultural and Food Chemistry of the American Chemical Society at the September meeting in Cleveland and accepted for publication in the Journal of Industrial and Engineering Chemistry.

Metabolism in the Chicken and Other Animals.—Dr. Buckner has completed the chemical data pertaining to certain experiments with chickens, begun some time ago at the poultry farm, and has embodied the results in the following papers: "The Normal Growth of White Leghorn Chickens," published

in the American Journal of Physiology, December, 1918: "The Effect of Certain Grain Rations on the Growth of the White Leghorn Chick," submitted for publication in the Journal of Agricultural Research; and "The Effect of Certain Grain Rations on the Growth of White Leghorn Chicks and its Influence on Subsequent Egg Production," submitted for publication as a bulletin of the Experiment Station. The experimental work and chemical analyses have been completed for a paper on "The Mineral Metabolism of the Laying Hen and the Influence Causing Variation in the Mineral Constituents of the Eggs" which is in course of preparation. Considerable time has been spent by Dr. Buckner in studying the habits and normal growth of the particular stock of rats to be used in our metabolism experiments and the conditions most satisfactory for breeding and raising them. The minimum quantities of proteins, fats and carbohydrates necessary for their normal growth are being determined.

The Deterioration of Stored Corn Meal and Corn.—Work on this investigation was begun by Mr. McHargue, July 15th, 1918, and some 22 different portions of corn meal and grain have been under observation in the laboratory, subjected to different conditions of moisture, temperature, etc., and tested at stated intervals as to acidity, enzymic action, development of bacteria and molds, etc. A preliminary study by Dr. Healy has shown that the number of microbes in the meal carefully prepared from some of the lot of corn provided for this investigation is small, 25 or 30 per gram, and that these do not readily multiply at room temperature in meal of normal moisture-content.

Determination of Protein in Cottonseed Meal.—Certain discrepancies in analyses of this material led to a study of this subject and resulted in the publication in the Journal of Industrial and Enginering Chemistry, July, 1918, of a paper entitled "Uniform Nitrogen Determination in Cottonseed Meal," by J. S. McHargue.

Agricultural Limestones.—Partial analyses were made by Messrs. Iler and Averitt of 260 samples of limestone and other calcareous materials, sent in by farmers and county agents, from 46 counties, to determine their suitability for agricultural use. We now have a tabulation of some 2,200 analyses of Kentucky limestones, which would make a valuable reference publication.

Soils.—Quantitative analyses of 70 samples of soil, from 16 counties, have been made by Mr. Averitt and Mr. Iler. This number includes 22 samples collected by Mr. Averitt in the co-operative survey of Logan County. Comparative qualitative tests for phosphorus, acidity and calcium carbonate have been made upon 141 samples of soil sent in by farmers and county agents, from 44 counties. These tests give practical indications as to the need for using limestone and phosphatic fertilizers.

Soil Surveys.—Our part of the joint report for the co-operative survey of Shelby County was finished early in the year. We were notified in July by the Bureau of Soils that the manuscript was in the hands of the public printer and we placed an order for 2,000 copies for this Experiment Station. Nothing farther has been heard from this report, however, probably on account of the press of work incident to war conditions. Mr. Averitt was in the field in Logan County for about three months and the field work was nearly finished, but its completion was prevented by an attack of influenza which disabled the whole field party. At least two weeks of field work will be required to finish this survey.

Calcium Content of Soils.—Mr. Shedd has made a large number of calcium determinations in samples of soil from different parts of the State, one object being to compare soils where alfalfa and sweet clover thrive with nearby soils where these crops do not succeed, and virgin soils with cultivated soils. The Extension Division co-operated in this investigation by allowing county agents to collect the desired samples. The general conclusion, so far, is that there is more calcium in the soils where alfalfa and sweet clover thrive, than in the oth-

ers, and a larger proportion of it is soluble in carbonated water. In the greenhouse, 126 pots have been started with soil of 6 different types, all relatively low in calcium, in which soy beans have been planted, the object being to discover, if possible, whether calcium is the limiting element for crop production on these soils, and to compare the effects of different compounds of calcium.

Barium in Plants and Soils.—Mr. McHargue finished a number of water-culture experiments with barium and strontium compounds and made chemical analyses of the plants grown in these experiments. This investigation was discontinued July 1st. The results have been brought together in a paper entitled "The Effect of some Barium and Strontium Compounds on the Growth of Plants," submitted to the Journal of Agricultural Research for publication. The interesting observations were made that barium sulfate, an almost insoluble compound, is toxic to the plants tried; that certain more soluble compounds of barium have a stimulating effect, in high dilutions, tho they, too, are toxic when more concentrated, and that soluble strontium compounds have a similar action, tho are less toxic. The wide distribution of barium in plants and soils, the peculiar behavior of the sulfate as compared with more soluble compounds and the stimulating action of small quantities of barium salts, as brought out by this work, are remarkable facts which suggest that possibly barium may perform some function in the plant economy which is not yet understood.

Hog Cholera.—Dr. Healy has made some very interesting experiments which suggest that large doses of arsenious oxid may be curative in acute hog cholera and that salicylic acid may effect a cure for the chronic form of this disease. A paper entitled "Salicylic Acid as a Remedy for Chronic Hog Cholera," giving an account of the work with salicylic acid, will appear in the February number of the Journal of the American Veterinary Medical Association.

Abnormal Flavors of Milk.—Three samples of milk presenting abnormal flavors were studied by Dr. Healy, who isolated from them and identified two microbes causing such flavors. Dr. Buckner made a chemical examination of these samples.

Supplementary Rations for Hogs.—Mr. McHargue has co-operated with the Animal Husbandry Department by suggesting and preparing certain mixtures of mineral compounds to be fed to hogs with a grain ration, for the purpose of supplying certain mineral substances which it was thought the grains did not supply in sufficient quantity. He has also prepared samples for analysis of the grain rations fed. The results, so far, show a marked benefit from this addition, as indicated by increased growth of the hogs receiving the minerals.

Department of Geology.—Under a co-operative arrangement, 10 clays, 4 coals, a fluorspar, a glass sand and a mineral water were analyzed by Messrs. Iler and Averitt for the State Department of Geology and Forestry.

Spoiled Corn.—Mr. McHargue has done considerable analytical work on four samples of corn of the crop of 1917, grown at the Experiment Station farm, the purpose being to get data on the relative food value of the damaged corn of that crop, as compared with sound corn. Some change was noted in the amino-acid make-up of the proteins, but the greatest changes were in acidity and the rancidity of the fat. The results obtained are sufficiently interesting for a short paper.

Miscellaneous Analyses.—Messrs. Iler, Averitt and Peter have analyzed 28 mineral waters, from 23 counties; 22 coals, 9 nitre earths, 7 fluorspars and 27 miscellaneous samples, including 2 for poisoning of live stock; besides which, 187 samples of minerals, ores and other materials have been examined and reported upon, without formal analysis. Messrs. Peter and Iler have analyzed for the Department of Horticulture 25 samples of green corn to determine their sugar content.

Dr. Buckner has co-operated with the U. S. Department of Justice in the analysis of about 45 samples of materials sup-

posed to have been tampered with by German agents. He has examined about 50 miscellaneous samples, including whisky, brandy, mother's milk, blood, calculi, urine, etc., and also examined the food samples during Mr. LaBach's absence of about a month, last summer.

During July and August Dr. Healy made bacteriological examination of the Lexington city water for the information of military authorities. During the same months he made daily bacterial counts of the milk from the Experiment Station dairy.

ENTOMOLOGY AND BOTANY.

By H. Garman.

The work of the department has been carried forward this year under disadvantages incident to the war and the consequent difficulty of getting assistance suitable for the duties required. This has made it necessary for some of the staff to devote part of their time to work with which they are not ordinarily engaged.

The study of the corn ear-worm has been continued, and material secured for a comparison of the insect with the true bud worm of tobacco, with which the corn ear-worm is sometimes confused when working on tobacco. The two insects are alike in their injury to this crop and much alike in color and structure, but it is believed they can be distinguished by characters obtained by a comparison and which are embodied in a manuscript prepared during the summer and fall. The study of the ear-worm has been extended to other American representatives of the genus Chloridea, a group of flower and seed-eating insects, of which, however, the two to which chief attention has been given are of the most economic importance in the United States.

The work with nodule bacteria has been prosecuted this year with special reference to learning structural differences between the species and to isolating the organism present in nodules on several non-leguminous plants which we now have under observation. During the year 1,054 tests have been made of plants grown in test tubes of agar. The difficulty of growing some of these plants from seeds and under controlled conditions such as we have found satisfactory for many Leguminosae has hindered the work, tho we hope that these difficulties may yet be overcome. We are satisfied that no organism of the same group as those living in nodules of leguminous plants is present in the nodules of Ceanothus. A fungus,

present on the roots of the latter, has been isolated and may prove to have something to do with producing the nodules.

Some observations on commercial cultures which we find are mixtures of bacteria and other organisms, have suggested the possibility that an association of organisms may give better results in producing nodules by artificial means than absolutely pure cultures; in other words, that a sort of symbiosis is necessary rather than a single nodule-producing organism. Some tests made with what seemed to be absolutely pure cultures have appeared to bear out the idea, but this feature of the subject is still being given attention and has not been looked into far enough to justify more than the suggestion made above. Tests have gone far enough, however, to show conclusively that mixtures of organisms containing the Pseudomonas of Leguminosae produce organisms very freely and are at least as good for commercial purposes as pure cultures.

Work with the black locust borer was done largely while I was engaged in inspecting Kentucky nurseries during July and August, the object being, in part, to determine the distribution of the species of goldenrod in the state and the ones upon which the adult beetle is dependent, or chiefly dependent, for food. A good deal of material was collected during this time that has not yet been fully studied and will have to be compared with the named series in the United States National Herbarium. The work indicates that the borer is practically dependent on one or two species of Solidago, as announced in my publication on the subject (Kentucky Station Bulletin No. 200).

The study we are making of the hothouse white fly **(Aleyrodes vaporariorum)** is now being prosecuted in the insectary, the main object at present being to learn if any treatment can be devised that will kill all stages of the pest and at the same time not damage the plants upon which it closely adheres in the egg and larva stages. The adults have proved more easily destroyed. The life history of the pest has been quite fully worked out.

During the past summer Mr. Jewett devoted a good deal of time to the southern tobacco worm, with the object of learning more exactly the life periods. It was kept under observation in the insectary and also in the field. The history for the season was not very different from that of previous seasons during which this pest has been given attention. The last adult from pupae carried thru the winter in soil came out July 24, not as late as in 1917. The worms have, for some unexplained reason, not been as common as usual, and in some sections of the state but little injury was done by them. The maximum numbers appeared this year about August 10, two weeks earlier than in 1916, when the greatest numbers were observed August 25. This fact illustrates the importance of following the life-histories of our injurious species more than one season and at more than one latitude. It has sometimes been suggested by shortsighted persons, when a subject of this sort was proposed, that the same insect was being studied by some one else, the intimation being that if another person took up the same subject he would duplicate this work. It might be so in a mathematical study or in an attempt to solve some mechanical problem. It is not necessarily so in biological studies such as I have outlined as part of the work of this department. A life history in Maine is a very different matter from one in Kentucky or Alabama. Even habits may change with a wide range of latitude. An interesting feature of tobacco worm injury was noted this year in the presence of an exceptional number of northern tobacco worms among the others in our tobacco fields. This is practically the only tobacco worm of Connecticut Valley tobacco fields. Its life history here, as far as followed, is about the same as that of the southern species.

We are still working on the fall history of the Hessian fly, now rather scarce because of the general disposition to sow wheat late. Material collected in the southern part of the state this fall shows no indication that the adults had come out for a second brood before cold weather, but this will probably prove not to be the case if the insect becomes more common,

and growers fall back into the habit of September sowing. Adults constantly emerge in the fall at the Experiment Station from flax seeds brought in from wheat fields, and a few have come out here this year. There would thus appear to be no good reason why with warm fall weather they should not come forth and yield a second brood in the fields. Thus far we have not succeeded in obtaining convincing evidence that they do this in large numbers out-of-doors. We are keeping flax seeds thru the winter to determine the time at which the adult comes forth in the spring.

In an effort to get light on the possibility of treating seeds with chemicals and fertilizers so as to stimulate and encourage the growth of young plants, four hundred and twenty pot tests in the conservatory and sixty row tests out-of-doors were made during the summer, and the growth of the plants observed subsequently for the effects. It cannot be stated that any of the treatments gave promise of being effective, the check plants giving about as good growth, on an average, as the others. The excessively hot, dry weather during which the tests were made was unfavorable to satisfactory tests, and they are now being repeated as rapidly as possible in the conservatory, where all available space is occupied with a second lot of pot tests under what is hoped to be more favorable conditions.

A repetition of tests started in the fall of 1916 to learn what, if any, injurious effect is exerted by formalin on seed wheat when the latter is treated for stinking smut, has been thought desirable, and fifty-six rows embracing twenty-eight separate tests, were planted out of doors in October. Seventy-six rows on a bench in the cold section of our conservatory were planted, with the same object in view. The results of the original tests were published as Experiment Station Circular No. 22.

In addition to his work in seed testing Mr. Vaughn has given a good deal of time during the past summer to work with certain selected soy beans and other plants, which we hope to bring to a conclusion by the publication of results of a good

many years' work. We are now working over some of our figures.

When our state seed law was enacted in 1916 I designed some sets of the weed seeds designated as especially noxious, for distribution to seedsmen, with a view to acquainting them with these impurities of their stock and thus enabling them to comply with the law more intelligently. The demand for these sets was such as to make it worth while to prepare others and this has been done, largely by Miss Hathaway, as her other work in testing seeds for germination permitted. We have thus accumulated material for about fifty additional sets, each including forty-eight weed species, and expect to send some of these to high schools in the state where agriculture is being taught.

The sending out of cultures of nodule bacteria from the department was discontinued February 15, 1918, but between January 1, 1918, and that date the following were distributed to applicants:

Soy bean cultures	2
Alfalfa cultures	3
Red clover cultures	20
Sweet clover cultures	164
Total	189

Nursery inspection has been looked after almost entirely by the head of the department this year, owing to the withdrawal of an assistant when the work was about to begin. It was found that some of the small lots of trees grown for local sale had been sold or given up, owing to the lack of demand for trees— a result of war conditions—and the number of certificates issued is only twenty-seven, tho the total number of trees examined was greater than in 1917. The following figures will give an idea of the quantity of stock examined:

Shade and forest trees	579,352
Fruit trees	465,239
Ornamentals	592,236
Misc. (strawberries, etc.)	1,511,700
Total	3,148,527

In some cases the stock was not in a good state of tillage, owing to the general dearth of workmen. Some of the nurserymen were employing women for their lighter work, such as budding and grafting.

Importations of stock have been examined as usual, in cooperation with the Federal Horticultural Board, but have been reduced very greatly from former years, none at all being received in Kentucky during the fall of 1918. During the year eleven shipments were inspected, consisting of 104,531 trees and plants. It is expected that this work will greatly increase when conditions become normal again.

The seed inspections have been held up largely because of the war. The testing of seeds has gone forward as usual and has, I believe, greatly helped both farmers and seedsmen. In the spring of 1918 the injury suffered by seed corn in Kentucky and elsewhere from severe cold, led to an exceptional number of demands for tests of seed corn, 653 samples having at that time been tested in our laboratory.

The following is a list of the tests made from January to January:

Total number of purity tests	1,352
Total number of germination tests	4,547

Seed corn led in the number of tests called for. Red clover, bluegrass, orchard grass, redtop, timothy, sweet clover and alfalfa follow in the order named, in the number of tests made.

I have now ready for the printer manuscript with illustrations for a bulletin on the grain weevils, **Calandra granaria** and **C. oryzae,** giving results of tests with fumigants and em-

bodying the results of work done at intervals from 1899 to the present time. I have brought my notes together at the present time because of an increased interest in stored seeds and in the hope of being able to help farmers and others out of their difficulties. The grain weevils are particularly difficult to destroy and require stronger doses of fumigants, I find, than the bean weevils treated in Experiment Station Bulletin No. 213, issued in December, 1917.

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FARM MANAGEMENT.

By W. D. Nicholls.

I beg to submit herewith a brief report of the work of this department for the calendar year 1918, as follows:

Investigations in the Business Organization of Dairy Farms.—This study was undertaken to determine the most important factors for success in the organization and management of dairy farms, and consisted in a minute analysis of the business organization and the methods employed on 162 farms in Shelby, Spencer, Oldham and Hardin Counties. The results of the study are embodied in Bulletin No. 217 of the Kentucky Agricultural Experiment Station, issued in June, 1918. This bulletin shows the most profitable balance of live stock and crop enterprises, the most profitable size of dairy herds for farms of given areas, the proper distribution of capital, the proper degree of diversity, the correct degree of intensity of cultivation of crops, and the feeding of stock, and numerous other practical factors for the profitable operation of dairy farms.

Farm Management Studies of Hill Farms in Northern Kentucky.—This study was made in Kenton County, in connection with the Farm Management Demonstration Work and included a complete and detailed analysis of the business organization of 90 farms. A valuable body of data with respect to the factors for the profitable management of hill farms was brought out and published in Circular No. 21 of the Kentucky Agricultural Experiment Station.

Farm Bookkeeping.—Studies were made during the year with a view of working out a practical method of keeping simple sets of accounts on the farm. A Farm Account Book was prepared in the department and was published by the Extension Division and distributed thru county agricultural agents

to farmers who agreed to keep the accounts according to the plans outlined by the Extension Division.

Labor Distribution Studies.—Profitable farm management is dependent in large measure on the selection of the kind, number and size of crop and live stock enterprises which will permit as nearly as possible an even distribution of the labor of men and teams thruout the year. The object of this study was to show the amount and distribution of labor required by various crops and live stock, with a view to showing how these enterprises may be proportioned and dovetailed so as to avoid an overplus of work at certain periods and inadequate employment at other periods. This work was begun in Daviess County, a group of sixteen careful farmers being selected who agreed to keep daily records on the labor expended on all crop and live stock enterprises, these farmers being visited at intervals of 60 or 90 days by the project workers to insure the accuracy and continuity of the records. Mr. J. W. Whitehouse, County Agricultural Agent, has extended his active co-operation in this work. It is contemplated that this work shall be extended to several other representative agricultural areas

Investigation of the Farm Tractor as a Means of Conserving Labor.—This study is being carried on to determine to what extent the tractor may be used economically as a means of piecing out the shortage of man power and reducing the cost of horse power on Kentucky farms. There is a widespread demand on the part of Kentucky farmers for information on this question and such data are also necessary for the successful prosecution of the farm labor program, which has been placed in charge of this department. Detailed reports of the experience of approximately 300 tractor users representing every section of Kentucky have been gathered and these will be embodied in a report which will be ready for publication early in the year.

Cost of Producing Milk.—This work was begun last year in Shelby County, and was later extended to McCracken County. The results of the investigation in the latter county

were embodied in a report which was issued during November of the past year.

The Study of Farm Practis of Individual Successful Farms.—This work has been carried on for the past three years and consists in gathering complete records of notably successful farms of various types, located in different important agricultural areas of the state. In obtaining these records personal visits are made to successful farms and a careful record is made of the methods employed in the notably successful enterprises. In this way it is frequently possible to discover new and useful ideas and these are then made available for the use of other farmers.

FEEDS.

By J. D. Turner.

The following is a brief summary of the work of the Feed Department for the year ending December 31, 1918.

There is nothing especially new in the work over previous years. Most of the feeding stuffs sold within the state were of average quality, but an abnormal situation has existed in the feed markets of Kentucky, as well as in other states. It has been practically impossible to obtain some of the standard feeding stuffs during the heavy feeding season, and at times difficult to obtain any feeds at all. The demand thruout the year, with the prevailing high prices, was good, and even with the extremely high prices, the supply did not equal the demand. There was a feeling of great uncertainty thruout the country on account of the scarcity. Prices reached figures which were almost prohibitive and this caused great uneasiness among live stock farmers.

Due in a large measure to these conditions, the unscrupulous manufacturers and dealers were tempted to place inferior goods on the market at exorbitant prices. This was particularly true with highly compounded mixed feeds and oil meals.

Notwithstanding the crippled condition of our organization on account of the war, about the same lines of work have been maintained as in previous years—regulatory and educational, and all activities have been directed essentially along the same lines.

If requests for inspection of feeds and information concerning them, form any basis for judging, the law is certainly growing in favor with the purchasers, as there is hardly a mail that does not bring such requests.

In the administration and enforcement of the law, the department has realized the delicate and difficult situation which

the handlers of materials and the feed manufacturers have had to face during the year, at least, on account of the war, and has endeavored to assist them in every legitimate way possible in the conduct of their business.

At the close of the year there were 3,124 different brands of feed registered with the department, representing about 750 different firms. In addition to these firms, the department has come in touch during the year, thru its inspectors and by correspondence, with hundreds of dealers and consumers of feeding stuffs.

Our laboratory examined and reported results, both chemically and microscopically, on about 700 samples. A number of these examinations represented inspections upon which prosecutions were based. Others represented examinations which resulted in the manufacturers refunding thousands of dollars to consumers in the state on account of deficiencies in goods delivered under contract.

FERTILIZERS.

By H. E. Curtis.

I submit herewith a brief report of the work of the Fertilizer Department for the year 1918.

During the year, 727 brands of fertilizer were registered, by 41 firms. These brands were classified as follows:

Complete fertilizers	324
Bones, tankage, etc.	66
Nitrogenous superphosphates	161
Phosphates and potash	51
Acid phosphates	125

A bulletin, No. 219, covering the work for the year and containing the analyses of 326 samples collected by our inspectors or sent in by farmers, is now being prepared for publication.

There were issued during the year a total of 3,369,000 blank tags. We issued, also, stamps as follows:

100 pound size	220,300
125 pound size	1,023,072
143 pound size	20,195
167 pound size	228,188
200 pound size	328,900

In addition to the above stamps issued, the following were exchanged for old issues, without cost:

100 pound size	10,947
125 pound size	5,553
143 pound size	1,164
167 pound size	12,022
200 pound size	4,962

The sales of stamps during the year were more than $17,000.00 above the sales of the previous year, which, in turn, were larger than those of any previous year. Therefore the

increase in consumption within the last two years has been very great.

In the laboratory Mr. Owen S. Lee, who had previously enlisted for war service, was called to duty March 15th and Mr. Rodes, the only one left in the laboratory, also enlisted for service the latter part of May. During the summer vacation, from early in June until about the middle of September, Mr. J. R. Mitchell, of the Chemical Department of the University, helped with the laboratory work, and in November Mr. Harry R. Allen, who had previously assisted in the Feed Laboratory, took up the work in our department and after the signing of the armistice Mr. Rodes again took charge of the work.

The inspection work was without any of the regular force, as both Mr. Roger W. Jones and Mr. Elmer Ingram were in the service and had been for some time. Mr. E. Gano Lee, who had temporarily helped us with the inspection work during the fall of 1917, started the inspection work in the spring, but before doing much work was enlisted for war work. It was then found necessary to transfer from other departments in order to get men to do this work and Mr. W. G. Terrell, one of the inspectors in the Food Deparement, which was soon to be closed, made application for transfer to this work. Mr. P. E. Bacon, also, was transferred to the fertilizer work. Both men began work about the middle of May and are still with the department.

As regards inspectors, these men are jointly employed by the Fertilizer and Feed Departments, and Mr. Bacon also does the creamery inspection work for the Experiment Station.

HORTICULTURE.

By N. R. Elliott.

I beg to submit the following report for the Department of Horticulture, according to the records at hand. No projects were approved in horticulture until May 1st, 1918.

The Lincoln Institute demonstrational orchard was visited by Profs. Mathews and Olney, and the trees were pruned May 16th. This orchard is in good condition. There are no definite data to give out concerning it other than to state it is a young orchard of promise.

In regard to the variety orchard, started in the summer of 1913, and carried to the present time, there are no definite data to be given, other than that the trees have been replanted that were winter killed during the winter of 1917-18. The trees have been pruned and cultivation has been carried on in the orchard. This fall, tree protectors were placed around the trees to prevent winter injury from rabbits. Last spring the students did considerable work in pruning in this demonstrational orchard, under the care and direction of Prof. Olney. Later in the season spraying demonstrations were conducted in this orchard.

The work of handling the nursery planting of trees and shrubs (fruits and ornamentals), is as follows: Grafts, buds and cuttings were made and planted. Most of these were planted in the ground April 21. Records were kept showing the percentage of these that grew. This work was carried on by students in conjunction with Experiment Station employees.

According to the project entitled Grape Investigations, American and Hybrid varieties were to be used in determining vigor, hardiness and susceptibility to disease. According to the records at hand, no data were taken on this project other than a few observational notes made by Prof. Olney on the growth of these vines.

Under the strawberry project, entitled Variety Trials and Cultural Experiments, Prof. Olney made observational records showing the date of bloom, the amount of bloom, the first appearance of leaf spot, and the development of this trouble. Then accurate records were kept on the yield of the crop. The yield was practically ruined by the frost of May 2nd, so that our records for crop yield are practically valueless in respect to normal conditions. However, this much can be said, the Gibson, McAlpin and St. Louis were varieties that showed remarkable hardiness to unfavorable conditions, namely, frost and extremely hot weather.

The project on strawberry breeding, where the object was to improve varieties for Kentucky conditions, was, of necessity, conducted in the field and on account of the destructive frost of May 2nd, none of the crosses produced perfect berries.

Projects on tomato investigations were carried thru. Very careful records were kept and some valuable data compiled. At present Mr. Olney is preparing a publication (Bulletin 218) giving the results of this project. The conclusions arrived at from the data collected give us some valuable information to pass on to the farmers of Kentucky who are growing tomatoes, particularly those for the canning factories. Our experiments show that staking and pruning diminish the yield per plant and increase the earliness of ripening and size of the fruit. The yield per acre is increased because more plants can be set on an acre, when they are staked and pruned, but the expense for stakes and additional labor is so considerable that the method is only desirable under intensive conditions and would not be desirable in producing tomatoes for canning.

MARKETS.

By John R. Humphrey.

The Experiment Station projects which were instituted and partially carried out during the calendar year were the following:

1. During the early months of the year an experiment was carried out with respect to Kentucky-grown hemp fiber and investigations were made concerning the methods of marketing at terminal points. The hemp-marketing industry of Kentucky has previously been carried out thru private agencies who maintain warehouses and dressing plants, and the farmer has, therefore, been separated from the ultimate consumer and has had no other market than provided by the hemp dealers of Kentucky. An effort was made to procure the patronage of eastern mills and buyers direct to the farmer, but owing to the small quantity of hemp raised on the individual farms eastern mills were not interested in sending buyers to Kentucky. Furthermore, the mills refused to establish commercial relations with individual farmers concerning whose credit they knew nothing.

Experimental pools of growers were formed in Woodford, Mercer, Madison, Garrard, Harrison, Franklin, Shelby, Scott, Jessamine and Clark Counties for the purpose of interesting mill owners and the business of marketing the hemp was placed in the hands of an agent representing all the pools. Under this method the eastern buyers were willing to bid on the hemp provided the agent would guarantee the quality of the product. This was done and the various pools were organized in such a manner as to be capable of preparing their own hemp for market so that it might be shipped from various counties' centrals direct to market. The hemp was baled and carried a uniform tag showing the name of the agent, the pool from which it originated and a guaranteed grade of the hemp. This method

proved very satisfactory to buyers and approximately one thousand tons of hemp fiber were marketed direct from the farmers' agent to the consuming mill at a price well in advance of local quotations. The method appears to have been successful and to indicate a desirability of continuation provided sufficient hemp is grown in a county to make the establishment of a pool profitable.

2. Considerable work has been performed upon the project instituted for securing useful information for the purpose of publication in a bulletin on the "Marketing, Manufacturing and Exportation of Kentucky Hemp Fiber." Studies so far conducted have included methods of marketing in Kentucky and manufacturing processes and uses of hemp and the possibility of exporting American hemp to foreign countries. It is found that the present methods of retting and breaking hemp and its consequent comparatively poor preparation for market militate against the expansion of the hemp industry in Kentucky in competition with hemp prepared for market by machinery. Eastern buyers lay stress upon the fact that Kentucky hemp is not uniform in grade nor in the thoroness with which it is prepared for market and seem to be partial to hemp fiber prepared by machinery in other parts of the United States.

The general impression that hemp fiber has a very wide market in the United States and that hemp raising is capable of being greatly extended is not substantiated by this investigation, it being found that American hemp fiber is used for very little else than the manufacture of commercial twine, marlins and other minor ship supplies at the present time and that it meets with sharp competition with foreign fibers, especially Italian hemp, sisal, manila or abaca and jute. For the finer materials Italian hemp is favored, while manila has displaced hemp in rope making and jute has taken away the market of hemp in the manufacture of furniture webbing and cotton bagging, as well as in the manufacture of gunny sacks. Indications are that the future of the hemp industry rests upon

the introduction of improved machinery for its preparation for the market and improvements in the manner of retting hemp so that it may compete more generally with Italian fiber.

3. Cold storage investigation. This investigation, which has been only partially carried out, embraces a study of economic influence of cold storage upon perishable and semi-perishable products and includes statistics upon relation of cold storage capacity to demand in Kentucky, the location of cold storage facilities, and types of construction of cold storage houses suitable for various agricultural crops. Attention has also been given to the securing of information relative to food value of cold storage and fresh products and to such other information as may be of value to farmers and shippers in the handling of perishable and semi-perishable products grown in this state.

PUBLIC SERVICE LABORATORIES.

By J. O. LaBach.

I hereby submit my report of the work of the Public Service Department for the calendar year of 1918. The Food and Drug Department ceased to exist on June 18, 1918, when the state food and drug executive work was transferred to the State Board of Health. Under the new State Board of Health Law of 1918 all laboratory work of the State Board of Health devolves upon the Experiment Station.

In June the Experiment Station organized the Public Service Laboratories for the purpose of carrying out the provisions of this act. This new department handles all the laboratory work of the State Board of Health, the State Sanitation Bureau, Tuberculosis Bureau, Bureau of Bacteriology and Epidemiology, as well as the food and drug inspection work. On account of a suit between two factions in the State Board, the various bureaus contemplated by the new law were not organized this year. However, after November 1st samples were sent in by food and drug inspectors, as well as all summer by doctors and private parties thruout the state, mostly waters for sanitary analysis.

Before the Food and Drug Act became void there were 538 official food and drug samples submitted to the department, covering an inspection period of about four months. About the first of May three of the inspectors left the Food and Drug Department, one going to the U. S. army service, one to the Extension Division of the College of Agriculture and the third into egg demonstration work in collaboration with the U. S. Bureau of Chemistry and then into the feed and fertilizer inspection service of the state. One inspector, Mr. J. W. McFarlin, worked in Louisville, in collaboration with the U. S. Public Health Service, in restaurant and public eating place inspection and on general sanitation problems.

The annual total of work done by the department in the calendar year of 1918, is as follows:

Office—	
Help given, answers to inquiries, etc.	1,328
Reports of inspections, etc.	652
Letters of work done, etc.	1,230
Total	3,210
Inspections to June 18, 1918—	
Towns visited once	166
Towns visited more than once	208
Total	374
Groceries visited	980
Bakeries visited	33
Restaurants, etc.	1,022
Slaughterhouses	234
Drug stores	84
Paint and oil stores	31
Soda fountains	140
Dairies, milk depots, creameries, etc.	166
Mills, patent medicine manufacturers, etc.	42
Total	2,732
Total laboratory work for the year of 1918—	
Official and unofficial samples	1,619

This work included poison cases, medicine and other products suspected of having poisonous action, or prescriptions thought to have been improperly filled, food products suspected of containing ground glass or other poisonous matter, human milk for nutritive qualities, sputa for tuberculosis, dog heads for rabies, hookworm specimens, typhoid examinations (Widal reaction), chemical and sanitary examination of food products for wholesomeness, blood examination, urine anal-

ysis, chemical examination of food and drugs for adulteration or misbranding, special milks from diseased cows, making of autogenous vaccines, chemical and sanitary examination of cream, milks, waters and other food products, and various problems having a commercial or technical value.

When the Board of Health shall have organized and the heads of the various bureaus have been appointed, as contemplated by the law, it is to be expected that the work of the department will be extended.

VETERINARY SCIENCE

By R. L. Pontius.

Owing to the inability to secure skilled assistance in the Veterinary Department during the period of the war, the activities have been confined to: the testing and distributing of anti-hog cholera serum, the distributing of blackleg vaccine, the pathological and bacteriological examination of specimens, the preparation and distribution of anti-botulinus serum and assisting Professor Good in his work on infectious abortion. We have also conducted four tests on hog tonics for the State Live Stock Sanitary Board.

Hog Cholera Serum.—During the year we have purchased 2,496,750 cubic centimeters of anti-hog cholera serum which was held until it had undergone a satisfactory potency test and then distributed to the swine breeders and feeders and veterinarians of Kentucky. Owing to the increased demand for this product during the past summer, it was necessary for us to purchase serum from several different serum manufacturers at a cost ranging from 85c to $1.40 per hundred cubic centimeters. The state law of Kentucky requiring us to distribute serum at one cent per cubic centimeter to residents of Kentucky made the handling of this serum a rather expensive proposition to the Experiment Station. It might be mentioned, however, that serum from the commercial companies has proved very satisfactory, and we have never yet experienced testing serum which was not highly potent.

Owing to the shortage of our serum supply we deemed it advisable to discontinue the serum depots thruout the state until this condition is improved.

Blackleg Vaccine.—During the year 31,645 doses of blackleg vaccine have been distributed thruout the state to veterinarians, county agents and farmers. This vaccine is furnished gratis by the Bureau of Animal Industry. There are a number

of new liquid vaccines manufactured for the prevention of blackleg, but it seems that this vaccine is giving most excellent results, and there is very little demand for the improved vaccines in this state.

Examinations of Specimens.—During the year, this department has examined 93 specimens and diseased tissues, both pathologically and bacteriologically. These tissues have been sent in by veterinarians, farmers and county agents and our examinations have led to the diagnosis of such diseases as hog cholera, blackleg, tuberculosis, hemorrhagic septicemia, necrobacillosis, nodular disease of sheep and cholera in chickens.

Botulinus Antitoxin.—Botulinus antitoxin has been prepared by this department with the view of determining its efficacy as a prophylactic in herds affected with the so-called forage poisoning. 10,750 cubic centimeters have been sent out to veterinarians to be used in outbreaks of this disease. This product has been sent into several states and some very favorable reports have been received.

METEOROLOGICAL SUMMARIES.

For the Year 1918.

Compiled from the records of the U. S. Weather Bureau Station, Lexington, Kentucky.

MONTHLY AND ANNUAL MEAN TEMPERATURE

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann.
1872											37	27	
1873	30	35	42	53	66	74	75	74	67	55	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						
											44	35	
1887													
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	76	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
1914	37	29	40	54	66	76	78	75	67	59	46	30	54.6
1915	32	40	36	59	62	70	74	70	70	60	49	36	54.8
1916	40	33	41	52	67	69	78	76	67	58	47	34	55.2
1917	35	32	44	54	57	70	74	74	67	50	44	25	52.3
1918	20	38	49	52	69	72	73	79	62	61	44	43	55.2

TEMPERATURE EXTREMES

Month	Highest	Year	Day	Lowest	Year	Day
January	72	1906	21	-14	1918	12
February	75	1918	28	-20	1899	13
March	85	1910	24	- 1	1873	4
April	88	1915	25	15	1875	18
May	93	1911	28	30	1876	1
June	99	1914	27	40	1910	3
July	102	1901	22	51	1891	9
August	100	1918	6	46	1915	31
September	98	1899	6	32	1899	30
October	88	1916	7	21	1873	29
November	78	1895	7	2	1872	28
December	71	1875	31	-9	1917	10

MONTHLY AND ANNUAL PRECIPITATION

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann.
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	4.27	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	6.04	2.41	4.32	3.29	2.43	1.00	1.76	3.40	4.00	2.74	44.35
1914	2.50	3.87	2.24	2.23	1.65	4.77	2.63	4.69	1.82	5.32	1.62	4.40	37.74
1915	4.38	1.12	1.49	0.65	7.23	3.20	5.72	6.03	3.74	0.81	3.90	6.67	44.94
1916	5.65	3.40	3.30	1.01	2.92	5.33	1.72	2.34	2.75	2.04	1.25	3.63	35.34
1917	5.67	2.12	5.48	3.97	3.51	3.54	2.80	1.94	2.46	2.36	1.03	1.97	36.85
1918	4.46	1.92	1.55	2.09	4.13	3.61	2.01	2.68	1.41	4.57	2.24	4.83	35.50

EXTREMES OF PRECIPITATION AND WIND

Month	PRECIPITATION			WIND			
	Greatest in 24 hours	Year	Day	Max. Vel.	Dir.	Year	Day
January	3.50	1913	11	60	sw	1891*	1
February	3.04	1909	23-24	60	sw	1890*	25
March	3.61	1913	25-26	62	sw	1889*	31
April	3.24	1909	29-30	64	sw	1909	29
May	2.61	1898	6-7	60	nw	1889*	12
June	4.45	1898	26-27	60	n	1890*	29
July	4.02	1875	11-12	58	nw	1915	30
August	2.98	1915	1-2	72	s	1918	6
September	4.26	1910	18-19	68	w	1889	8
October	2.32	1893	3-4	50	nw	1904*	21
November	3.07	1900	20-21	62	s	1895*	26
December	2.50	1895	25-26	60	sw	1895	26

*Also in subsequent years.

ANNUAL METEOROLOGICAL SUMMARY

Month.	Temperature, Degrees Fahrenheit.							Relative Humidity, Per cent 7 a. m.	Precipitation, in Inches.				Per cent of Sunshine	Wind					Number of Days.											
	Mean			Extreme.												Maximum For five mins.											Max. Temp.		Min. Temp.	
	Maximum.	Minimum.	Monthly.	Maximum.	Date	Minimum.	Date.		Total	Maximum in 24 hours.	Date.	Total Snowfall, Ins.		Average Hourly Velocity.	Prevailing Direction.	Velocity.	Direction.	Date.	Gales, 40 Miles Per Hour or Over.	Clear.	Partly Cloudy.	Cloudy.	Precipitation of .01 Inch or More.	With Trace or More of Snow.	Thunderstorms.	Fog Observed.	90 deg or above.	Freezing or below	Freezing or below	Zero or below.
January	27	12	20	47	26	-14	12	92	4.46	1.30	14-15	21.7	36	14.7	SW	42	SW	12	2	7	9	15	21	18	0	2	0	23	31	4
February	48	28	38	75	28	-1	4	84	1.92	0.88	19	0.1	39	17.5	SW	60	SW	12	7	8	9	11	9	5	3	3	0	4	18	2
March	60	39	49	77	9	23	10	74	1.55	0.51	22-23	0	44	15.2	SW	54	W	9	4	11	8	12	9	0	4	1	0	0	9	0
April	60	43	52	75	2	26	10	80	2.09	0.55	3	0.3	34	15.9	SW	48	SW	17	5	5	13	12	13	2	4	0	0	0	3	0
May	78	60	69	91	28	36	1	73	4.13	1.39	12-13	0	58	13.0	SW	44	SW	12	1	16	9	6	9	0	9	0	1	0	0	0
June	82	62	72	94	16	48	23	72	3.61	2.04	24-25	0	60	11.7	SW	40	SW	30	1	13	11	6	10	0	8	1	2	0	0	0
July	81	64	73	90	4	55	31	75	2.01	0.80	7-8	0	48	9.0	SW	31	NE	11	0	13	9	9	10	0	6	0	1	0	0	0
August	89	70	79	100	6	63	20	71	2.68	0.89	27-28	0	55	10.5	SW	72	S	6	1	14	13	4	9	0	10	0	16	0	0	0
September	72	53	62	84	2	40	27	76	1.41	0.65	4-5	0	52	10.4	SE	33	NW	19	0	12	11	7	10	0	3	0	0	0	0	0
October	70	52	61	84	5	38	31	84	4.57	2.22	19-20	0	37	12.7	SW	40	S	27	1	6	11	14	12	0	2	2	0	0	0	0
November	51	38	44	68	16	24	25	80	2.24	1.29	17-18	0	44	13.1	W	48	SW	28	1	11	6	13	6	0	0	0	0	0	7	0
December	50	36	43	64	13	18	26	84	4.83	2.30	31	0.6	32	10.2	SW	40	S	31	1	5	8	18	15	6	0	1	0	4	13	0
The Year	64	46	55	100	Aug 6	-14	Jan 12	79	35.50	2.30	Dec 31	22.7	45	12.8	SW	72	SW	Aug 6	24	121	117	127	133	31	49	10	20	31	81	6

THIRTY-FIRST ANNUAL REPORT

of the

Kentucky Agricultural Experiment Station

FOR THE YEAR 1918

PART II

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Kentucky
Agricultural Experiment Station
University of Kentucky, Lexington, Ky.

BULLETIN NO. 215

Care and Management of Sheep in Kentucky

By

E. S. GOOD and L. B. MANN

January, 1918

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BULLETIN NO. 215

CARE AND MANAGEMENT OF SHEEP IN KENTUCKY

By

E. S. Good and L. B. Mann.

I. Introduction

Outlook for Sheep Industry—Sheep production in the eastern sections of the United States offers an inviting field and promises to take its place again as one of the major farm enterprises. In years past this branch of the live stock industry held an important position in the eastern agricultural systems, due largely to the demand for wool. With the increased supply of this commodity, both from our western ranges and from abroad, this industry became an unprofitable one for our eastern farmers and for that reason rapidly declined. Gradually the sheep-producing areas drifted westward and became concentrated in the range states where plenty of cheap pasture land was available.

In recent years the substitution of lamb for mutton on the market has revolutionized the sheep industry and the American meat-eating public have overcome their former dislike to anything that savored of mutton, so that now the west, as well as the east, has become a large consumer of this meat. The number of fat lambs slaughtered each year at central, western and eastern markets testifies strongly to this fact.

Decline of Industry—This increased demand, however,

has not been followed by a corresponding increase in production, but rather by a reduction in numbers. In 1903 there were something over 64,000,000 head of sheep in the United States, while in 1916 there were less than 49,000,000—a decrease of 16,000,000, or 25 per cent. in 13 years. Not only has our own country suffered a decrease, but since the opening of the European war in 1914 the flocks in Europe have decreased over 54,000,000 head, or 33 per cent. The greatly increased demand for both wool and mutton, due to the war, has had a tendency to raise prices of lambs and sheep to almost undreamed of heights. These increased prices have greatly stimulated the interest in sheep raising over the country and large numbers of farmers have indicated their desire to go into this branch of live stock production.

Because of lack of knowledge concerning proper care and management and a popular fallacy that sheep are so much more troublesome and more subject to disease than other animals, the eastern farmer has been slow to go into the business.

The purpose of this bulletin is to give the results of a survey of sheep conditions over the State of Kentucky, to describe the best methods in use by practical sheepmen, and the results of successful experimental work adaptable to Kentucky conditions. With this idea in view, questionnaires relative to the most approved methods and cost of handling sheep were sent to a large number of sheep raisers of 39 counties situated in different sections of the State.

II. General Survey of Kentucky's Sheep Industry

RANK—At the present time Kentucky ranks sixteenth among the states of the Union in line of sheep production, with a reported number for 1916 of 1,155,000 head.

DECLINE—This number shows a decrease of 77,000 head, over the previous year, and a loss of 165,000, or 12½ per cent., since 1913. The most rapid decline has occurred in the mountain districts, which goes to show that Kentucky farmers are rapidly depleting their foundation stock, the hardy mountain

ewe, with very little attempt being made to replace her. This rapid decline can be traced to a number of causes, the most striking being the present wasteful method of wholesale marketing of ewes and ewe lambs each season. Other factors have been the lack of interest in sheep farming, the change to dairy, grain and tobacco enterprises in some sections and the losses from disease and dogs.

ADVANTAGES—Kentucky's advantages as a sheep state are very marked. The well-drained, cheap, hilly lands of the eastern and western parts of the State offer an ideal home for sheep. With the mild climate, short winters, early springs and long pasturing season, sheep can be maintained for the greater part of the year on pasture alone. No great amount of expensive shelter is necessary and only a limited grain ration need be fed the ewe flock. An abundance of fresh running water is furnished by springs in most of these sections, which adds another valuable feature to the State, from a live stock standpoint. Due to these favorable circumstances the cost of production is necessarily low and the returns on the investment are very satisfactory.

EXTENT AND LOCATION OF THE INDUSTRY—Central and northern Kentucky counties are the most densely populated with the "wooly coats," as is indicated by the report of the State Board of Equalization. In the Bluegrass Region the sheep business is prospering on high priced lands and is gaining in popularity. The feature of restocking every two or three years with mountain ewes allows farmers of this region to handle sheep at a profit with very little care and a minimum amount of loss from disease. These mountain ewes, which are descendants of some of the early sheep brought over from Europe, are long legged, narrow bodied animals with a very light, open fleece. They are of a hardy nature and very resistant to the diseases common to sheep in these regions.

From figures obtained from the report just mentioned, the mountain districts appear to be sparsely supplied, in comparison with the central sections. The supply of mountain ewes

has been greatly reduced in recent years, due to the lack of interest and to the methods of wholesale marketing every year or so by Bluegrass farmers, with no attempt to replenish the foundation stock by breeding operations in the Bluegrass Region. This practis of buying a new flock of ewes each season, from the mountain sections, has been a very paying one up to the present time but, due to the rapidly diminishing supply in that region, cannot be longer followed. This is a great misfortune for the sheep industry in Kentucky, as the native mountain ewes are very hardy and are especially adapted to the rougher portions of the State. By saving the ewe lambs, culling out only the old and worthless ewes, and by the use of pure-bred mutton rams this condition could be materially remedied in a few years' time. Either the Kentucky sheep farmer must start the raising of his own ewes, as practist in neighboring states, or eventually go out of the business.

THE PRINCIPAL BREEDS—Besides the mountain sheep, there are a considerable number of pure-bred and high-grade flocks in the central and northern parts of the State. Our survey shows the pure-breds to rank as follows in the 39 counties investigated:

Southdowns	59%
Shropshires	16%
Hampshires	15%
Oxfords	10%

In addition to these breeds, a few Suffolks, Dorsets, Cheviots, Cotswolds and a large number of grade flocks were reported, scattered thru central, western and northern counties.

While the Southdown is undoubtedly the most popular of the breeds, as shown by its wide distribution, yet the black faced breeds, Hampshires and Shropshires, are gaining in popularity and are producing an excellent type of wool and mutton lamb, when crossed on native mountain ewes.

The matter of which breed a man shall select is not so important as that the breed of sheep chosen be adapted to local

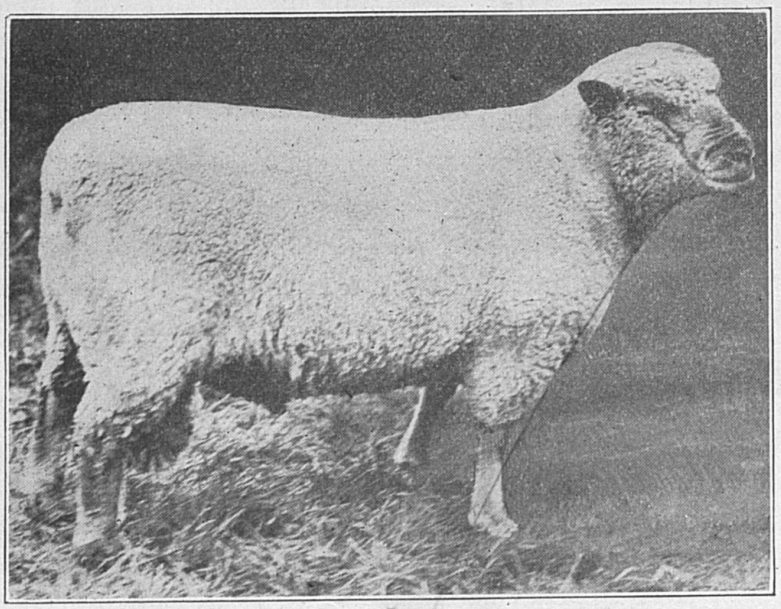
conditions. Where one breed is established in a community and it appears to be well adapted to climatic and grazing conditions, it is not desirable to introduce a new breed. By doing so one tends to narrow the market and restrict the breeders in the exchange of breeding stock and in the building up of the reputation of the community for a superior type of live stock. Standardization in buying, breeding and marketing have made certain Wisconsin counties famous in the dairy world and it would do the same for Kentucky counties, in the sheep business.

In general it may be said that the lighter and smaller breeds are best adapted to hilly regions of scant pasture while the heavier breeds give best results on the more level lands with luxuriant pastures and abundant feed.

The breeds of sheep may be classified as mutton and wool types. In Kentucky, at the present time, because of the spring lamb industry, the mutton breeds are more popular than the wool breeds. The following short description of the principal breeds found in Kentucky may be of some use in determining the breed best adapted to a certain locality.

In the experimental work at this Station the rams of the Down breeds, crossed on mountain ewes, have materially increased the amount and quality of wool and size of carcass over such ewes bred to common mountain bucks.

SOUTHDOWN.



A SOUTHDOWN RAM.
(Courtesy American Sheep Breeder.)

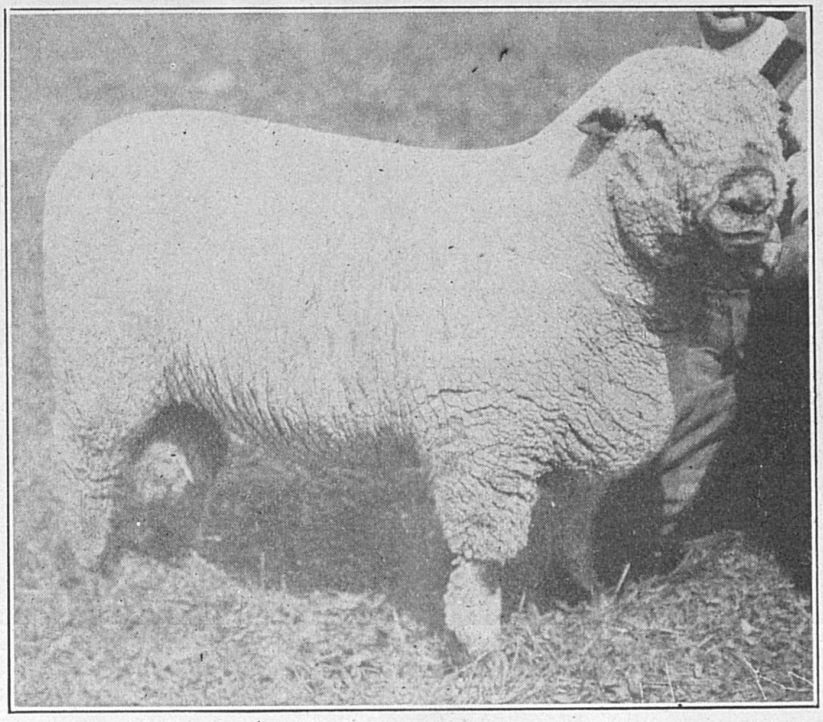
Origin: Sussex County, England. Was raised on rolling lands in temperate climate.

Description: Head small and hornless. Smallest of mutton breeds; rams weigh 175 pounds, ewes 135 pounds. Face bare of wool between the eyes; mouse-colored hair on nose and legs.

Strong Points: Excellent grazers and feeders; fine quality of meat; carcasses dress out high per cent.; adapted to rolling pastures; one of the most hardy breeds; lambs very early maturing; ewes prolific and good mothers.

Weak Points: The Southdown is a very poor wool producer, fleeces averaging 6 to 8 pounds. Lack of size is another criticism that is often made.

SHROPSHIRE.



A SHROPSHIRE RAM.
(Courtesy American Sheep Breeder.)

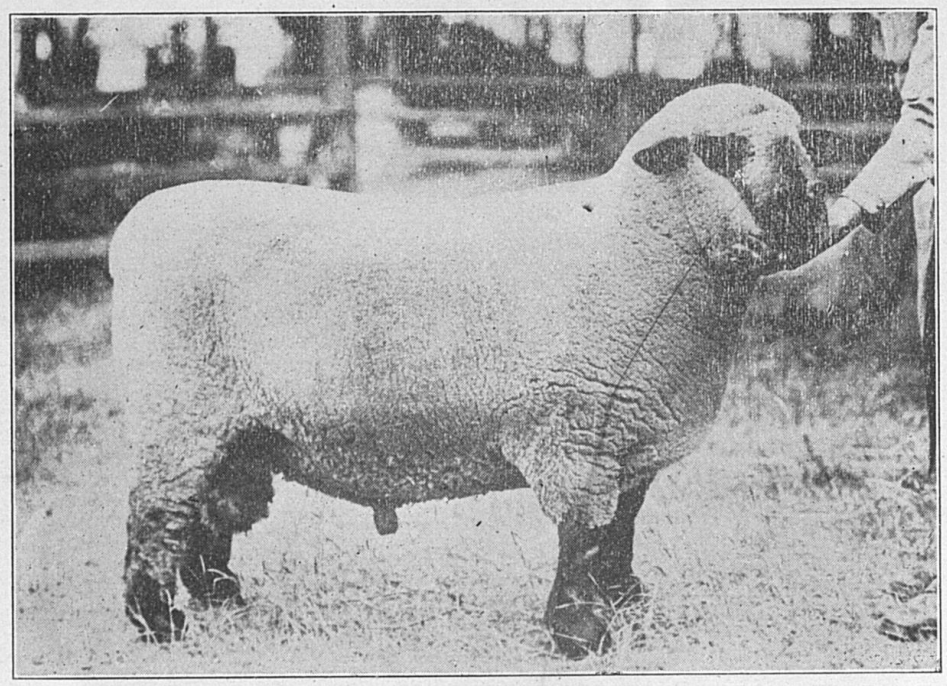
Origin: England; Shropshire and Stafford Counties. Rolling land, mild climate and good grazing. Shropshires come from an infusion of Southdown, Leicester and Cotswold blood.

Description: Breed of medium wool class, heavier and larger than Southdown; weight of rams 225 pounds; weight of ewes 150-160 pounds; face, ears and legs dark brown in color; hornless; heavily wooled over face down to nostrils and on legs to toes.

Strong Points: Excellent mutton sheep. Fleece heavier and denser than Southdown. Weight of fleece 8 to 12 pounds.

Weak Points: Vigor sometimes criticized; require good pasture.

HAMPSHIRE.



A HAMPSHIRE RAM.

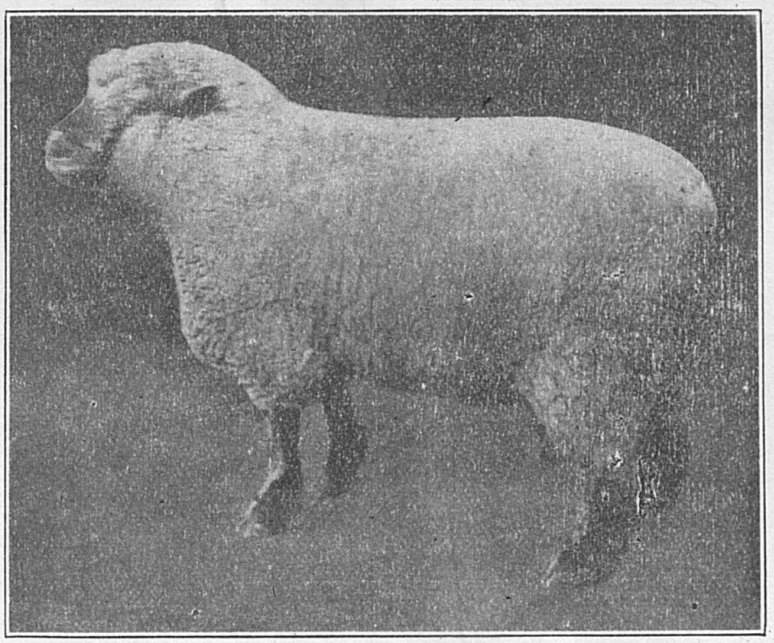
Origin: England; Hampshire County, in 1834. Raised on rolling land, in temperate climate. Bred from Southdown, native horned sheep and black-faced Hampshire sheep.

Description: Large size; rams weigh 250 pounds; ewes 185 to 190 pounds. Face and head dark brown or black hair. Face, ears and legs covered with black hair. Roman nose pronounced in males; thick lips and nostrils; large drooping ears.

Strong Points: Large size, rapid growth, ability to utilize coarse roughage and forage crops. Lambs very rapid gainers; ewes superior to all breeds in ability to winter on roughage. Meat of excellent quality. Ewes are prolific and rams crossed on scrub ewes produce an excellent type of mutton lamb.

Weak Points: Tend toward coarseness; wool of inferior quality; sometimes black fibers in fleece. Require heavy feeding and good pastures; not adapted to scanty pastures.

OXFORD.



AN OXFORD RAM.
(Courtesy American Sheep Breeder.)

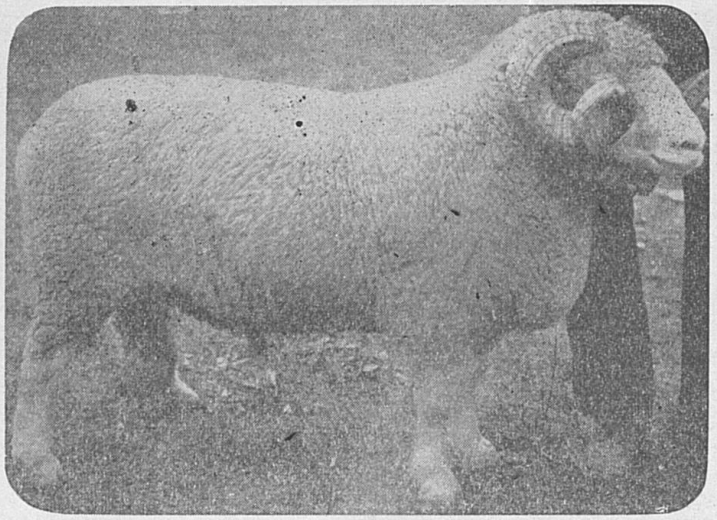
Origin: The Oxford breed was developed in Oxford County, England, in 1833, in a region of rolling land, mild climate and excellent grazing. Breeds used in improving the Oxford were the Cotswold, Hampshire and Southdown.

Description: The Oxford, while a larger sheep, resembles the Shropshire in appearance, being hornless, with dark brown or gray colored face and legs, and heavy covering of wool over the head and down to the eyes.

Strong Points: Wool, altho not so fine, is long and the fleeces are heavier than most of the Down breeds, ranging from 8 to 14 pounds per head. Its size places the Oxford in first rank, rams weighing 250 to 350 pounds and ewes 180 to 275 pounds. The Oxford ranks high as a feeder, lambs making exceptional gains. Valuable as a cross on fine-wooled breeds. Ewes are very prolific and good milkers.

Weak Points: Require plenty of feed and good pastures. Are not adapted to rough, scant pasture lands. Wool quite coarse and open.

DORSET HORN.



A DORSET RAM.
(Courtesy American Sheep Breeder.)

Origin: The Dorset breed takes its name from its home in Dorset County, England. It is one of the oldest distinct breeds in England, having been developed prior to 1707 by the mingling of the sheep of Somerset and Dorset counties.

Description: In form and fleece the Dorset resembles the Down breeds but differs widely in the fact that this breed is horned. The face and legs are bare of wool and are covered with pure white hair. In size these sheep are between the Southdown and the Shropshire, the weight of the rams being about 200 pounds and ewes 160 pounds.

Strong Points: Dorset ewes breed earlier than any of the other English breeds and ewes, being heavy milkers, finish their lambs for market in about 10 weeks, thus obtaining an early product or "hot house lamb" which commands a higher price. Ewes are very prolific and the percentage of twins is high. The crossing of Shropshire or Southdown rams on Dorset ewes produces a superior mutton lamb.

Weak Points: In wool production the Dorsets rank low, as their wool is short, quite open, and bare under the belly—the average being from 6 to 8 pounds. Individuals lack uniformity and are inclined to be leggy and somewhat coarse. Adapted to level or slightly rolling pasture lands where food is abundant.

CHEVIOT.

Origin: The Cheviot breed of sheep came from the border country between England and Scotland, in the counties of Roxburgh (Scotland) and Northumberland (England.) The country is mountainous, the hillsides being covered with short, nutritious grass. The climate is moist and quite rough, considerable snow falling in winter. The Cheviot was developed from Leicester, Mound and Highland breeds.

Description: Head usually hornless and covered with short, white hair behind the ears and under the jaw. The legs and ears are covered with white hair. Ears are thin and narrower than Shropshires and are held upright. In size the Cheviot is medium, about the same as Shropshire in weight, rams weighing 200 pounds and ewes 150 pounds. The lips, nostrils and hoofs are black.

Strong Points: This breed ranks very high as a mutton producer, the meat being of superior quality. Ewes are very prolific and good milkers, producing a high percentage of lambs. The Cheviot is unsurpassed as a grazer, existing for long periods on scant pasture and a small amount of hay. They are a hardy sheep, requiring little shelter, and the lambs are very vigorous. This breed is especially adapted to hilly or mountainous districts.

Weak Points: As wool producers Cheviots are only fair, the average often ranging from 6 to 8 pounds, altho the quality is satisfactory. Lack of uniformity in type is another objection.

FINE-WOOLED SHEEP.

While the mutton breeds are by far the most popular with Kentucky sheep breeders, yet the low yield of wool from our native Kentucky flocks warrants the use of sheep of the fine-wooled characteristics to improve this deficiency. The use of a fine-wool ram on the light-wooled mountain ewes would materially increase their yield of fleece. Of the fine-wools, the Rambouillet and Delaine breeds come nearer answering this purpose, due to their mutton as well as wool characteristics.

RAMBOUILLET.

Origin: This breed originally came from Spain but was improved and developed at Rambouillet, in France, whence it gets its name.

Description: Head is large. Rams are horned. Heavy, dense wool extending over face below eyes and over entire body; has the best mutton conformation of any of the fine-wool breeds; is much freer of folds than the American Merino. Weight of rams 175 to 185 pounds and ewes 140 to 160 pounds. Wool in folds on neck but smooth over body.

Strong Points: Largest of fine-wooled breeds. Very hardy and excellent grazers on poor pasture. Fleece very dense and fine, averaging 10 to 18 pounds. Lambs gain rapidly and fatten quite well.

Weak Points: Rangy and leggy. Slow maturing and lacking in mutton form.

DELAINE.

Origin: This type was developed in the United States from two importations of Merino sheep from Spain, in the early part of the 19th century.

Description: This sheep is sometimes called the "Southdown of the fine-wool type." It is smaller than the Rambouillet but has a more compact carcass than that breed. The Delaine is quite free of folds. Weight of rams 140 to 200 pounds, ewes 100 to 150 pounds.

Strong Points: Leads in the Merino families as to quality of mutton and early maturity.

Weak Points: Smaller in size than the Rambouillet.

III. System of Flock Management

Starting the Farm Flock—Late summer and fall is the proper time to start the farm flock. In Kentucky the common practis is to buy outright, every year or so, in the fall or late summer, a new flock, after disposing of all former ewes and lambs.

Selection of Breeding Stock—It is seldom advisable for the man just going into the business to purchase pure-bred ewes, because of their higher price and their need of better care and management than the beginner usually will give them. With his

limited knowledge the practical thing to do is to select good, healthy, grade ewes which can be bought at a reasonable price during the late summer months, from dealers or from the farms in mountain districts. In many counties, autumn auction sales are held where thousands of breeding ewes are sold. No matter what breed the beginner selects he should look for strong, thrifty ewes, not too old, and free from disease. Beware of purchasing broken-mouthed ewes, or "gummers," as sheep without teeth are called, because they are unable to utilize coarse roughage to advantage. After purchasing the ewes, a pure-bred ram of one of the mutton breeds, either a yearling or a two-year-old, should be secured. One often hears the saying that the sire is half the herd, which certainly holds true in regard to his use in crossing on the grade or native ewe flock. In order to obtain a superior type of mutton lamb it is essential that an excellent ram, of one of the mutton breeds, be selected.

The Age of Sheep—This may be determined fairly accurately by means of the teeth. Sheep are classified as lambs up to 12 months old. During this period lambs have temporary or milk teeth which are distinguished from the permanent teeth by their being narrow, small and of a pure white color. At about one year the first pair of permanent incisors replaces the central pair of "milk teeth" on the lower jaw. (Sheep have no incisors on the upper jaw.) The permanent teeth are wider, longer and of a yellowish color. When a two-year-old, the second pair of permanent incisors replaces the next outer pair of milk teeth. At three years the third pair appears and at the end of four years the sheep has four pairs of permanent teeth, or a "full mouth." Sheep are said to reach maturity at this time. After the "full mouth" period is reached the only means of telling the age is by the degree of wearing and notable protruding. After about six years of age sheep begin to lose their teeth and are classed as "gummers."

Size of Flock—Men with little or no experience in sheep raising should not go into the business too deeply the first season. Reports show the number of sheep per farm flock in Kentucky varies from 2 to 1,500, altho only 8 per cent. of the flocks

were over 100 head, while 92 per cent. were considerably under this number, the average running between 50 and 60 head.

NUMBER OF EWES PER ACRE—The number of sheep handled depends largely upon the size and type of the farm. In the Bluegrass Region, where pastures are good and feed abundant, reports from farmers allow from 1-2 to 3-4 acre per ewe, while in the rougher regions of scantier pastures about 2 1-2 acres are required. By an intensive system and the use of forage crops, root crops and rough feeds the number handled per acre in the more fertile regions could be materially increased. Where sheep are kept in connection with other live stock, the average 160 acre farm could handle a flock of 50 to 60 ewes very easily. At the present time Kentucky supports only one ewe on every 22.4 acres —a fact that illustrates very clearly the low rate of production in the State.

EQUIPMENT NECESSARY—Shelter, under Kentucky conditions, while it does not need to be expensive, is necessary during the months of January, February and March, when the ewes are lambing. Reports from farmers concerning equipment show that 58 per cent. of them use tobacco barns during this season, 26 per cent. use the open shed, some, enclosed sheds, and a small number report the use of buildings erected for sheep only. This clearly shows that very little extra building equipment is necessary to successfully handle sheep on the Kentucky farm. However, during and after lambing, sheep require dry and fairly warm quarters, protected from wind and snow. Every winter an unnecessary loss occurs among the ewes and lambs, due to exposure and lack of shelter at this time.

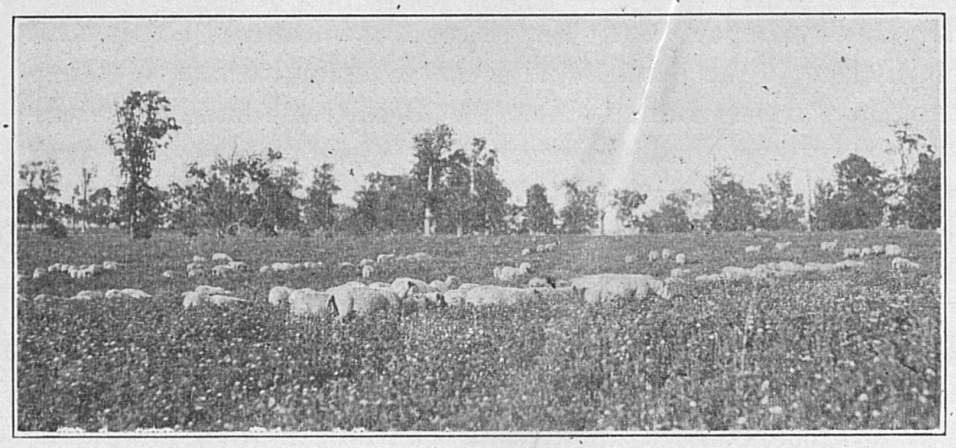
A good plan to follow when tobacco or other barns are used is to build temporary lambing pens, in order to separate the ewes with lambs from the rest of the flock. A small pen 10x10 feet, made of movable panels which can later be removed, is sufficient to hold the ewe and young lambs for the first few days. Where the open shed is used, the use of sliding or hanging doors which will keep out wind and snow has been found very satisfactory at the Experiment Station farm. Plans and specifications for sheep houses and equipment can be obtained by wrtiing to the Animal

Husbandry Department, Kentucky Agricultural Experiment Station, or to the U. S. Department of Agriculture at Washington, for Farmers Bulletin No. 810. Besides the buildings necessary, one needs combination grain and hay racks, lamb creeps, movable panels for yards and hurdles or woven wire fence for use in pasturing forage crops. The Bulletin just mentioned illustrates fully the equipment for farm sheep-raising.

AUTUMN MANAGEMENT OF THE FLOCK—Most of the Kentucky lamb crop is weaned and sold by the last of July, so that the ewes have a period of needed rest during August and are, if put on good pasture, in a good, thrifty condition before the breeding season opens. Where there is sufficient grass very few men practis feeding any grain previously to breeding, less than one-fourth of the farmers reporting this practis. In most sections of the state, however, during the month of August, bluegrass pastures are very dry and of little feeding value. Because of this fact a highly palatable and nutritious grain ration, such as 1-2 to 3-4 lb. of bran and oats, should be fed for a few weeks prior to the breeding season. This is commonly known as "flushing the ewes" or the bringing them up to a vigorous condition by a short period of high feeding. The successful shepherd has his ewes in a gaining, altho not fat, condition when they enter the breeding season. This method brings results by the production of a high percentage of twins and in the vigorons, healthy lamb crop. It also has a tendency to bring ewes in heat earlier, thus producing earlier lambs. Where forage crops are available, such as rape or clover, they serve very well in building up the ewes and reduce the amount of grain necessary to be fed.

TIME OF BREEDING—This will depend upon several things, namely; the facilities for handling early lambs, the feeding conditions, the market demand and the tendency of the ewes to breed early or late. Unless one is handling Dorset or Merino ewes it will be impossible to figure on early winter lambs, as most ewes of other breeds will not breed early.

The period of gestation of the sheep is invariably 147 days. The date of breeding ewes on Kentucky farms varies from July



SHEEP ON CLOVER.

to November, the most common time being from the last of August to the first of October. A general practis with Kentucky farmers is to turn the rams in with the ewes in early September and let them run with the flock until the last of November or until the ewes start to lamb. By this method the farmer has lambs dropped anywhere from the first of February till the last of May, a very undesirable procedure from a business standpoint, because of the great variation in ages, lower prices paid for late lambs and the increased danger of loss from parasitic diseases.

The practis of allowing the ram to run with the flock for a long period is not to be recommended, not only because of the irregularity of lambing, due to the long breeding season, but also because of the tendency to lower the vitality of the ram.

The Feeding of the Ram at Breeding Time

Beginning about a month before the breeding season, usually during August, the ram should be fed some extra grain, in order to put him in a vigorous, thrifty condition. Good rations to feed at this time are 1 to 1 1-2 pound of oats alone or 1 1-2 pound of a mixture of oats 2 parts and brain 1 part. If the ram is in poor condition, a ration of 1 1-2 pound of a mixture of 5 parts oats, 4 parts corn and 1 part oil meal may be used. Besides grain, some succulent feed such as pasture or silage should

be used and a limited amount, 1 to 2 pounds, of clover hay. Where good pasture is available, hay and silage are not needed.

Breeding Methods Recommended—First, the number of ewes to each ram is of vital importance, this varying with age and condition of ram. As a general rule the yearling or two-year-old ram is the most popular with sheep raisers, altho an aged ram of known breeding qualities is valuable for 8 or 9 years. The practis of breeding ram lambs, except to a limited degree, should be discouraged, as it has a tendency to reduce their size and impair their vigor. A ram lamb, when properly handled, can serve from 8 to 12 ewes; a sturdy yearling, from 25 to 30, and a two-year-old or aged ram, from 40 to 50 ewes, without harm.

In order to handle this number of ewes successfully, the following methods have been practist with excellent results. Where a man has a small flock the "hand coupling" method is to be preferred. Turn the ram into an enclosure for a couple of hours, morning and night, with 15 or 20 ewes, and watch him. After he has served an ewe, turn her out of the pen and mark her. Limit the ram to 3 or 4 ewes in the morning and the same number in the evening. In this way a much larger number of ewes may be served, without injury to the ram.

Another method advocated by some breeders is to paint the breast of the ram and turn him in with a small flock of ewes in the evening, taking him out each morning. The ewes marked are separated from the rest and later tried with another ram. This method, however, does not always prove successful in getting all the ewes bred and is not practical under most conditions.

Still another method reported is that of dividing the flock up into lots of 25 each and turning a marked ram in for 2 or 3 days and then substituting a fresh one. By this system of changing rams excellent results have been obtained, the majority of ewes being bred in a short time without overtaxing the rams. Periods of heat in ewes last from 1 to 3 days and occur at intervals of 14 to 19 days. When a ram is not with the flock, it is a good plan to leave a couple of bred ewes with him in order to keep him quiet. After the breeding season is over, feed the rams only enough to keep them in good condition.

FALL PASTURES—Kentucky's long, mild falls and late, open winters make it possible to graze the flock during and after the breeding season and sometimes until after Christmas, with the use of very little grain. Pastures can be supplemented in the late summer by turning the sheep on stubble fields and meadows, followed by corn fields and some forage such as rape, clover and soy beans. For winter and early spring pasture rye offers the best crop available, thru most parts of the state. By means of a system of this sort the breeding flock is kept in a vigorous, gaining condition with very little grain. The actual condition of the ewe flock furnishes the best indication as to the feed required and the careful shepherd should take pains to keep his ewes in a vigorous, healthy, but not too fat condition during this period.

WINTER MANAGEMENT—The winter season is the most critical one for the sheep farmer. The care and treatment given his ewes at this time determine largely the condition and per cent. of his lamb crop. The practis of feeding some grain to the ewes previously to lambing is fairly popular with Kentucky sheepmen, over 66 per cent. reporting this to be their custom. The most common rations reported were:

(1) Alfalfa hay alone.
(2) Corn and hay.
(3) Corn and roughage (fodder) and straw.
(4) Oats, clover, corn fodder.

These rations all bring out the fact that the tendency of most farmers thruout the state is to winter their breeding flock as far as possible on cheap feeds, such as fodder, straw, hay and little grain. When there is no pasture available during the period previous to lambing it is essential that some succulent ration in the form of either root crops or silage be used. When ewes are fed upon dry feed alone they have a tendency to give little milk for the lamb, and the danger of loss from nodular disease is greatly increased. Corn silage of good quality is one of the best feeds and when fed in connection with legume hay, such as clover or alfalfa, it is sufficient, with very little grain. Beware of feeding moldy or frozen silage to sheep, as losses have

been heavy from this practis. Each winter the Kentucky sheep raiser experiences the loss of a considerable number of ewes and lambs, due to the feeding of only dry roughages and hay, with no succulent feed. While straw and fodder furnish a cheap, necessary filler for sheep, yet, without some grain, legume hay and succulent feed, sheep will not do well. Timothy hay should never be fed to sheep, because of its coarse, dry nature and constipating tendency and it also makes shearing difficult on account of the heads of the hay getting into the fleece. If no succulent feed or pasture can be obtained, some linseed oil meal should be given, on account of its loosening effect.

The following rations ("ration" means feed for one day) may be fed to ewes weighing 120 to 150 pounds, with excellent results:

(1) ¼ to ¾ lb. shelled corn and oats, half and half mixture. 2 lbs. corn silage, 1½ to 2 lbs. clover, alfalfa or cowpea hay.

(2) ½ to 1 lb. of a grain mixture, 5 parts bran, 4 parts corn and 1 part oil meal. 1½ lb. clover or alfalfa hay, 2 lbs. corn fodder.

(3) ½ to ¾ lb. of a mixture of 6 parts corn, 3 parts bran, 1 part cottonseed or oil meal. 2 lbs. clover or alfalfa hay, 2 lbs. corn silage.

(4) ½ to ¾ lb. grain mixture of 2 parts oats, 1 part bran and ½ part oil meal. 1½ to 2 lbs. clover hay, 2 lbs. corn fodder.

With fall pasture, a considerable amount of dry, coarse feeds can be fed, but where no succulent feed is at hand some laxative grain ration should be fed. A grain mixture containing linseed oil meal is a good laxative.

Value of Exercise—During the period previous to lambing it is essential that the ewes take sufficient exercise, in order that lambs born be strong and healthy. This can be accomplished by placing hay and feed racks away from the barns, thus making the ewes get out and exercise. If winter pastures are used the flock will obtain plenty of exercise in grazing. Sheep can withstand a great deal of cold and the presence of snow on

the ground should not cause them to be kept up in the barn during the day except in very stormy weather.

THE DATE OF LAMBING in Kentucky flocks varies widely, due largely to the extended breeding period. Reports show 20 per cent. of the early lambs dropped in January, 54 per cent. in February, 23 per cent. in March and 1 per cent in April, while the late lambs come 6 per cent. in February, 32 per cent. in March, 42 per cent. in April, 8 per cent. in May and 6 per cent. in June. This wide variance in lambing dates, often in the same flock, is due largely to the lax system of breeding followed and should be remedied. Late lambs are never as profitable as early lambs and are more subject to disease.

MANAGEMENT AT LAMBING TIME—The amount of care and attention given the ewe flock at lambing time determines largely the success or failure of the season's lamb harvest. A high percentage of strong, healthy lambs is a determining factor in the profits or losses of the enterprise.

Ewes heavy with lambs and ewes that have just recently lambed should be separated from the rest of the flock, in lambing pens. The pens can be made by dividing one part of the barn off with light, movable panels, the size of each pen being about 10x10 feet. The ewes with lambs should be kept in a fairly warm, dry, well ventilated place, out of wind or drafts. Just previously to lambing, cut down the amount of the grain ration fed, because heavy grain feeding at this time has a tendency to cause udder troubles. Trim away all loose wool locks around the ewe's udder in order to allow the lamb to suck easily. Occasionally an ewe will have difficulty in delivering her lamb and the careful shepherd should be on the alert to aid her if necessary. When it is apparent to him that the ewe is not able to deliver her lamb, he should first find out whether the unborn lamb is in normal position, that is with forelegs extended and with head lying between them. If not in this position, the shepherd should aid by inserting his hand and arm into the vulva and straightening the lamb into normal position. By looping a string around the front feet and pulling outward and downward as the ewe strains, the lamb can be successfully delivered

If the ewe seems weak, a stimulant, such as four tablespoonsful of whisky in some warm milk, should be given and the dose repeated every two hours until the ewe shows improvement. Make it a rule, however, never to interfere with an ewe unless it is absolutely necessary. The attendant should always wash his hands and arms thoroly in some antiseptic solution before and after rendering the ewe this assistance. This is done largely as a precautionary measure by the operator against contracting blood poisoning. If the attendant has abrasions on his hands or arms the danger to him is too great to undertake the operation.

Most lambs from healthy ewes which have been given proper feed and care will come sturdy and vigorous, needing little attention. In extremely cold weather, new-born lambs may become chilled and die, unless the shepherd comes to the rescue. A good plan to follow is to have a bucket or tub of very warm water handy into which dip the lamb and then wipe it dry with woolen cloths and place it in a warm, dry place. Probably the most important thing after the young lamb is dropt is to see that it sucks, because after the youngster gets some warm milk into its system and is able to move around, it is well on the way to become strong. If the lamb refuses to nurse, warm cow's milk, undiluted, should be supplied in a bottle with a nipple and, usually, after a few hours, with some little help, it will be able to nurse by itself.

Where the lambing ewes are separated from the other ewes little trouble arises from the ewes disowning their lambs. In order to make sure that the ewe will own her lamb it is best to keep them in the small lambing pens for several days. Where possible, always keep the ewes with lambs away from the ewes that have not yet lambed.

When an ewe dies or gives no milk, her young lamb may sometimes be adopted by another ewe by smearing oil, tar or milk first on the young lamb's head and around the tail and on the ewe's nose. When a young lamb dies and the mother has plenty of milk, she may be made to adopt another lamb by wrapping the skin of the dead lamb over the one to be adopted.

Feed and Care of Ewes After Lambing—For a few days

after lambing the grain ration should be limited to a handful or so of oats and bran and some hay, in order that the milk supply may not be greatly increased. As the lamb takes more of the milk, the ration may be gradually increased, a good ration at this time being 1 to 1½ lb. of a grain mixture (oats 6 parts, bran 3 parts, oil meal 1 part), 1½ to 2 lbs. silage, and 2 lbs. of clover or alfalfa hay. Any of the rations fed before lambing may be fed now, provided the grain be increased sufficiently to produce a good flow of milk. Silage is a very important feed for this use because of its palatable, succulent nature and milk-producing qualities.

The most common rations reported by Kentucky sheep raisers were as follows: (1) alfalfa hay only; (2) corn, bean hay and fodder; (3) hay and grain; and (4) corn and hay. All of these rations lack succulence or palatability and some are lacking in protein. A great deal of trouble has been encountered with the death of ewes, during and after the lambing period, due to "nodular disease." While there is little known as to a cure for this trouble, yet by the feeding of succulent, laxative feeds, such as silage, together with bran, oats and oil meal, during the winter season, the danger from loss is greatly reduced.

Spring Management—Kentucky spring lambs are primarily a milk fed product and are sold directly from the ewes when "milk fat." Reports from 86 per cent of Kentucky sheepmen show no grain fed to lambs. While the practis of feeding grain is considered unnecessary under some conditions yet, where the lambs are dropt early and the spring pastures are not available, the feeding of some grain and hay to young lambs aids greatly their early maturity for market. Especially is this true with orphan and twin lambs. Probably the most successful way to feed grain to lambs is by means of a "lamb creep." This is an enclosure, either in the barn or yards, which is separated from the ewe flock by panels thru which the lambs can enter but the ewes cannot. In this enclosure or creep, troughs and racks are placed in which grain and hay are fed the young lambs. For fattening lambs, feed morning and night a limited amount (½ lb. per head) of grain mixture, 6 parts corn, 3 parts oats, 1 part

cotton seed meal, with a small amount of silage and plenty of clover hay. It will be surprising how soon the young lambs will nibble at grain and hay and how well they will do on a small allowance of grain. As soon as pastures become good the feeding of grain may be reduced.

PERCENTAGE OF LAMBS RAISED—The number of lambs raised, Kentucky sheepmen report, runs from 80 to 90 per cent., extremes varying anywhere from 60 to 200 per cent. With the ideal conditions of Kentucky these figures appear very low, for even upon the ranges where thousands of sheep are handled under the most trying conditions with very little care, a higher lambing per cent. is obtained. Here is a loss that can be materially decreased by proper care and management of ewes and lambs during the lambing season.

DOCKING LAMBS—The practis of docking lambs is followed by approximately only 50 per cent. of Kentucky sheep raisers, altho it appears to be gaining in popularity each season. The common age of docking is from 2 weeks to a month old, altho it can best be accomplished at 7 to 10 days old. When left longer than this the operation becomes more serious, due to a greater loss of blood. The docking of lambs is performed either with a sharp knife or by the use of hot pincers, which sear the wound, thus preventing loss of blood. As the knife is simpler and quicker it is preferred by the small sheep raiser. Push back the skin toward the body and remove the tail about 1½ inch from the body, leaving this loose skin to heal over the stub. Next apply some good antiseptic, such as sheep dip. Docking produces a more compact, blocky lamb in appearance and prevents the accumulation of filth around the tail, thus lessening the danger from disease. Docked lambs usually bring a higher price on the market. Be sure all utensils used are well disinfected.

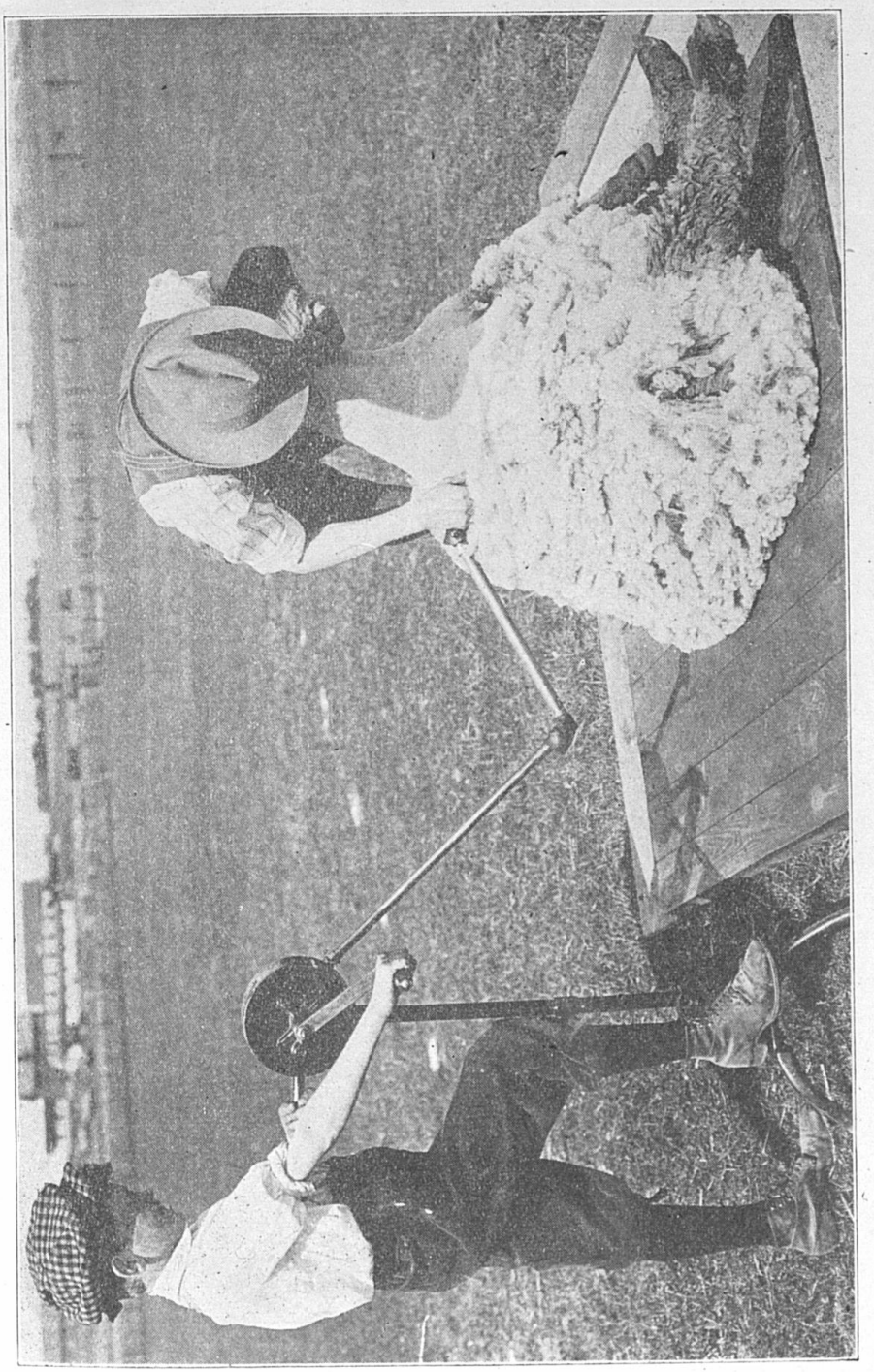
CASTRATION OF MALE LAMBS—This was reported as being practist by only 28 per cent. of the farmers, altho the majority admitted that it paid, especially with late lambs. The time to perform this operation is about a week after the docking of the lambs, usually from 2 to 4 weeks of age. By castrating lambs when young the operation is simple and very little blood is lost. In

castrating lambs the lower one-third of the bag should be removed with a sharp knife which has been thoroly boiled or disinfected (in 4 per cent. solution of dip); next pull out the testicles, being sure to remove the entire cord. Apply a good antiseptic (coal tar or creosote dip, 2 per cent. solution) and put the lamb in a dry, clean pen for the rest of the day. Perform the operation in the morning of a sunshiny day so there will be no danger from taking cold. Many farmers do not consider that it is necessary to castrate early lambs, because they are sold before the hot weather begins and before they get "staggy." However, a man who castrates his lambs can let them run with the ewes longer and will have lambs that fatten more easily and sell for a higher price.

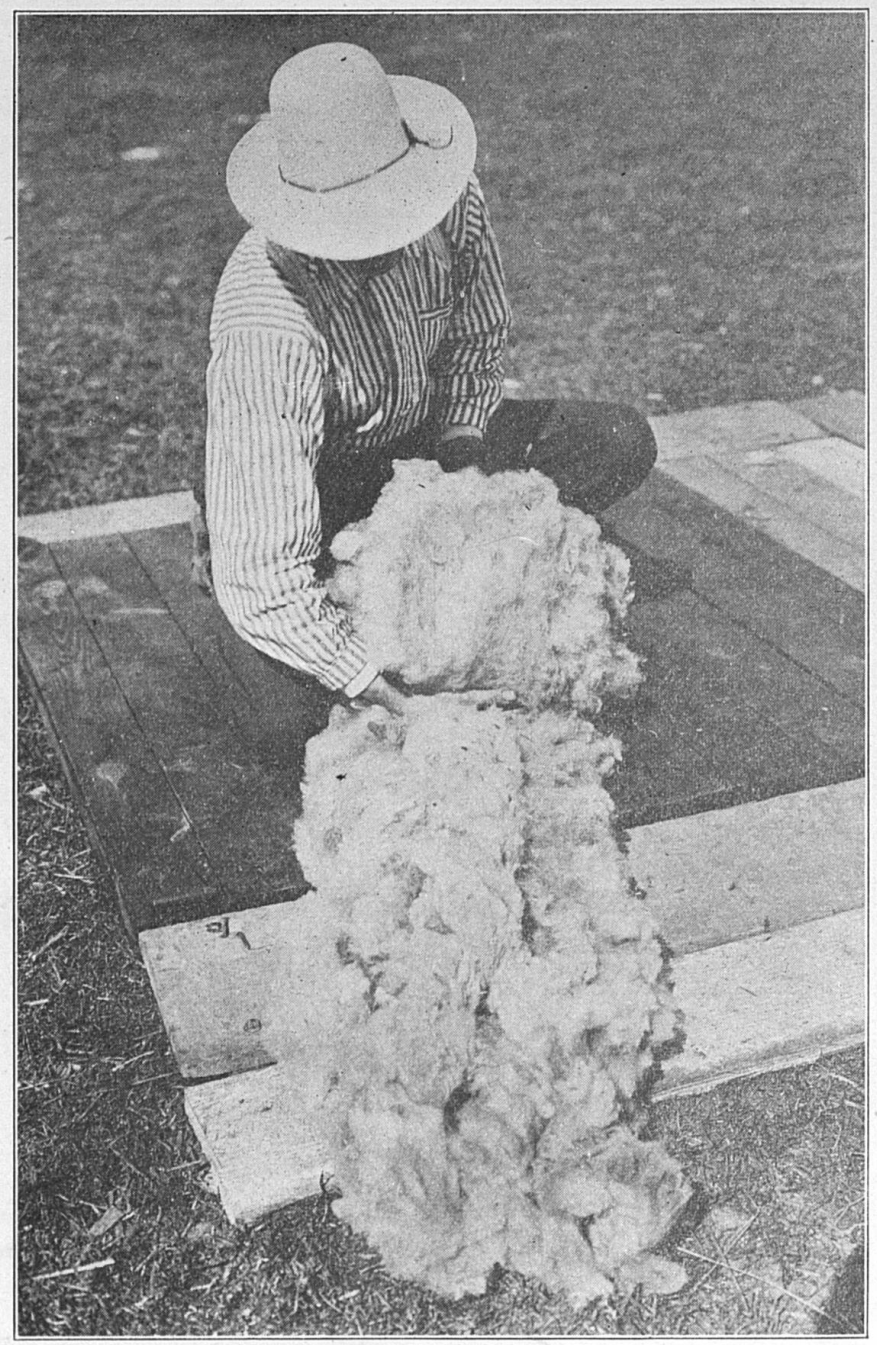
Shearing the Flock—The date of shearing, thruout Kentucky, ranges from April 15th to May 15th, the most common date being from the 1st to the 15th of May. Some men reported the shearing of their flock in April and again in August.

Shearing is done, for the most part, with machines because they perform the work quicker and with less labor than the old hand shears. For small flocks of 50 head the hand-power machines are the most practical, while with larger flocks the power driven machines save time and labor.

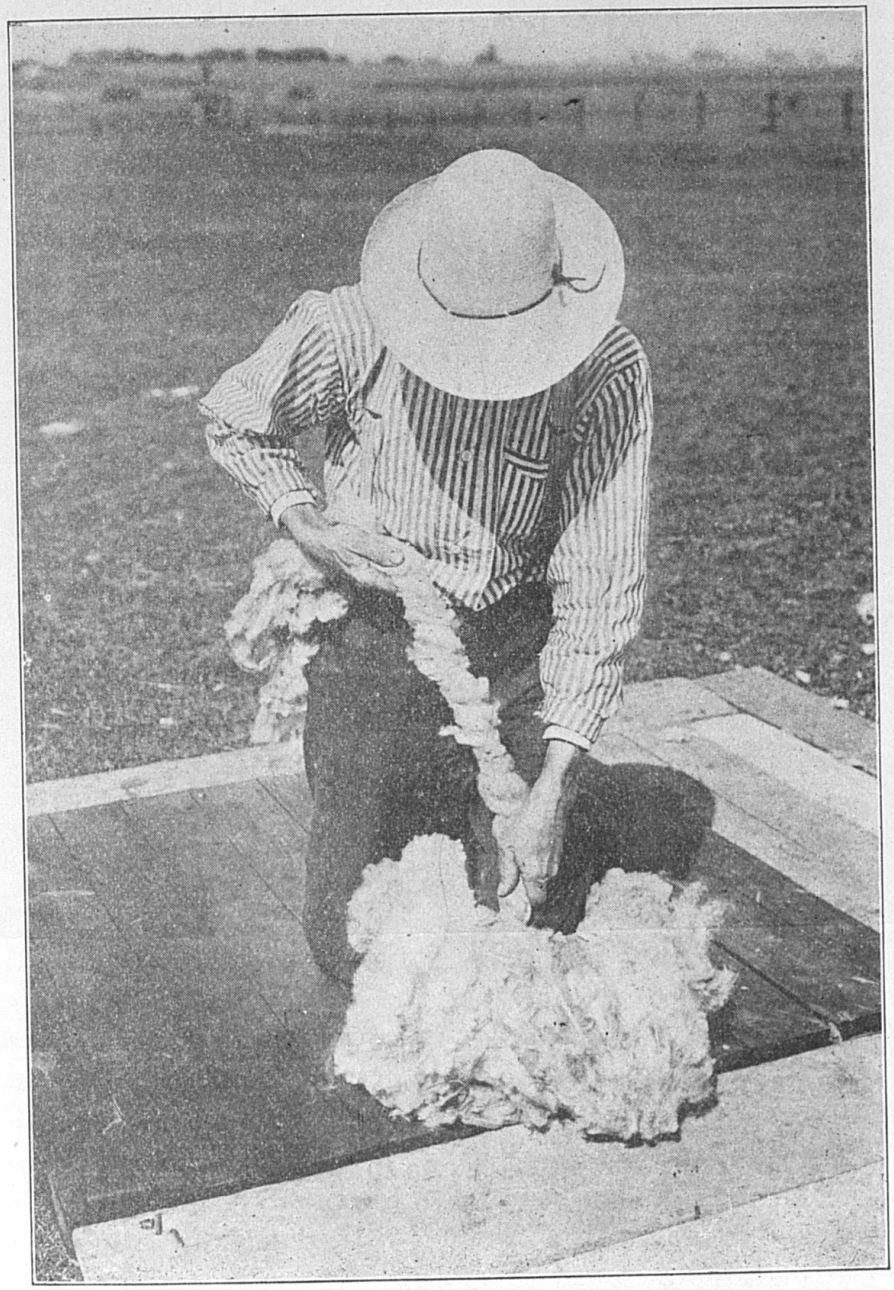
Before shearing, all dung locks and tags should be removed and sold separately. After shearing, place the fleece, skin side down, on a smooth surface, fold outer parts in and roll into a compact bundle. When finished, no outer part of the fleece should be seen.



SHEARING SHEEP.



FLEECE READY TO ROLL.



PROCESS OF TYING FLEECE.



A WELL-TIED FLEECE.

Fleeces can be tied either with a strand made from the wool or with regular paper twine sold for this purpose. Never use hemp or cotton twine to tie the fleece, because it gets into the wool and causes trouble in dyeing. Some wool buyers will not buy fleeces tied in this manner. In Kentucky, where shearing follows the lambing period, there is little danger from injury to the ewe.

WEIGHT OF FLEECE—The weight of fleece reported by breeders over the state varied from 2 to 10 lbs., while the average was 5.8 lbs. According to government figures the average

of the state is only 5 lbs., this being 2 lbs. less than the average of the United States. The reason for this light weight of fleece is explained by the use of the scrub ewe, which has a very coarse, open and light fleece. As long as the practis of using these mountain sheep, with no attempt toward improvement, continues, the weight of wool produced by Kentucky sheepmen will be inferior. By the selection of the best ewe lambs each year, sired by rams of superior mutton and wool qualities, the weight of wool can be materially increased. This has actually been done with mountain ewes at the Kentucky Experiment Station farm. In the last two years the Experiment Station, by the use of pure-bred rams of superior wool and mutton qualities, has been able to increase the weight of wool from cross-bred yearlings 3 lbs. per head. Even better results could be expected from the breeding of the high-grade ewe lambs. By the use of pure-bred rams and the substitution of cross-bred ewes for scrubs, the present wool supply of the state could be easily increased 25 to 30 per cent., with no increase in numbers. This fact, together with the high price of wool, should bring home to the man handling only scrub stock the advisability of changing his methods.

Marketing the Wool—The Kentucky wool crop is sold largely to local buyers who go thru the country in the early spring and contract for the farmers' output at a certain price. This system, while undoubtedly the easiest from the farmer's standpoint, in most cases is a very expensive one to him. This point may be best illustrated by a comparison of prices received by different farmers for last spring's wool crop. Reports show that prices ranged from 35 cents to 75 cents per pound, with an average of 52 cents. This means that some of those farmers who contracted early with wool buyers actually lost from 20 to 40 cents per pound, while those farmers who shipped their wool directly to a central wool market or pooled it with their neighbors for sale, received double the amount of the local buyers' price. Wool pools or co-operative organizations for selling the wool directly to large buyers, are gaining in popularity in Kentucky, the past season finding eighteen of them in successful operation. These organizations not only enable farmers to

obtain higher prices for their wool but teach them the value of grading and packing their wool product for sale. In some counties tobacco warehouses were used as salesrooms where representatives of the large wool buyers came to bid on the farmers' wool. When the farmer pays more attention to the grading and marketing end of his business, his losses will decrease and his profits increase. The Department of Markets of the College of Agriculture will undertake to inaugurate wool pools this spring.

Dipping the Sheep—The practis of dipping sheep to free them from ticks and lice is quite generally followed by Kentucky sheepmen. The time for dipping is shortly after shearing, during the months of May and June, while some men also dip in August and September. The sheep should be dipt twice, 10 or 12 days apart. Each individual should be kept in the solution 2 minutes and the head ducked for an instant just before the animal emerges from the vat. The best method is by the use of a dipping tank or vat. For the small flock a vat 10 to 12 feet long, 4 feet deep and 16 to 18 inches wide is suitable. The ordinary hog-dipping tank will answer the same purpose. One end should be perpendicular, while the other should have a cleated incline so that the animals may climb out. A draining platform which allows the liquid to run back into the vat is a means of saving. A few sheep may be dipt in an ordinary barrel.

Any of the nicotin or standard coal-tar sheep dips are good. Directions for use are given on the containers.

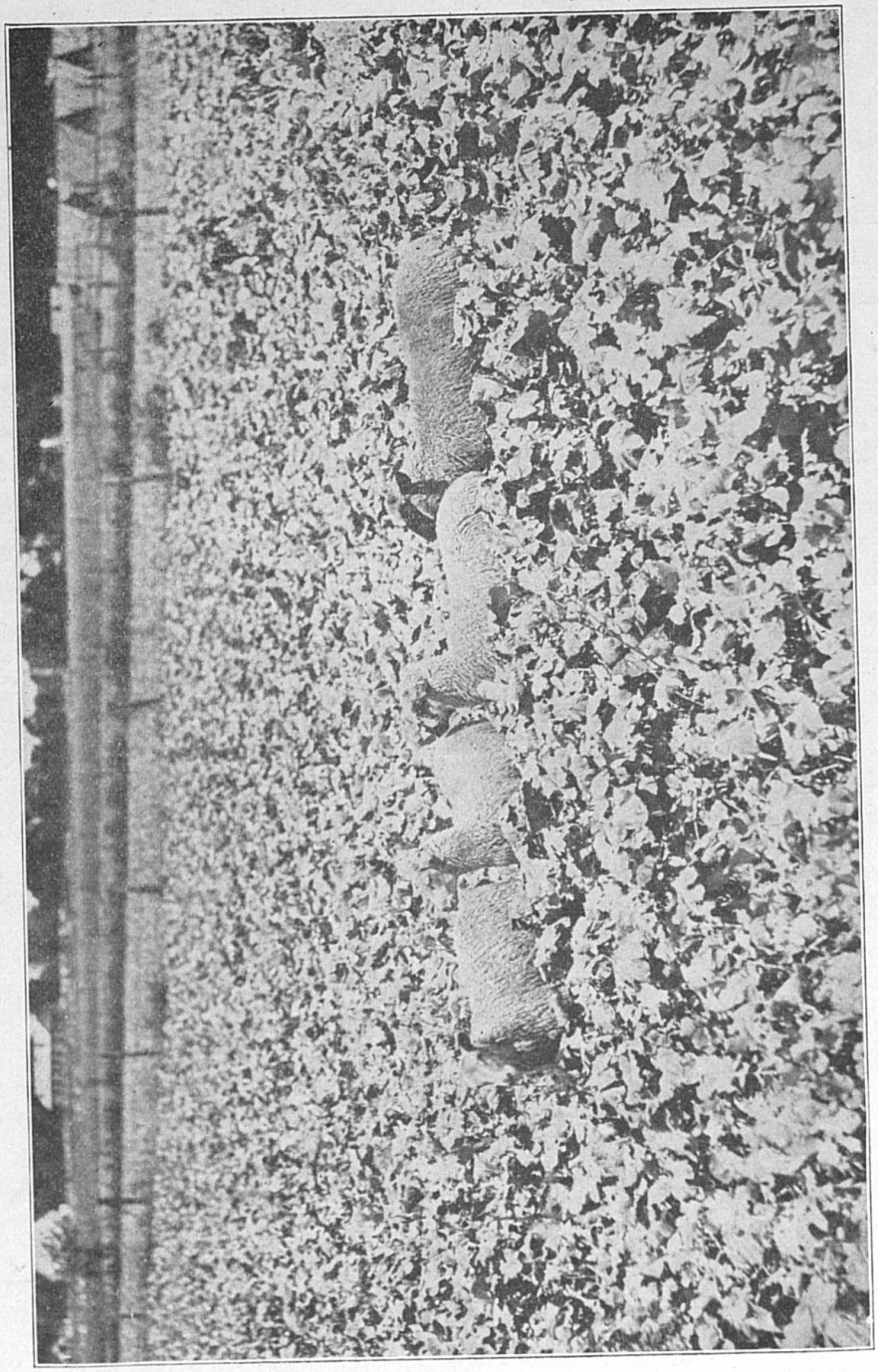
Summer Management—During the summer months the flock on the average Kentucky farm is left to shift for itself, due to the other pressing summer work. While it is true that sheep do not need as much care then as at other seasons of the year, yet some attention during the summer months is essential. In most sections of Kentucky rye will afford excellent early pasture for the entire flock and nothing is better to stimulate the milk flow of the ewes than this green, succulent feed. Whenever possible, sheep should be kept off bluegrass pasture in the early spring before the grass gets a good start. Reports from practical live stock men show that where this system is followed the grass is more nourishing and furnishes pasture for a longer

period during the summer. By the use of early rye the bluegrass can be saved until summer when the need is greatest.

FORAGE CROPS—The value of forage crops in connection with sheep husbandry cannot be overestimated. Green forage crops, the rotation of pastures and a reasonable amount of care will practically solve the problem of successful sheep production. The practis of this system of management is absolutely essential if Kentucky sheepmen are to stay in the business and build up their flocks by raising their own breeding stock.

Such diseases as stomach worm and nodule disease are the worst enemies of the sheep industry in the state and forage crops offer the most successful remedy for preventing these losses. Besides the aid in preventing disease, forage crops greatly increase the carrying capacity of the farm pastures, reduce the cost of production by lessening the amount of grain required and furnish an excellent means for fertilizing the farm. In order to do away with a large number of permanent fences, movable panels or woven wire fence can be used to good advantage.

The following table gives a suggestion of what crops may be grown for sheep in this state, their date of planting and pasturing season:



LAMBS IN RAPE PASTURE.

CROPS AVAILABLE FOR SHEEP PASTURE AT DIFFERENT TIMES.

Crop	Date of Sowing.	Rate of Seeding per Acre.	Time to Pasture.	Length of Time to Mature.	No. of Animals per Acre.
Cowpeas, Whippoorwill.	May 15 to June 15.	48 lbs. or 3 pks. per acre, sowed in rows 28 to 35".	Sept., Oct.	Sept. 15 to Oct. 22d. 1½ to 2 mo.	10-15 ewes or 15-25 lambs.
Soy beans, Haberlandt, Peking.	May 1st to July 1st.	25 to 40 lbs. sowed in rows 28-35" apart.	Sept., Oct.	4 mos., Sept. 20 to Oct.	8-15 ewes or 10-20 lambs.
Rape, Dwarf Essex.	May, Apr., in corn for summer. Early Aug. for fall pasture.	6 to 8 lbs. drilled in.	June to Aug., also until frost.	6 to 8 weeks.	10-15 ewes or 15-25 lambs.
Oats	March, April.	2 bus. to 3 bus.	Spring and early summer.	May, 6-7 weeks.	6-10 ewes or 10-15 lambs.
Rye	Aug. 1-30. Sept., Oct.	2 to 3 bus.	Spring and late fall. All winter.	3 to 4 weeks.	10 ewes or 10-15 lambs.
Alfalfa	Spring or fall.	15-20 lbs.	All summer and fall.	1 year.	10 ewes or 15-20 lambs.
Red Clover	Spring, Feb. or March.	10-15 lbs. drilled in wheat or broadcast.	Aug., Sept., Oct.	Aug., Sept., Oct.	10-15 lambs.
Sorghum, Sudan grass.	May or early June.	8-10 lbs.	July to Oct. Summer.	2 mos., July.	15-20 lambs.
Mangels or beets	April or May.	6-8 lbs.	October.	4-5 months.	

Rotation of Pastures. In order to control parasites and to keep the flock in a healthy condition, the frequent changing of pastures is essential. Where only permanent bluegrass pasture is available the flock should be changed every two weeks. In badly infested flocks lambs should be separated from the ewes before June, being kept in another field and allowed to nurse their mothers at night in the dry lot or barn.

Salt, Water and Shade. It is best to keep salt before sheep at all times. This can best be accomplished by placing it in small covered containers so as to keep it dry when it rains. Fresh water should be provided and utensils used in this connection should be kept clean. The use of a small barrel with a hole in the side large enough for a sheep to insert its head is a good way to water sheep, where running water is not found. During the summer months shade should be provided. Trees in a pasture will answer for this purpose. If these are absent shade can be provided with boards.

Weaning the Lambs. Kentucky spring lambs are usually sold directly from the ewes, at 4 or 5 months of age. Lambs kept for breeding should be weaned at the same time and put on fresh pastures where there is no danger from infestation by stomach worms. After weaning the lambs the ewe should be kept on scanty pasture several days in order to check the milk supply. Inspect the udders and where necessary they should be milked out every few days until dry, so as to prevent injury from becoming caked.

Late Summer Management of Lambs and Ewes. July and August are among the hardest months in the year on the flock and especially on late lambs. Bluegrass pastures are dried up and the conditions are most favorable to the work of the stomach worm. Forage crops are very valuable at this time in supplementing bluegrass. During August the ewe flock should be gone over and all diseased, non-breeding and old ewes should be taken out, fattened, if possible, and shipped to market, filling their places with healthy ewe lambs.

Marketing the Lamb Crop. The Kentucky spring lamb is a specialized product and finds a ready sale in eastern and north-

ern markets. First shipments of Kentucky lambs start in early May, but the month of June sees over 50 per cent. of the trade, while during July and August the culls and late lambs are sold. Spring lambs are marketed from 3½ to 5 months old and weigh from 65 to 90 pounds, the most popular market weight being 70 to 75 pounds. The highest prices are usually paid for the early lambs in April and May, altho June prices are always good and recent July prices have held up remarkably well. As a general practis it should be the aim of the Kentucky sheepman to have his lambs ready to market as early as possible, in order to obtain the high prices offered and also to escape the loss from diseases so common with late lambs.

MARKETS. Probably no region in the United States is more ideally located from a marketing standpoint than is Kentucky, because of her close proximity to a number of good markets. With Louisville and Cincinnati on the north, St. Louis on the west, and Jersey City, Baltimore and Pittsburg on the east, the Kentucky sheep raiser should have little trouble in disposing of his product at excellent prices. Notwithstanding these advantages the Kentucky farmer fails to profit by them, largely because of his inefficient and costly methods of marketing. Over 60 per cent. of all lambs marketed are sold to local buyers who travel thru the country contracting for the season's lamb crop several weeks before their sale. The farmers sell to these men and agree to deliver their lambs in finished condition, averaging around 65 pounds. About 30 per cent. of the men reporting shipped their lambs directly to some central live stock market, while 8 per cent. sold to local butchers. According to government reports* over 81 per cent of sheep sold in Kentucky are handled thru the local buyer. The prices paid by local buyers are, as a rule, considerably below the market price, varying with the distance, amount of competition and with grade of stock handled. In some localities where competition is keen, fair prices are paid the farmer, but in most cases he sells his stock far below market value.

In Kentucky, where the farmers carry on sheep raising with

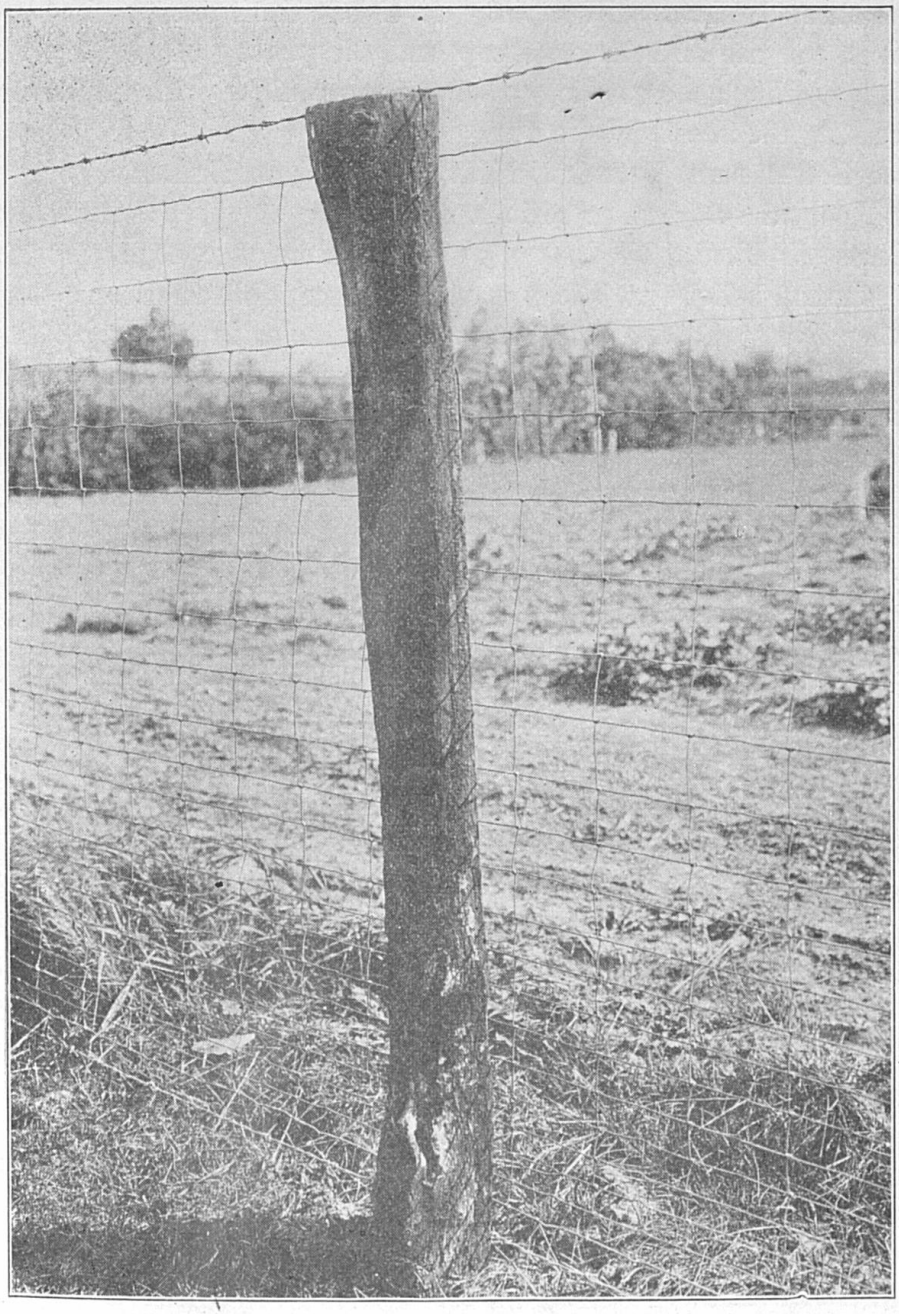
*Report 113. Bureau of Markets. Meat Situation in the United States.

small flocks, the co-operative shipping organization offers the best means of getting around the difficulty of marketing. These co-operative shipping organizations are composed of the farmers of one locality, for the purpose of more efficiently and profitably shipping their stock. They are easily formed, require little capital and with the aid of a capable manager can be used not only to market lambs and wool but all other live stock and grain products. In Minnesota, Wisconsin, Kansas, Nebraska and Tennessee these organizations have proved very successful in reducing marketing costs and thus increasing the farmers' profits. For information along the line of organization of such associations write the Department of Markets, Kentucky Agricultural Experiment Station.

IV. Obstacles to the Sheep Industry.

Notwithstanding the high prices paid for lambs during the past few years, the number of sheep in the state has steadily declined, a circumstance for which there must be some very logical reason. Aside from the fact that in some sections grain and tobacco farming have been more profitable, the direct causes for this decline may be summed up by noting the following obstacles to successful sheep raising:

Dogs. Without doubt the "chief bugbear" to the sheep industry in the state is the "cur dog pest." In recent years this one factor has done more, not only to cause sheepmen to become disgusted and to dispose of their flocks, but also to keep hundreds of other men from going into the business. Reports from Kentucky sheep raisers show that 69 per cent. of them consider the dog the greatest menace to the sheep business today. The losses reported for 1916 varied from 1 to 68 head per flock. From these figures one can see that the dog menace is the greatest limiting factor to further development of the sheep industry in Kentucky. The solution of the dog problem rests largely with the farmers themselves. By co-operation of farmers by communities and counties for the elimination of the "cur," by the election of competent men to office who will enforce the dog law, by requiring all dogs not taxed to be killed and by the restraint of dogs at



DOG-PROOF FENCE.

night, the "dog pest" will cease to be. As soon as this occurs, the sheep business will rapidly develop. Until such a time arrives, the use of bells on sheep and the practis of keeping the flock within a closed, dog-proof fence at night will aid in decreasing the loss from the dog.

Losses from Disease. Next to the dog problem in notoriety and considerably more serious in number of sheep lost, is the disease problem. The lack of "sheep" knowledge, together with a common belief that sheep are more susceptible to disease than other live stock, are both important obstacles in the way of increased production. While it is true that sheep do require careful attention, in order to do well, yet with proper care they are no more susceptible to disease than other kinds of live stock.

Common Diseases and Their Treatment. Diseases of sheep may be divided into (1) internal and (2) external troubles. Under internal are considered the parasites working in the stomach and intestines, bloat and indigestion; while under external diseases are included such as ticks, scab and foot rot.

Internal Diseases

Stomach Worms. Probably the most injurious of all parasites affecting sheep are the stomach worms. Lambs, as a rule, die when badly infested, while old ewes may linger for months in a run down condition which makes them very unprofitable. The worms are taken into the mouth with the grass and lodge in the fourth stomach. Here they develop and produce a large number of eggs, many of which are passed out in the feces of the animal. Irritation of the lining of the stomach by the worms produces indigestion and scours. They also are blood sucking parasites and utilize the sheep's food supply. Infestation is most serious in late lambs during July and August. Lambs affected are subject to diarrhoea, are unthrifty, have harsh dry fleeces and yellowish colored skins.

Remedies. Prevention is better than cure with this disease. Thru the use of green forage crops and rotation of pastures it can be largely prevented.

Gasoline treatment—Sheep should be kept off of feed and

water the night previous to treatment. The dose should be 1 tablespoon of gasoline with 2 tablespoons of linseed oil in a cup of sweet milk. Administer as a drench by means of a long necked bottle, care being taken not to strangle the sheep. If badly infested, repeat in a couple of days.

Copper Sulfate—A simple and more effective remedy is copper sulfate or common "blue stone" which is advocated by the U. S. Department of Agriculture.* Keep sheep off of feed and water over night and give as a drench 50 to 100 cc of 1 per cent. copper sulfate solution. For a lamb 50-75 cc or 3 or 4 tablespoonfuls is sufficient, while old ewes require from 75 to 100 cc, or 4 to 6 tablespoonsful for results. For mixing up the proper solution—dissolve 2½ level tablespoonsful of pulverized "bluestone" in 1 gallon of water, which amount is sufficient to treat about 75 lambs. The following morning give each a dose of Epsom salts in a little dry feed, the amounts being 1 to 2 ozs. for lambs and 2 to 4 ozs. for mature sheep.

Nodular Disease. Nodular disease is another parasitic infection. This parasite is taken into the system in the form of eggs on grass or feed, and lodges in the intestinal tract. On reaching the intestines the eggs develop and the small worms fasten themselves to the walls, later working into the lining. Here they form tumors or nodules, as many as 1,000 being found in the tract of one sheep. These parasites obtain their nourishment from the intestinal fluids and from the blood, thus robbing of nourishment and weakening the constitution of the infested animal.

Mature sheep suffer greater loss than lambs because of the time required for the disease to develop. Symptoms in old sheep are similar to those of lambs—loss of condition, harsh fleece, pale-colored skin but vigorous appetite until the acute stages are reached, when the animal becomes listless, weakened and finally dies.

The disease is incurable, but can be combated by preventive methods and careful management. Pastures should be rotated

*Cir. No. 102. Bureau of Animal Industry, U. S. Department of Agriculture.

every few weeks and forage crops should be utilized, because the parasites are picked up from infested grass lands. During the winter, when no green feed is available, the feeding of some succulent roughage such as silage, together with a laxative grain ration, such as bran and oil meal, will aid in keeping the ewes in a vigorous, healthy condition. A dose of 2 to 4 ozs. of Glauber's salt, administered in the daily feed, when the disease is suspected, will often prove beneficial. When the flock is badly infested it is sometimes best to sell them all and allow the pastures to rest for several months.

Scours. This is a common ailment with lambs, caused by change of feed, by overfeeding and by internal parasites. The best remedy is to remove the cause, cut down on the feed and feed a small amount of some dry ration, as wheat bran and oats. A tablespoonful of ginger in a cup of warm water usually helps, while with young lambs a dose of 1 to 2 tablespoonsful of castor oil is beneficial.

Constipation. In sheep, stretching is a symptom of this trouble. A good remedy, for young lambs, is 1 to 2 tablespoonsful of castor oil; with mature sheep, 4 to 6 ozs. of Epsom salts, dissolved in warm water and administered as a drench, is effective.

Bloat—In pasturing sheep on forage crops such as rape, clover and alfalfa, the loss from bloat is considerable. This can often be prevented by gradually getting the sheep accustomed to the pasture by feeding a small amount of dry feed each morning before turning them on pasture. Another good plan is to have a bluegrass pasture in connection with the forage pasture. When an animal does become affected the best remedy is the formalin treatment. For a 60-70 pound lamb, administer as a drench 4 ounces or 8 tablespoonsful of a 1½ per cent. solution of formalin. Formalin is the trade name for a 40 per cent. formaldehyde solution and can be obtained at any drug store. To prepare this 1½ per cent. solution, add 1 tablespoonful of formalin to 1 quart of water. After drenching, place a block of wood in the lamb's mouth in order to allow gases to escape. Sometimes pressing firmly in the animal's sides aids in reducing bloat.

After the animal is relieved it is well to follow with 2 ozs. of Epsom salts, together with ½ oz. of ground ginger, in a small amount of water, as a drench. In extreme cases the use of the trocar may be necessary.

Caked Udder. Caked udder results from an inflammation caused by cold, wet floors, injury or overfeeding at lambing time. When the udder is caked, milk it dry then bathe the udder with as hot water as the hand can stand for twenty minutes using a cloth for the purpose. Then rub dry with a woolen cloth. After this rub on hog lard. The treatment should be repeated three or four times a day until relieved. Put her in a clean, dry pen.

External Diseases

Maggots. Maggots, or worms from eggs of the blow-fly, occur in late summer, especially around sores or soiled wool locks. The larvae eat into the flesh of the sheep and, unless prompt treatment is given, will cause death. Washing the affected parts with a solution of coal tar dip or any good antiseptic and the application of a good carbolic salve will effect a cure.

Sore Eyes and Mouth. One of the best remedies for sore eyes and mouth is a saturated solution of boric acid dropped into the eyes by the aid of an eye dropper. Common burnt alum blown into the eyes is another remedy. Sheep dip applied to sore mouth is good.

Ticks and Scab. These are of very little concern to the man who dips his flock each year as has already been mentioned.

Foot Rot. This disease is caused by too much moisture and by the accumulation of filth between the toes, producing lameness. True foot rot is infectious and spreads rapidly on wet land. There is an offensive odor and the hoof becomes swollen and rotten. Cut away all diseased portions of hoofs, after which treat the feet thoroly with saturated copper sulfate solution. Be careful not to get this solution above the hoofs as it causes the hair to drop off.

Grub in the Head. This is another common disease prevalent during the summer months. It is caused by the gadfly

which lays eggs in the sheep's nostrils. These eggs hatch out and the small grubs crowd up into the passages and attach themselves to the mucous membrane. This moving about produces great irritation and annoyance to the sheep and causes them to sneeze violently. While these grubs do not cause any permanent injury, yet they hinder the maximum development of the flock and this should be prevented. Probably the best means is the practis of smearing pine tar in the nostrils, the smell of which prevents the gadfly from laying the eggs. Bore a number of 2 inch holes in a plank or log and fill these holes part full of salt. Smear the pine tar around the edge of each hole and the sheep will automatically smear their own noses in reaching for the salt.

V. Needs of the Kentucky Sheep Industry

Increased Numbers. The most pressing need at the present time is that of increasing the supply of breeding stock. The native mountain flocks have been greatly reduced and the mountain districts are now almost bare of sheep. An increase in the number and a wider distribution of the sheep business is essential for its ultimate success.

Improvement of Flocks. The flocks already in the state may be improved by the use of pure-bred rams of superior mutton and wool qualities, by saving the best ewe lambs and by the abandonment of the present practis of wholesale marketing of breeding ewes every fall.

Care and Management. These are essential to successful sheep production, and as soon as the idea that "sheep are only scavengers" calling for little or no attention, is dispelled, just that soon will the sheep business become a profitable enterprise on the farm. The feeding of well balanced rations to the ewes, especially before and during lambing, greatly increases the strength and number of lambs raised.

By the rotation of pastures and the utilization of forage crops, the sheep can be maintained in a healthy condition, larger numbers can be handled and the cost of production greatly reduced. Preventive as well as curative measures should be prac-

tist in the control of disease and the reduction in loss of sheep in the state.

Castration and Docking. These are two practises that pay well, not only in higher prices but in producing healthier and more rapidly maturing lambs of superior quality.

A More Intimate Knowledge. A knowledge of sheep and the sheep business, on the part of the farmer, will add greatly to the profits of the business by reducing losses and lowering cost of production. Farmers in general have a good insight into the cattle and hog business but only a comparatively few either have the patience or desire to acquaint themselves with the proper management of the farm flock.

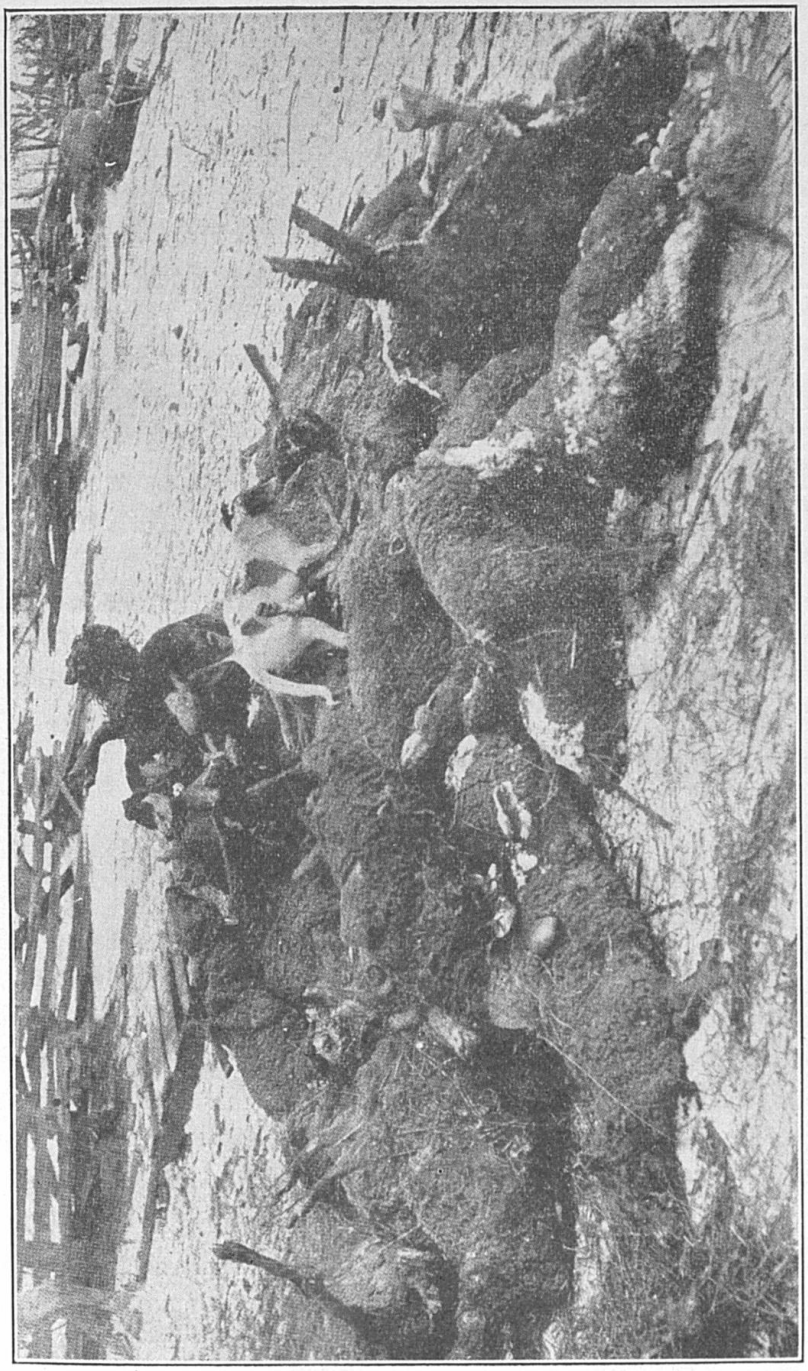
Co-operation Needed. While all these needs are very evident and would bring surprising results if satisfied, yet undoubtedly the most crying need for the small sheep raiser of Kentucky is that of co-operation. By means of co-operative methods in the purchase and use of breeding stock and standardization of breeds, the sheep industry in certain communities could be greatly improved. Besides the reduced cost from interchange of live stock the community's reputation as a live stock center would be established.

Co-operation is needed in ridding the country of "cur dogs" and curable diseases. By means of community effort in disposing of worthless dogs, this menace could be quickly eradicated and the fear from this curse removed.

Co-operation in Marketing—In sections where the small flock is the practical unit, the problem of marketing is one of vital concern to the small shipper. Local buyers' prices are usually much below those of the central market and these lower prices do not allow a fair return on the enterprise. By means of co-operative shipping associations both lambs and wool can be handled to the best possible advantage and on equal terms with the direct shipper. Not only does the small shipper obtain more for his product but he also learns the type and grade of lambs and wool that the market demands.

Co-operation with the Kentucky Agricultural Experiment Station in the way of obtaining expert information as to the

best methods of management and care of his live stock, will bring returns to the farmer by decreasing unnecessary losses and consequently increasing profits. The circulars and bulletins of the Station will be sent free to any one who desires them and any other information of a more definite nature can be obtained by means of letters.



Fifty sheep killed by two dogs in one night. Photograph secured thru the courtesy of the More Sheep More Wool Association of the United States.

APPENDIX.

The New Dog Law.

The following act relative to taxing and restraining dogs and reimbursing owners of live stock for damage done by dogs was passed by the General Assembly, recently adjourned, after the text of this bulletin had been put into type. It is a measure which will do much to promote the sheep industry of this State.

The amount of wool produced in this country has gradually decreased from 321,362,750 pounds in 1910 to 288,490,000 pounds in 1916. It is said "that if our imports of wool be cut off, so that we have to use reworked or shoddy wool, there would be just about enough to equip and maintain an army of 2,000,000 men, while the rest of the country would have to dress on cotton or some other textile fabric, as not a pound of new wool would be available for civilian use." On the other hand it is estimated that there are 10,000,000 dogs in the United States which cost the nation over a quarter of a billion dollars annually for their food support.

House Bill No. 349.

AN ACT relating to dogs, the promotion of live stock industries, and the protection of live stock and poultry from damage by dogs; providing for the licensing of dogs; regulating the keeping of dogs, and authorizing their destruction in certain cases; providing for the protection of licensed dogs, and for dogs temporarily imported for trial, show, and breeding purposes; prescribing certain privileges for hunting dogs, providing for listing of dogs by County Assessors and penalty for his failure to so list; providing for the assessment of damages done by dogs, and payment thereof by the proper county to the owners of live stock and poultry, and of damages to licensed dogs; imposing powers and duties on certain State and County officers and providing penalties and fees.

Be it enacted by the General Assembly of the Commonwealth of Kentucky:

Section One. That this act shall be known and may be cited as an act to promote and protect live stock industries in Kentucky.

Section Two. For the purpose of this act the following terms shall have the following meanings respectively designated for each: The term "livestock" shall include horses, stallions, colts, geldings, mares, sheep, rams, lambs, bulls, bullocks, steers, heifers, cows, calves, mules, jacks, jennets, burros, goats, kids and swine. The term "poultry" shall include all domestic fowls. The word "person" shall include state and local officers or employes, individuals, corporations, copartnerships and associations. Singular words shall include the plural. Masculine words shall include the feminine and neuter. The word "owner" when applied to the proprietorship of a dog, shall include every person having a right of property in such dog, and every person who keeps or harbors such dog or has it in his care, and every person who permits such dog to remain on or about any premises occupied by him.

Section Three. The term "kennel" shall mean any establishment wherein or whereon dogs are kept for the purpose of breeding, sale or sporting purposes. The term "police officer" shall mean any sheriff or his deputies or any one appointed by the sheriff in this Commonwealth, and whose duty it is to enforce this law.

Section Four. On or before the first day of January one thousand nine hundred and nineteen and on or before the first day of January of each year thereafter, the owner of any dog shall apply to the county court clerk or deputy county clerk, as hereinafter provided, of the county in which said owner resides, either orally or in writing, for a license for each such dog owned or kept by him. Such application shall state the breed, sex, age, color, and markings of such dog, and the name and address of the last previous owner; and shall be accompanied by a fee of one dollar for the first male dog for which license is applied by the owner, and by a fee of two dollars for

the first female dog for which license is applied by the owner, and by a fee of two dollars for each male and a fee of four dollars for each female for which license is applied subsequent and in addition to the first male or female licensed as above provided for.

Section Five. Such license shall be issued on a form prepared and supplied by the Commissioner of Agriculture to said county court clerk. Such license shall be dated and numbered, and shall bear the name of the county issuing it and a description of the dog licensed. All licenses shall be void on the first day of January of the following year. The Commissioner of Agriculture shall furnish the county court clerk of each county, with each license, a metal tag. Such tag shall be affixed to a substantial collar. The collar shall be furnished by the owner, and with the tag attached shall at all times be kept on the dog for which the license is issued.

Section Six. The Commissioner of Agriculture shall prepare and furnish to the county court clerk annually, metal tags to be given by the county court clerk to the owners of dogs when such owners shall pay the license fee for said dogs. Such tags shall be of metal, and shall bear the name of county issuing it, and a serial number corresponding with the number on the license issued to said owner, as provided in the preceeding section of this act. Such tags shall also have impressed thereon the calendar year for which such tag is issued, and shall be equipped with a substantial metal fastening device. The general shape of said tag shall be changed from year to year. Said blank license and said metal tags shall be paid for by the county for which said license and tags are issued. If any such tag is lost it shall be replaced without cost by the county court clerk, upon application by the person to whom the original license was issued, and upon production of such license.

Section Seven. Any deputy county clerk within the county applying to the county court clerk, and having received and receipted for necessary blanks and tags, may issue such dog license and tags in like manner as prescribed for the is-

suance of licenses by the county court clerk, and for so doing shall receive the same fee in the same manner as is provided for the county clerk in section fifteen hereof. Within ten days after the issuance of any license by him he shall report same to the county clerk and turn over to him all receipts for licenses issued, whereupon the county court clerk shall make record of, and otherwise treat, said license as though it had been issued from his office, except that he shall also note upon his record the name of the deputy clerk issuing the license. Every deputy clerk shall deliver the book or books from which he has issued licenses, together with the stubs therein properly filled out and showing the names of each licensee and the number of license issued to him, to the county clerk before the first day of January of each year.

Section Eight. Any person becoming the owner, after the first day of January of any year, of any dog which has not already been licensed, shall forthwith apply for and secure a license for such dog in the same manner as the annual license is obtained under the provisions of this act.

Section Nine. No license or license tag issued for one dog shall be transferrable to another dog, except as provided in sections eleven and twelve of this act. Whenever the ownership or possession of any dog is permanently transferred from one person to another within the same county, the license of such dog may be likewise transferred, upon notice given to the county court clerk. This act does not require the procurement of a new license, or the transfer of a license already secured, when the possession of a dog is temporarily transferred for the purpose of hunting game, or for breeding, trial, or show, in this Commonwealth.

Section Ten. Whenever any dog licensed in one county is permanently removed to another county, the county court clerk of the county where the license was issued shall, upon the application of the owner or keeper of such dog, certify such license to the county court clerk of the county to which the dog is removed. Such county court clerk shall thereupon, and upon the payment of a fee of twenty-five cents, issue a license

and tag for such dog in the county to which it is removed. This section does not apply to dogs used during the hunting season for hunting game, or temporarily for breeding, trial, or show in the Commonwealth; nor for the transportation of dogs, for hunting, breeding, trial, or show purposes, the home county license holding good for such purposes throughout the Commonwealth.

Section Eleven. Any person who keeps or operates a kennel may, in lieu of the license for each dog required by this act, apply to the county court clerk for a kennel license, entitling him to keep or operate such kennel. Such license shall be issued by the county court clerk on a form prepared and supplied by the Commissioner of Agriculture to the county court clerk, and shall entitle the licensee to keep any number of dogs not at any time exceeding a certain number to be specified in the license. The fee to be paid for each kennel license shall be $10.00 ten dollars for ten dogs or less, and $25.00 twenty-five dollars for more than ten dogs permitted to be kept under the kennel license. With each kennel license the county court clerk shall issue a number of metal tags equal to the number of dogs authorized to be kept in the kennel. All such tags shall bear the name of the county issuing it, the number of the kennel license, and shall be readily distinguishable from the individual license tags for the same year.

Section Twelve. The licensee of a kennel shall, at all times, keep one of such tags attached to a collar on each dog kept by him under a kennel license. Such tags may be transferred from one dog to another within the kennel whenever any dog is removed from the kennel. No dog bearing a kennel tag shall be permitted to stray or to be taken anywhere outside the limits of the kennel. This section does not prohibit the taking of dogs having a kennel license outside the limits of the kennel temporarily and in leash, nor does it prohibit the taking of such dogs out of the kennel temporarily for the purpose of hunting, breeding, trial or show.

Section Thirteen. Any person may bring or cause to be

brought into the State, for a period of thirty days, one or more dogs for show, trial or breeding purposes.

Section Fourteen. The county court clerk shall keep a record of all dog licenses, and all kennel licenses, and all permits issued during the year. Such record shall contain the name and address of the person to whom each license or permit is issued. In the case of an individual license, the record shall also state the breed, sex, age, color and markings of the dog licensed; and in the case of a kennel license, it shall state the place where the business is conducted. The record shall be a public record and open to persons interested, during business hours. And in addition thereto it shall be the duty of the county court clerk to cause to be published by precincts in one of the newspapers in this county, if there be such, by February fifteenth of each year, the owner's name, postoffice and number of dogs for which he has obtained a license. Whenever the ownership or possession of any dog licensed under the provisions of this act is transferred from one person to another, except the temporary transfer of dogs for hunting purposes, or for breeding, trial, or show, as provided in section nine of this act, such transfer shall be noted on the record of the county court clerk.

Section Fifteen. An accurate record of all license fees collected by the county court clerk, or paid over to him by any deputy clerk shall be kept in a book furnished by the Commissioner of Agriculture as a matter of information; but all such funds shall be turned into the county funds for the payment of live stock or poultry killed or damaged by dogs except as hereinafter provided. All moneys at present in the "dog fund" derived from taxation of dogs under the existing law, shall be turned into the said fund. All bills incurred under this act, or due at the time of the passage of this act, shall be paid out of the said fund. The said county court clerk or deputy shall receive 25c twenty-five cents for each and every license issued by them respectively, to be paid out of said county fund and shall be retained by the county clerk or deputy as his fee for issuing said license.

Section Sixteen. The assessors in each county, of this Commonwealth shall annually, at the time of assessing property as required by law, make diligent inquiry as to the number of dogs, owned, harbored, or kept by any person, and shall list them. The assessor shall receive ten cents (10c) per dog for each dog listed by him, same to be paid out of said county fund. The assessor shall annually, on or before the thirty-first day of December, make a complete report to the county clerk, and duplicate report to the Commissioner of Agriculture on a blank form furnished by the county court clerk, setting forth the name of every owner of any dog or dogs, whether licensed or unlicensed, the license number of each licensed dog, how many of each sex, licensed or unlicensed, are by him owned or harbored, and if a licensed or unlicensed kennel is maintained by any person such fact shall also be stated. It shall be the duty of the assessor, at the time of taking the list, to notify the owner of such dog or dogs that he must obtain a license for same as provided for in this act; but the neglect or failure to so notify such owner shall not relieve the owner from his duty to obtain such license.

Section Seventeen. On and after the first day of January, one thousand nine hundred and nineteen, it shall be unlawful for any person to own or keep any dog unless such dog is licensed by the county court clerk or deputy of the county in which the dog is kept; and unless such dog at all times wears the collar and tag provided for by this act, excepting such dogs as are temporarily brought into the State for breeding, trial or show purposes.

Section Eighteen. It shall be the duty of the sheriff of the county or his deputy to seize and impound any dog or dogs which are found running at large and unaccompanied by its owner or keeper. It shall be the duty of the sheriff or deputy to seize and impound any dog, running at large which does not bear a proper licensed tag. Sheriff or deputy shall cause any dog bearing a proper license tag and so seized and impounded to be properly kept and fed, and shall cause immediate notice, either personal or by registered mail, to be given to the

person from whom or from whose premises the dog was taken or in whose name the license was procured, or his agent to claim such dog, within ten days. And it shall also be the duty of sheriff or deputy to go upon the premises of any person for the purpose of ascertaining if such person is the owner of or is harboring any unlicensed dog or dogs, and if such officer find any unlicensed dog or dogs the officer shall seize and impound said dog or dogs, as is above provided, and he shall give notice as above provided.

Section Nineteen. If, after ten days from the giving of such notice, such dog has not been claimed, such officer whose duty it is to enforce this act shall dispose of such dog by sale, or by destruction in some humane manner. All moneys derived from the sale of such dog after deducting the expenses of its detention shall be paid to the county court clerk and by him placed in the county live stock funds. For services under sections eighteen and nineteen of this act, such officers shall be paid the sum of two ($2.00) dollars for impounding and detaining a licensed dog, and the sum of one ($1.00) dollar for the killing of the dog. All expenses incurred under this act or the preceding section, and not otherwise provided for, shall be paid by the proper county.

Section Twenty. For failure to perform any duty under the provisions of this act, any officer shall be liable to a penalty of not less than five nor more than twenty dollars for each offense, which amount shall be deducted from any amount due such officer from the county at any settlement between such officer and the governing authorities, or if it appear that nothing be due, then to be collected as any other fine, and as provided by law.

Section Twenty-one. Any person may kill any dog which he sees in the act of pursuing, worrying or wounding any live stock, or attacking human beings, whether or not such dog bears the license tag required by the provisions of this act. There shall be no liability on such person in damages or otherwise for such killing. Any dog that enters any field unaccompanied by its owner shall constitute a private nuis-

ance, and the owner or tenant of such field, or their agent or servant, may kill such dog while it is in the field, without liability or responsibility of any nature for such killing. Licensed dogs when accompanied by their owner or handler shall not be included under the provisions of this section unless caught in the act of worrying, wounding or killing any live stock, or attacking human beings.

Section Twenty-two. It shall be unlawful for any person, except the owner or authorized agent, to remove any license tag from a dog collar, or to remove any collar with a license tag attached thereto from any dog. It shall be unlawful for any person to harbor, or permit to remain about his premises, any dog not having a license.

Section Twenty-three. It is unlawful for the owner or keeper of any female dog to permit such female dog to go beyond the premises of such owner or keeper at any time she is in heat, unless such female dog is held properly in leash.

Section Twenty-four. The owner or keeper of every dog shall keep at all times between sunset and sunrise of each day, such dog—either (a) confined within an enclosure from which it cannot escape, or (b) firmly secured by means of a collar and chain, or block attached, or other device so that it cannot stray beyond the premises on which it is secured, or (c) under the reasonable control of some person, or when engaged in lawful hunting accompanied by an owner or handler. Any dog found or discovered off the premises of the owner between sunset and sunrise, unaccompanied by the owner, shall be considered as being an unlicensed dog and may be killed by the one so finding said dog or dogs, unless such person so finding such dog shall elect to hold him and then turn him over to the sheriff or deputy sheriff for impounding as provided in sections eighteen and nineteen hereof.

Section Twenty-five. Whenever any person sustains any loss or damage to any live stock or poultry by dogs, or any live stock of any person is necessarily destroyed because of having been bitten by a dog, such person or his agent, or at-

torney may complain to the county judge, or to any justice of the peace.

Such complaint shall be in writing, shall be signed by the person making such complaint, and shall state when, where and how such damage was done, and by whose dog or dogs, if known. Such county judge, or justice of the peace, shall appoint two appraisers whose duty it shall be to investigate and ascertain the amount of damages sustained. Said appraisers shall be a resident land owner of the county and not related to claimant by either blood or marriage. Said appraisers shall examine the place where the alleged loss or damage was sustained and the live stock or poultry injured or killed, and shall also examine under oath or affirmation any witness called before them. After making diligent inquiry in relation to such claim, said appraisers shall determine whether any damage has been sustained and the amount thereof, and if possible, who was the owner of the dog or dogs by which such damage was done, and shall forthwith make a written report of this investigation and findings to the county judge, or justice of the peace appointing them. Any owner or keeper of such dog or dogs shall be liable to the county in which the damages occurred to such live stock or poultry in a civil action for all damages and costs, and the owner who suffers the loss shall be reimbursed out of said funds of the county in which said damage occurred.

Section Twenty-six. Upon making the examination required in section twenty-five of this act, the county judge or magistrate shall immediately make a certificate thereto, signed and sealed by him, that such appraisement was regularly and duly made. If, by such examination, it appears that any damage has been sustained by the claimant, the county judge, or justice of the peace shall deliver the report of such examination, and all papers relating to the case to the claimant or his agent or attorney, upon payment of the costs up to that time. Such reports shall be delivered to the county court clerks to be filed in their office.

Section Twenty-seven. The county court clerk of the

county receiving such report, if it appears thereby that a certain amount of damage has been sustained by the claimant, shall immediately draw his order on the treasurer of the county in favor of the claimant for the amount of loss or damage such claimant has sustained according to such report, together with necessary and proper costs incurred. Such amount shall be paid by the proper county. No person shall receive any order for any claim until the county judge, justice of the peace, before whom the claim was made has certified that due diligence was made to ascertain whose dog or dogs did the damage and where the carcasses of the livestock or poultry killed, and for which damages have been assessed, when located within twenty-four hours after the assessment of damages.

Section Twenty-eight. When any payment is made by the county for any livestock bitten by a dog such payment shall not exceed one hundred dollars for each horse or mule, fifty dollars for each head of cattle, or fifteen dollars for each head of swine, or fifteen dollars for each head of grade sheep, or ten dollars for each head of grade lamb, or twenty-five dollars for each head of registered sheep, or fifteen dollars for each head of registered, or eligible-to-be registered lamb.

Section Twenty-nine. Any valid claim or parts thereof for loss or damage to sheep, horses, mules, cattle or swine which have accrued under any general or local laws at any time, prior to the passage of this act, shall not abate by reason of the repeal of such general or local act, but shall be paid out of the same fund of the proper county. All claims or parts thereof remaining unpaid for any reason at the close of any year shall not abate, but shall continue as claims until paid in full.

Section Thirty. It is unlawful for any person knowingly to make any false statement or to conceal any fact required to be disclosed under any provisions of this act.

Section Thirty-one. In any proceedings under this act the burden of proof of the facts that a dog has been licensed, or has been imported for breeding, trial, or show purposes,

shall be on the owner of such dog. Any dog not bearing a license tag shall prima facie be deemed to be unlicensed.

Section Thirty-two. The Commissioner of Agriculture, through his officers and agents, is charged with the general inforcement of this act and shall have general supervision over the licensing and regulation of dogs and protection of livestock and poultry from damage by dogs in all counties of the Commonwealth. To this end the Commissioner of Agriculture may employ all proper means for the enforcement of this act. Any other state department, bureau, or commission may on request of the Commissioner of Agriculture assist in the enforcement of the provisions of this act. To that end each county clerk shall on or before February one, one thousand nine hundred and nineteen, and on the first day of each succeeding month, draw his warrant on the county treasurer of his county in favor of the Commissioner of Agriculture for a sum equal to five (5) per cent. of the amount received for said licenses during the preceding month, and said amount so received by him shall be used and employed by the Commission for the purpose herein set forth.

Section Thirty-three. Any person other than an officer violating, or failing or refusing to comply with, any of the provisions of this act shall be deemed guilty of a misdemeanor and upon conviction shall be adjudged to pay a fine of not exceeding one hundred dollars, or to undergo an imprisonment of not exceeding three months, or both, at the discretion of the court. All fines collected under the provisions of this act shall be forthwith paid to the treasurer of the proper county, and credited after the payment of such commissions as officers be entitled to under the law, to live stock fund.

Section Thirty-four. This act is intended as a complete and uniform system throughout the Commonwealth for the licensing of dogs and the protection of live stock and poultry from injury by dogs; but nothing in this act shall interfere with any law for the protection and preservation of game. Except when such act or parts of acts are specifically repealed,

this act does not repeal or affect any acts or parts of acts relating to mad dogs or dogs affected with any disease.

Section Thirty-five. Nothing in this act shall be construed to prevent the owner of a licensed dog from recovery, by action at law, the value of any dog, which dog has been illegally killed by any officer, farmer, stockman or other person within the Commonwealth, from said officer, farmer, stockman or other person. In case such officer or other person fails to pay the value of such dogs so killed, the same shall be paid by the proper county. Said value of said dog to be ascertained in the same manner and form as provided in section twenty-five of this act for assessing the damages done to live stock by dogs. But the amount so paid for such dog or dogs shall not exceed twenty-five dollars per dog. Nothing in this act shall be so construed to prevent the killing of a dog caught chasing deer at any time of the year, on either public or private lands, or to prevent the killing of dogs by any officer empowered to enforce the game laws of this Commonwealth when said dogs are pursuing game during the closed season for the training of dogs on game providing said dogs are not under the immediate control or accompanied by their owner or keepers, and also provided that legal notice has previously been given said owner or keeper as required by the game laws of this Commonwealth.

Section Thirty-six. In the event that any one or more of the provisions of this act should be decided to be unconstitutional, the court's decision holding same unconstitutional shall not affect the validity of the remaining provisions of this act, it being the intention of the legislature that the provisions of this act are sevarable. The county court clerk shall annually on or before February first of each year make an annual report to the Commissioner of Agriculture of all licenses issued, the amount collected, number killed, and kind of live stock, amount paid for same, the amount collected in fines, amount paid out and for what, and in fact a general report covering the enforcement of this act and any other information requested by the Commissioner of Agriculture. The

Commissioner of Agriculture shall on or before January first, one thousand nine hundred and nineteen and on or before the first day of January of each year thereafter furnish the county court clerk of each county in this Commonwealth with the necessary blank licenses, metal tags and records as provided for in this act.

Section Thirty-seven. All moneys collected by the various county clerks in this Commonwealth under the provisions of this act shall, after deducting the amounts paid out for loss, damages, compensation and other expenses necessary for the enforcement of this act, revert to the school fund of the county.

Section Thirty-eight. All laws or parts of laws in conflict with this act are hereby repealed and this act shall become effective upon its passage and approval.

Approved March 28, 1918.

A. O. STANLEY, Governor.

ROBERT T. CROWE,
Speaker of the House of Representatives.

JAMES D. BLACK,
President of the Senate.

Kentucky
Agricultural Experiment Station
University of Kentucky, Lexington, Ky.

BULLETIN NO. 216

STRAWBERRIES

By

A. J. OLNEY and C. W. MATHEWS



April, 1918
(65)

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BULLETIN NO. 216

STRAWBERRIES

By A. J. Olney and C. W. Mathews.

Introduction

The purpose of this bulletin is to give a concise report of the varieties of strawberries tested at this Station from 1913 to 1917, inclusive, the status of strawberry growing in Kentucky and a few general cultural directions.

A number of newer varieties were tested side by side with old standard varieties for comparison. The general treatment of all varieties has been as uniform as possible. The matted row system has been used thruout with additional plots of the hill system in 1914-15, each variety being uniformly given 100 feet of row, and plants set 20 inches apart in the row, regardless of their habit of making runners.

It is an accepted fact that strawberry varieties are greatly affected by local conditions of soil, climate, etc., so that varieties which have failed on the station grounds may be successfully grown in other localities and vice versa. A striking example may be cited in the case of the Aroma which is the leading commercial variety of the State, but which has never shown more than average merit, as fruited here for several years.

The growth of commercial shipments of strawberries in the State from 1914 to 1917 is shown in Table I., in comparison with a few adjacent states.

TABLE I.

Carload Shipments.*

	1914	1915	1916	1917
Kentucky	84	193	412	677
Tennessee	1571	1447	2192	1626
Indiana	103	174	4	73
Illinois	268	262	407	333
Virginia	779	640	324	1268
Missouri	440	645	1114	665
Arkansas	33	365	1727	848

The rapid and consistent increase in the production of strawberries in Kentucky from 1914 to 1917 indicates the importance and possibilities of this industry for the immediate future. The following tables of carlot shipments show that the State is very favorably located. Tennessee is her closest competitor, but the crop in that state is well advanced when the Kentucky harvest begins, which suggests one of the reasons why the Aroma, being rather late in ripening, is the greatest strawberry of the State. Because of this competition, early varieties should not be expected to be as profitable for commercial plantings as late ones. Illinois and Missouri harvest their crops about the same time Kentucky does, but they supply such markets as St. Louis, Chicago, Omaha, Milwaukee, etc., and do not interfere seriously with Kentucky's markets. The majority of Kentucky strawberries go to Detroit, Cleveland, Cincinnati, Pittsburg, Buffalo, Chicago, Milwaukee, etc.

Delaware, Maryland and Virginia, large producing states, ripening their crops with Kentucky, confine their shipments very largely to the northeastern seaboard. The centers of commercial strawberry growing in Kentucky are: Bowling Green, Middletown, Kings Mountain, Louisville, Paducah and Pembroke. The Bowling Green section grows about 90% of the total carlot shipments of the State, and its product has an enviable reputation. The following quotations from the U. S. Department of Agriculture, Bulletin 477 for 1915, with reference to this district are worth noting here.

"Others can profit by adopting the methods of sections

*Report of U. S. Bureau of Markets.

producing berries of excellent reputation, such as Kentucky, which never showed a price range greater than 25 cents per 24 quart crate on the Pittsburg market thruout the season.

"The comparative inferiority of Tennessee berries is also shown in Buffalo where prices were lower than for Kentucky and Delaware-Maryland berries, selling at the same time.



Loading Refrigerator Cars at Bowling Green, Ky.

"In general, the market quality of Louisiana, Kentucky, Missouri, Arkansas and Delaware-Maryland berries seems to have been fairly satisfactory in 1915."

Bowling Green expects to harvest 2,700 acres of strawberries for the season of 1918, an increase of about 400 acres.

Strawberry Shipments by Cars, Tabulated from Report of the Bureau of Markets, U. S. Department of Agriculture, Washington, D. C. Designed to Show the Carlot Shipments from Various States as the Season Advances.

TABLE II.

Season 1916.

	May		June				July
	15-22	28-29	30-5	6-12	13-19	20-26	27-3
Louisiana	5	....	....	....	....	....	....
Mississippi	30	3	....	....	....	....	....
Arkansas	516	200	30	....	....	....	....
Virginia	201	116	7	....	....	....	....
Carolinas	96	71	5	....	....	....	....
Alabama	35	26	9	1	....	....	....
Texas	5	3	5	3	....	....	....
Tennessee	871	374	82	14	....	....	....
Illinois	76	193	138	28	1	....	....
Kentucky	4	110	224	69	5	....	....
Missouri	95	594	361	45	6	....	....
Chesapeake Peninsula	....	783	1049	1119	691	179	4
Maryland	....	4	40	79	52	5	3
New Jersey	....	....	39	230	379	287	70
Oregon	....	....	5	16	22	19	15
Kansas	....	....	12	20	11	....	....
Indiana	....	....	....	....	3	1	....
Iowa	....	....	....	....	15	5	....
	1934	2477	2006	1624	1185	496	92

TABLE III.

Season 1917.

	May			June			
	8-14	15-22	23-29	30-5	6-12	13-19	20-22
Louisiana	103	36	4	....	....	....	....
Mississippi	13	9	4	....	....	....	....
Carolinas	164	100	33	10	....	....	....
Arkansas	287	327	188	44	2	....	....
Alabama	29	18	5	3	1	....	....
Tennessee	534	528	241	95	14	....	....
Virginia	29	400	523	289	25	2	....
Texas	6	6	3	3	3	1	....
Missouri	1	66	262	226	91	19	....
Illinois	....	32	112	75	79	29	6
Kentucky	....	13	187	293	159	25	....
Delaware	....	....	53	454	757	805	79
Maryland	....	....	271	666	795	325	11
New Jersey	....	....	....	16	123	369	136
Indiana	....	....	....	2	33	30	8
Iowa	....	....	....	....	2	9	14
Oregon	....	....	....	....	....	13	13
	1166	1535	1886	2176	2084	1627	267

VARIETIES DESIRABLE FOR MARKET.

Varieties	Season	Plant Maker	Local Market	Shipping Qualities	Remarks
Aroma	Med. late	Fair	Good	Very good	Leading commercial variety of the State.
Bubach	Med. early	Prolific	Good		Fine home berry.
Dunlap	Med. early	Prolific	Good	Fair	A good one.
Gandy	Late	Fair	Fair	Very good	Second only to Aroma commercially.
Haverland	Mid-season	Prolific	Good	Fair	Old and reliable. Very productive.
Kellogg's Premier	Early	Good	Good		Promising.
Klondyke	Very early	Good	Fair	Good	Popular in many sections.
McAlpin	Mid-season	Prolific	Good	Fair	A good table berry.
Missionary	Early	Good	Fair	Good	An early Klondyke.
Model	Mid-season	Prolific	Good	Fair	Similar to Wm. Belt.
Parsons	Mid-season	Prolific	Good	Fair	Very productive.
Wm. Belt	Mid-season	Prolific	Good	Fair	A high-class berry.
Sample	Med. late	Good	Good	Good	Fancy when well grown.

Varieties Which Have Been Most Productive Among Those Tested on the Station Grounds at Lexington for a Three to Five-Year Period.

(Approximately in order named.)

Name	Average date of First Picking	Average date of Largest Picking	Average date of Last Picking	Productiveness on scale of 10
Gibson	June 4	June 11	June 18	10
Parsons	June 2	June 11	June 18	10
Haverland	May 28	June 10	June 15	10
Mrs. Miller	May 28	June 10	June 15	9
Tennessee	May 28	June 10	June 15	9
Glen Mary	May 28	June 10	June 15	8
Wm. Belt	June 4	June 11	June 18	8
Model	June 4	June 11	June 18	8
Dunlap	May 28	June 10	June 15	8
Kellogg's Prize	June 4	June 11	June 18	7
Kitty Rice	June 1	June 9	June 15	7
Ekey	June 1	June 10	June 18	7
Helen Davis	May 28	June 9	June 15	7
Bubach	May 29	June 7	June 12	7
Warfield	May 28	June 5	June 12	6
Klondyke	May 25	June 1	June 9	6
St. Louis	May 27	June 5	June 10	6

Newer varieties tested but one year which have been productive and promising: Kellogg's Premier, McAlpin, Longfellow, Highland, Latest and Fendall.

Varieties desirable for home garden: Bubach, Dunlap, Haverland, Helen Davis, Highland, Longfellow, Parsons, St. Louis, Sample, Wm. Belt and Aroma.

Descriptions of Varieties and Notes.

The following varieties have been fruited one to five or more seasons on the Experiment Station grounds. They have not received any special care or attention other than the general culture which would ordinarily be practist by the average commercial grower. The notes indicate the record each variety has made in the test plots of the Experiment Station and it should be borne in mind that strawberry varieties vary considerably in their adaptablility to different sections of the State. For this reason many growers find it profitable as well as exceedingly interesting to test out a few varieties in a small way from year to year.

The terms staminate and pistillate, abbreviated to (S) & (P), respectively, are used to designate the sex of the varieties.

Amanda (S). Berries medium to large, irregular, roundish-conic or wedge-conic, dark crimson; flesh red, firm and good. Good plant maker. This variety has been tested but one year. The irregularity in size of berry and low yield do not give promise of special merit.

Aroma (S). Berries large, round-conic, bright red; flesh light red, firm; flavor mild subacid; quality good. Plants moderately vigorous. Moderate plant maker. This is the leading commercial berry of Kentucky. Conditions in the Bluegrass Region do not seem so uniformly favorable to this variety as in western Kentucky.

Black Beauty (P). Berries medium to large, roundish-conic, deep crimson; flesh red, soft, acid; quality good. Among the poorer varieties tested. Not productive enough.

Bubach (P). Berries medium to large, irregular-conic, light red, seeds large and surface often rough. Flesh light red streaked with white. Rather soft. Has not yielded heavily on the Station grounds altho it is rated as a prolific cropper by some growers. Not a good shipping berry but excellent for a local market and for home use. Midseason.

Cameron (S). Berries small, roundish-conic, crimson; flesh light red, soft, rather acid; quality rather poor. Not promising.

Cardinal (P). Berries large, roundish-conic, regular, dark crimson; flesh dark red, firm, subacid, good quality. Ripens in midseason. A very poor plant maker. Not productive.

Chesapeake (S). Berries medium to large, roundish or round-conic, regular, bright crimson; flesh red, very firm, mild subacid; quality very good. A rather poor plant maker. A very important commercial berry along the Atlantic coast. Has not shown exceptional merit on the Station grounds.

Climax (S). Berries medium size, very irregular, round, bright crimson; flesh red, firm, acid; quality rather poor, a very poor plant maker. Does not seem to be at all adapted to conditions at Station grounds.

Columbia (S). Berries medium to large, long-conic, crim-

son; flesh light red, soft, mild subacid, flat; quality poor. Ripens in midseason.

Commonwealth (S). Berries medium to large, roundish-conic, dark crimson; flesh red, firm, subacid; quality fair to good. Poor plant maker—not a particularly promising variety. Yield generally small.

Dr. Burrill (S). Berries medium size, roundish-conic; dark crimson; flesh red, moderately firm, quality good, a moderate plant maker. This is a new variety which has fruited but one season on the Station grounds, and has not yet shown special merit. Will be tested further.

Dornan (Uncle Jim) (S). Berries large, irregular, obtuse-conic, dark crimson; flesh red, moderately firm, quality good. Uncle Jim, Pride of Michigan and Roosevelt are practically identical. Sometimes highly praised but of only average merit here.

Dunlap (S). A very popular and cosmopolitan sort which succeeds nearly everywhere and in this respect has been termed the "logical successor of the Wilson." Berries medium to large, round-conic; bright dark crimson with dark red flesh, moderately firm, a heavy cropper.

Plants are small but very vigorous, often making runners too freely for large berries unless thinned. A good pollinizer for pistillate sorts. Recommended for home use as a table and canning berry. It is suited to local markets but quickly loses its bright color and becomes rather unattractive.

Early Jersey Giant (S). Berries medium to large, irregular, oblong-conic, dark crimson; flesh red, rather soft; quality fair to good. A poor plant maker. Ripens early. Has not been among the promising varieties.

Ekey (S). Berries large, oblong-conic, deep crimson; flesh dark red, moderately firm, subacid; quality good. A good plant maker. Ripens in early midseason. A good berry with us. Widely grown and usually satisfactory.

Excelsior (S). Berries small to medium; roundish, sometimes conic, dark crimson; flesh red, firm, acid; quality fair. Good shipper. A good plant maker. Ripens very early. A standard extra early sort but berries are rather sour and small.

Fendall (P). Berries large, irregular, oblong-conic, light red, flesh pale red, rather soft, mild subacid, quality fair to good. A poor plant maker. Ripens in midseason.

First Quality (S). Berries medium in size, long, conic, dark red, dull; flesh red, rather soft, very sweet; quality good to very good. A moderate plant maker. Ripens in midseason.

Frances Willard (P). Berries large, rough and irregular, roundish-conic, dark crimson; flesh red, moderately firm, subacid; quality good. Only moderate plant maker. Midseason. Individual plants seem to yield well, but stands have not been good and further tests are being made.

Gandy (S). Berries large, uniform, roundish-conic, deep red; flesh red, firm, coarse-grained; core often hollow; quality fair to good, subacid. A standard late variety for market but is being largely displaced by Aroma in large commercial plantations. It requires a strong soil with a clay subsoil. Ripens very late. A good shipper. An old variety which still retains its popularity with many growers.

Gibson (S). Berries medium size, roundish-conic; color dark with dark red flesh mild subacid; quality good. Moderately firm. Ripens in late mi season. Resembles the Parsons but does not set as many plants; a good yielder. Recommended for home and local market.

Glen Mary (Weakly S). Berries are large, irregular, oblong or roundish-conic, deep crimson; flesh red, firm; core solid; flavor subacid; quality good. Midseason. A very productive variety of considerable value in most sections and has usually shown good results on the Station grounds. Berries often with white tips.

Golden Gate (Weakly S). Berries medium to large, roundish-conic to wedge-shaped. Dark red, flesh red, moderately firm, subacid; quality only fair. Plants vigorous, moderate plant maker. Ripens in midseason, surpassed by many in quality and productiveness. Ripens unevenly.

Goodell (S). Berries medium size, roundish-conic, dark crimson; flesh red, rather firm, very mild and subacid to nearly

sweet; quality good to very good; a moderate plant maker. Ripens in midseason.

Haverland (P). An old standby. Berries medium to large, long conic, sometimes necked. Color light scarlet, flesh light red, inclined to be soft, quality good. Plants large and vigorous. Prolific plant maker. Ripens in midseason. A heavy cropper. One of the best for the home garden or local market. Rather soft for shipping.

Heflin (S). Berries medium to large, oblong-conic, bright crimson; flesh red, firm, subacid to acid, quality fair to good. A good plant maker.

Helen Davis (S). Berries medium to large and very irregular, round-conic; color bright red; flesh medium red, moderately firm, sweet; quality good. Plants moderately vigorous; good plant maker. Ripens medium early. Of average productiveness.

Kellogg's Premier (S). Berries large, roundish or wedge-conic, bright red, flesh moderately firm, subacid, good quality; plants vigorous and a good plant maker. Productive. Season very early. A promising, very early berry.

Kellogg's Prize (P). Berries large, long-conic, dark red; flesh red, rather firm. Plants vigorous, moderate plant maker. Fairly productive. Ripens medium late. Will be tested further.

Kitty Rice (P). Berries large, short, round-conic, dark red, flesh red, rather firm, subacid, good quality. Plants moderately vigorous, runners very few. Does not set enough plants. Productive when a good stand is secured.

Klondyke (S). Berries medium to large, roundish-conic, dark crimson, flesh dark red, very firm, core red, solid; quality fair; rather sour. Very popular in many parts of the South.

Latest (P). Berries medium to large, long, roundish-conic, sometimes wedge-shaped, irregular, light crimson; flesh pale red, subacid to nearly sweet; quality good; rather poor plant maker. Productive. Late.

Manhattan (S). Berries large to very large, irregular, roundish-conic or wedge-shaped, light dull red; flesh pale red, firm, subacid; quality fair. A poor plant maker. Medium late season.

Margaret (of Beavers) (S). Originated by J. F. Beavers, Dayton, Ohio. Sometimes confused with Marguerite on account of similarity of names. Berries large, roundish-conic, dark crimson; flesh dark red, firm, mild, subacid. Good to very good in quality. Responds to high culture. Desirable for home use.

McAlpin (S). Berries large, irregular, roundish; color dark red; subacid, good quality, firm. Heavy cropper. Plants vigorous. Prolific plant maker. A promising variety among the newer ones for home and market. Its chief fault is its irregularity in size and shape of berry.

Missionary (S). An important berry in some sections, very similar to Klondyke, ripening earlier. Very popular in parts of the south. Midseason, very firm, acid.

Monroe (S). Berries large, roundish, somewhat conic; dark crimson; flesh red, firm. Mild subacid; quality fair to good. Good plant maker.

Model (S). A seedling of Wm. Belt and practically identical with it. Berry oblong conic, medium to large; bright red, sweet, good quality, moderately firm; good plant producer and productive.

Mrs. Miller (P). Berries variable in size and shape from medium to very large, oblong-conic, often blunt at the point or apex. Dark red, subacid; quality good. Rather soft for market. Usually very productive. Plants vigorous and make runners profusely.

Nick Ohmer (S). Berries large, long, roundish-conic, dark crimson; flesh red, firm, mild, subacid; quality very good; sets few plants, ripens in midseason. Requires special culture.

Ohio Boy (S). Berries large, wedge-shaped, dull red; flesh pale red, rather soft, mild subacid, quality fair, rather flat. Moderate plant maker. Late midseason.

Orem (S). Berries large, roundish-conic or wedge-shaped, dull red; flesh pale red, rather firm, mild subacid; quality good. Good plant maker, ripens late.

Ozark (S). Berries medium to large, roundish-conic, sometimes angular; dark crimson; flesh dark red; firm, subacid; quality very good. Season very early—not outstanding among

varieties tested, but very popular in some sections as a canning and shipping berry.

Parsons (S). Berries medium size, irregular or wedge-conic. Color bright crimson, flesh red, firm, subacid; quality good. Ripening in midseason. The plants are very vigorous, sending out numerous runners; a heavy yielder. Recommended for home and local market.

Rewastico (S). Berries medium size, bright crimson, flesh dark red, firm, subacid to nearly acid; quality good, not a good plant maker. Does not seem to possess special merit as grown on the Station grounds, but in some sections is reported favorably.

Pride of Michigan (S). Berries medium to very large, roundish, oblong-conic; bright crimson; flesh medium red, firm subacid, quality good. A good plant maker, early midseason, moderately productive.

St. Louis (S). Berries medium to large, long-conic, pale red; flesh light pink, rather soft, subacid; quality fair to good. Plants small and moderately vigorous. Runners moderate. Ripens very early.

Sample (P). Berries medium to large, regular, roundish-conic, dark crimson; flesh dark red, firm, subacid, good quality; commonly pollinized by Aroma, Dunlap or Parsons. Productive. Plants vigorous, runners numerous. An excellent berry for home or near market.

Son's Prolific (S). Berries large, irregular, roundish or oblong-conic, bright crimson; flesh red, firm; quality good. Only moderate plant maker. Ripens in early midseason.

Stevens (S). Berries large, roundish-conic, sometimes irregular, bright crimson; flesh dark red; firm, acid, fair to good in quality. Runners moderate. Ripening in late midseason. Productive. Berries hold their size well thruout the season and withstand drought better than some.

Tennessee (S). Berries medium to large, roundish to ob long-conic, light crimson; flesh medium red, firm, subacid, good quality; runners numerous. Ripening in midseason. A good

pollinizer, productive. An old and excellent variety for Kentucky.

Three W's (Wallace) (S). Berries roundish-conic, sometimes oblong and blunt. Medium size; color dark red; flesh dark red, moderately firm, subacid, good quality. Rather poor plant maker. Medium or below in productiveness.

Warfield (P). Berries medium in size, often running small toward the end of the season if weather is hot or dry; roundish-conic, dark red, firm, acid, good quality. Early. A fine shipper and excellent canning berry. Very popular at one time and still grown in some sections.

Wm. Belt (S). Berries large, sometimes irregular in shape, typically wedge-shaped; flesh medium red in color, moderately firm, fine grained, subacid; quality very good to best. Plants vigorous; a good plant maker. A good pollinizer. A leading berry for the home garden in the Bluegrass region. It does not do well on sandy soil.

Everbearing Strawberries.

Has the everbearing strawberry come to stay? It undoubtedly has, but the importance of this type of berry has been to some extent exaggerated until considerable confusion has arisen in regard to it.

In the first place, it should be remembered that this is a new type of berry and its economic importance is not yet fully determined.

The following conclusion has been based upon the limited trials of these varieties in the Station test-plots. This class is primarily of value for producing berries after the season for the regular crop is past. There is no indication at present that they will compete with the standard varieties for the spring crop. The yield at a single picking is smaller but continues thru a much longer period than the spring berries, thus increasing the expense of picking them.

The everbearers require higher culture than standard varieties and suffer more quickly in dry weather. Many varieties

of this type make very few plants and appear to succeed better in hills or narrow matted rows.

The culture differs but little from that of standard sorts except that the blossoms are usually cut off until midsummer, to conserve the strength of the plants for the late summer crop. This operation is repeated annually. If permitted, they will bear in the spring at the regular season with standard varieties, but when a large crop is taken off at this time the yield will usually be light thruout the remainder of the season.

A crop may be secured in the fall of the same year the plants are set, if planted early in the spring and a vigorous growth is maintained.

The expense of cutting off the blossoms and of picking small quantities of berries and marketing them over a long season is unfavorable to extensive commercial growing.

The everbearers are, therefore, valued chiefly as a distinct addition to the home garden and in a very limited way for commercial culture.

Americus (S). Berries medium size, roundish-conic, light crimson; flesh pale, firm, mild, subacid; quality good to very good. Sets very few plants.

Francis (S). Berries medium to large. Long-conic, bright scarlet; flesh pale red, moderately firm; quality fair to good. Very poor plant maker. Has not yielded enough to warrant recommendation.

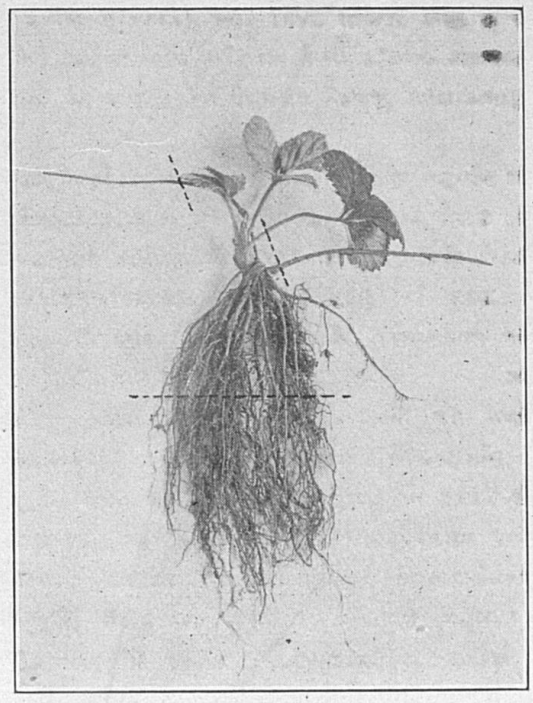
Productive (P). Berries small to medium, roundish-conic, scarlet; flesh red, firm, mild, subacid; quality fair. Very poor plant maker.

Progressive (S). Berries medium in size, wedge-conic or obtuse-conic, dark crimson; flesh firm, dark red, mild subacid, runners few. Ripens early midseason and continues till frost. Results in experiment plots have not been particlarly promising as a commercial berry so far. It is generally considered the best of its class and is recommended chiefly for the home garden.

Superb (S). Berries medium to large, roundish-conic, deep crimson; flesh dark red, firm; quality good to very good. Only a fair plant maker. Has not given much promise as grown on the Station grounds.

Cultural Directions.

It is the aim of these directions to give suggestions rather than specific details which must vary in every instance.



Strawberry Plant as Trimmed For Setting.

LOCATION.—It is usually advantageous to study the conditions found in successful strawberry growing sections before selecting a location for commercial purposes. Bowling Green is the center of strawberry growing in this State and may well be noted carefully. It has a large area suited to this industry, making possible carlot shipments. It has good transportation facilities. An ample supply of pickers may be obtained at harvesting time. Last and most important of all, the industry is well organized and the product is harvested and marketed under the direction of a competent manager.

For home use the selection of a location is necessarily restricted, but one side of the graden is usually satisfactory. It is desirable to have the strawberry bed conveniently near the house and fenced away from poultry. When possible, provision should be made for horse cultivation.

Site and Soil.—The type of soil is not so important provided it contains sufficient humus. However, some varieties seem to do better in certain soils; thus the Aroma seems to do much better in a silt loam and the Gandy in a clay loam. In any case the humus contained in the soil must be kept up. Any soil that will produce good crops of corn is usually suited to strawberries.

A southern slope will ripen berries a few days earlier than a northern one, and an elevated site is commonly desirable because of lessened danger to the blossoms from late frosts.

Hill sides may be planted to strawberries, provided the rows follow the contour of the land and do not run up and down the slope.

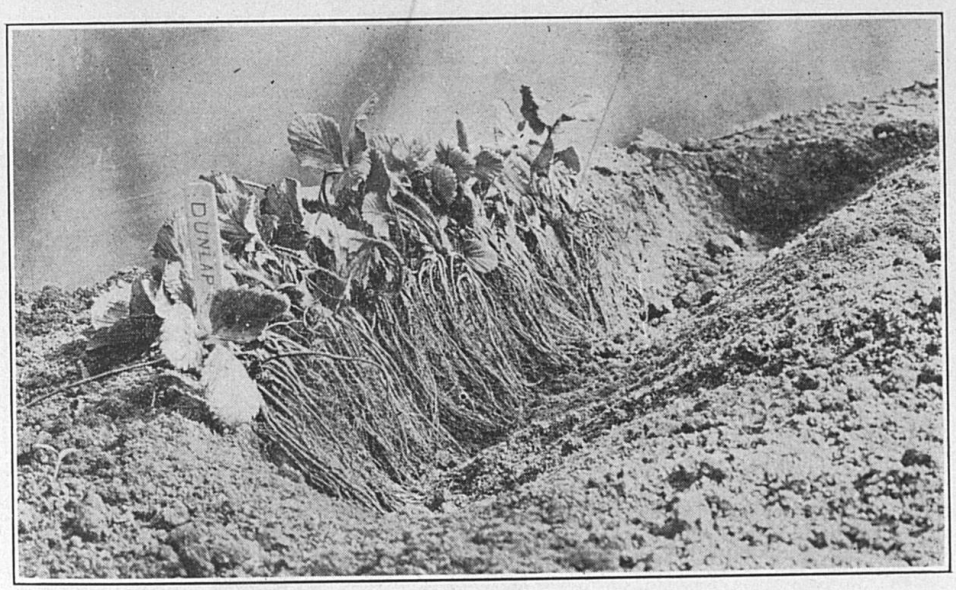
Preparation of Soil and Fertilizers.—The preparation of strawberry plantations should, when possible, be made a year or more before setting, to free the soil of weeds and certain insects (for example the white grub), both of which are frequently troublesome immediately after plowing sod land. As with most crops, thoro cultivation and preparation of the soil cannot be over-emphasized. Some of the growers around Bowling Green keep the fields fallow a year previous to planting. They recommend ten or fifteen tons of stable manure per acre, applied before fallowing. Manures and fertilizers applied to a preceding cultivated crop often give quite as satisfactory results as fallowing. Stable manure is not recommended after the plants are set.

From 300 to 500 lbs. of acid phosphate or steamed bone meal often prove beneficial applied at planting time. However, soils in the Bluegrass Region seem to have sufficient phosphorus. The proper amount to apply should be determined by each grower for himself, or at least for each community, by applying different amounts on small plots and noting results. Nitrate of soda

up to a hundred or more pounds per acre is often applied along the rows, the first season the plants are set, to make them vigorous enough to produce a heavy crop the following spring. If applied just before the fruiting season, the berries are likely to be soft and poor in color and quality.

PLANTS.—Strong, healthy plants, true to name, are essential. The best plants may be obtained from year-old beds which have not yet borne fruit.

PERFECT AND IMPERFECT FLOWERS.—Some varieties of strawberries have flowers with both pistils and stamens and



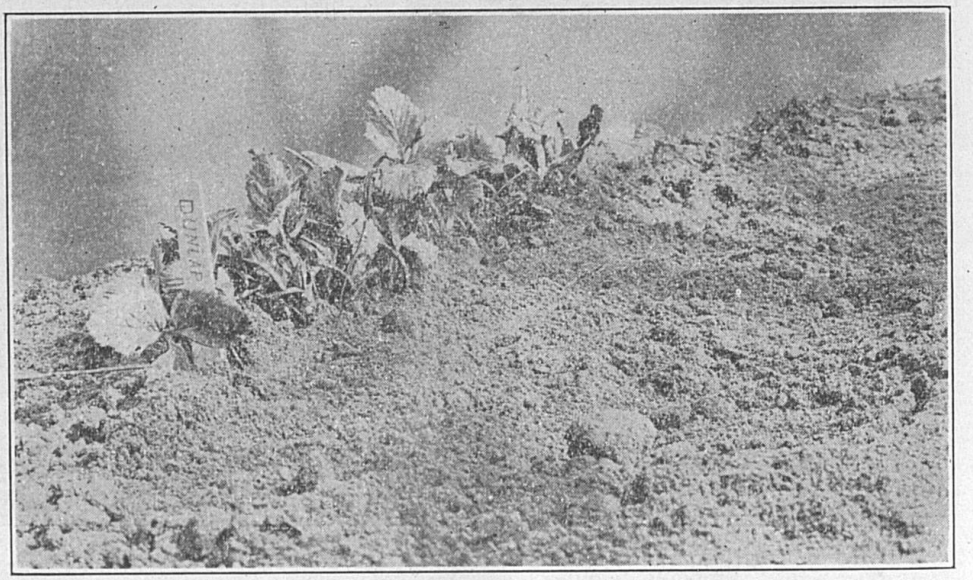
Plants closely placed in trench for temporary planting or "heeling in."

are called "perfect" or "staminate" (S), while others have pistils only and are known as "imperfect" or "pistillate" (P). The growers should keep this fact carefully in mind at planting time, for pistillate plants will not bear when planted alone but must be near a perfect-flowered variety. A row of staminate strawberries will fertilize three or four rows of pistillate varieties adjacent to it.

TIME TO PLANT.—The best results have been obtained in this latitude from spring planting. The plants should be set as early as the soil can be properly prepared. Poor stands are

often obtained when set late in the spring after the soil becomes rather dry.

System of Planting.—The most practical system for general use in Kentucky is the matted-row system, altho more intensive systems may be satisfactory for special cases or fancy markets. The plants may be set from 15 inches to 3 feet apart, in rows from 3 to 4 feet apart, the closer distances being more common. The distance apart in the rows should be governed by the runner-making habit of the variety to be set. It is desirable to have the row about 18 or 20 inches wide after the new plants have formed thru the summer.



Plants "heeled in." Safe for two weeks if necessary, before permanent planting.

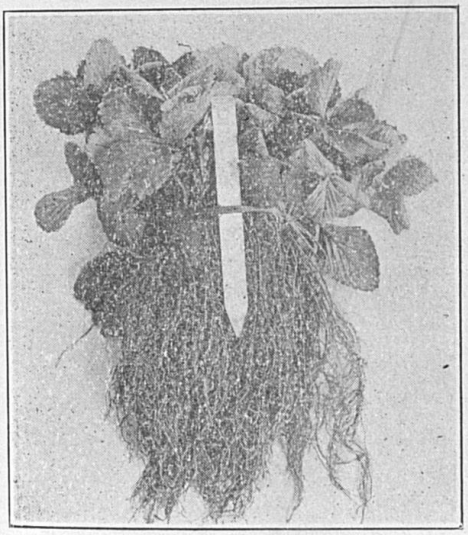
The Following Table Shows the Number of Plants to the Acre for Different Widths of Row and Different Distances Apart in the Row.

Distance Between Rows	3 ft.	3½ ft.	4 ft.
No. of plants 15 in. apart	11616	9956	8712
No. of plants 18 in. apart	9680	8297	7260
No. of plants 24 in. apart	7260	6222	5445
No. of plants 30 in. apart	5808	4978	4356
No. of plants 36 in. apart	4840	4150	3630

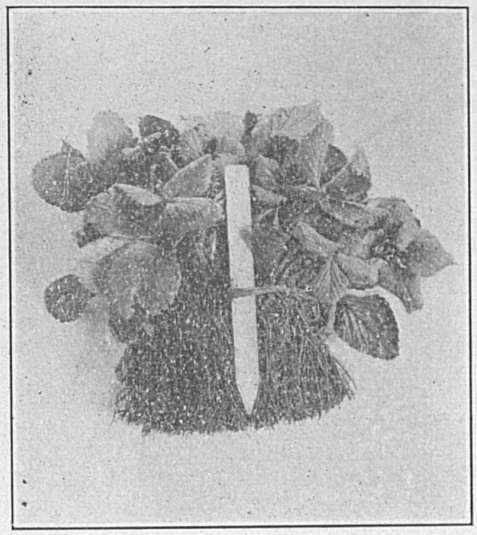
Plants often arrive from nursery companies before the grower is ready to set them. In this case they should be "heeled

in." This is done by opening the bundles and placing the plants in a thin line, close together, in a trench, with the roots of each plant covered firmly with moist soil. The roots should be pruned to 2 or 3 inches before planting and this is best done before the bundles are untied. Each variety should be separated somewhat from the rest and labeled carefully.

Rows may be laid out by furrows, corn markers or lines and the plants set by hand. A spade, trowel or flat dibber may be used to open up the soil. The plant is inserted with the roots well spread out and soil pressed *very firmly* about them. It is



Bundle of 25 Plants as Received From Nursery.



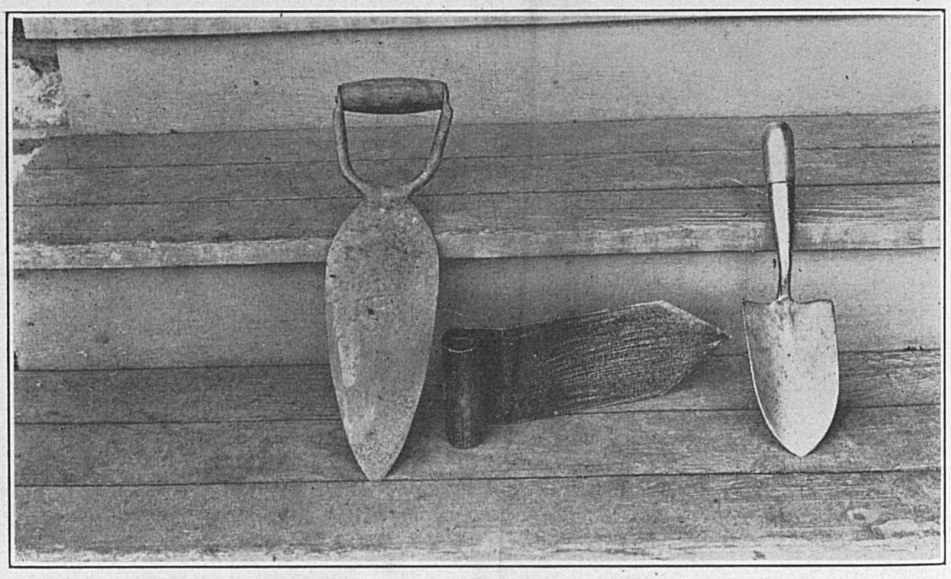
Trimmed for Planting.

very important that the crown should stand just above the surface of the ground.

CULTURE.—Frequent, shallow, clean cultivation should be followed thruout the first summer. It should begin soon after the plants are set and be continued often enough to keep the weeds down and prevent undue loss of moisture from the soil, until heavy frosts occur in the fall. The preservation of the soil moisture is very important. Some hand hoeing will be necessary in addition to horse cultivation. The amount of hoeing required will depend upon the number of weeds which come

up in the row and the system of planting used. Blossom clusters that appear soon after setting should be removed.

Most growers prefer to have the runners start early, altho late ones will make strong plants if the latter part of the summer is not too dry. The width of the row can be controlled to some extent by cultivating close to the plants at first and farther away from the row as the new plants develop. If care is taken to cultivate each row in the same direction every time, runners which are taking root will not be disturbed or pulled up. Cultivation tends to crowd the plants together in the row and with

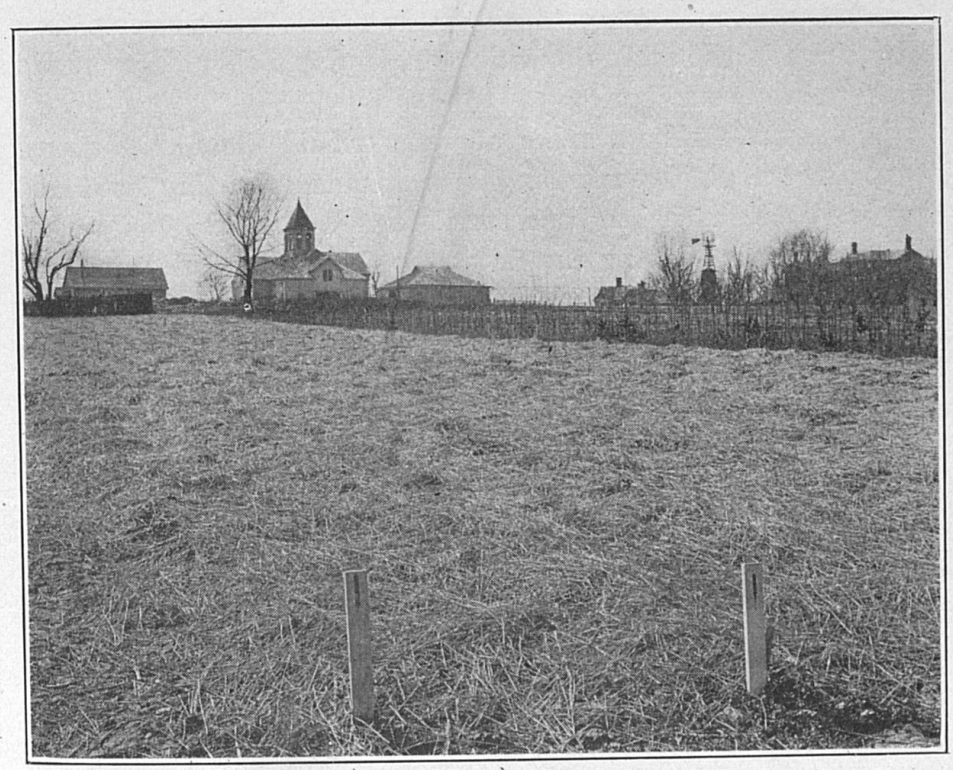


Convenient Implements for Plant Setting.

varieties which make runners freely it is necessary to do considerable thinning. This work may be done by cutting off the surplus runners as soon as they appear, or by fall thinning. The first method is undoubtedly best for intensive growers or small patches, but is too laborious for general field practis. Fall thinning is usually done by hand with a sharp hoe. The surplus individual plants may be removed or all of the plants in a strip, the width of a narrow hoe blade, may be cut out squarely across the row, leaving alternate strips of plants of about the same width. Some growers find it practicable to use a spike-toothed

harrow or weeder crosswise of the rows. This is done in late fall near the close of the growing season. The weak plants and partially rooted runners are pulled into the alleys between the rows. It requires some experience to determine the amount of harrowing that may safely be done in this way. Tho somewhat tedious it is probably safer to thin the plants by hand.

Mechanical runner-cutters are sometimes used with a degree of satisfaction in large plantations, to cut off runners after the



A Strawberry Field Well Mulched for Winter.

row is as wide as desired, but this too is often more satisfactorily done with a hoe.

MULCHING.—Mulching strawberries in Kentucky is practist to prevent loss of soil moisture previous to and during the picking season, to keep the berries clean and to control the weeds. It is also used to prevent the plants from "heaving out" on account of heavy freezing and thawing. The plants are likely to suffer from drought if they do not have some kind of

mulch. Cultivation during the fruiting season tends to make the fruit dirty and gritty and is therefore objectionable, but the straw mulch is a very effective substitute. Wheat, oat and rye straw, pine needles, marsh hay and strawy manure are commonly used. Any of these is satisfactory if it is free from weed seeds and grain. The mulch is usually applied any time in the late fall after the ground becomes frozen, tho it is sometimes delayed till midwinter. An even layer about 2 or 3 inches thick should be adequate. Most of the plants will push up thru this mulch in the spring, but any thick places should be opened up to prevent smothering.

Duration.—The number of years a field should be allowed to produce fruit depends on the system of planting used and how well the patch has been cared for. If the field has become weedy or grassy during the first year the work of cleaning out, thinning, cultivating and fertilizing the plants after the fruit has been harvested may be too great to warrant the practis. Only well-cared-for patches are worth renewing. It is a question whether the renovation process will cost more than the setting of a new bed. A patch is sometimes fruited two, three or even more years with profit, where conditions are favorable.

If the old field is to be renewed it is usually advisable to mow off the vines as soon as the crop is harvested and burn over when dry. This burning will not injure the plants, if done on a windy day so the field will burn over quickly, and destroys many insects and checks disease. The vines should be dry but less injury will be done to the plants if the soil is wet. In case the stand of plants is poor the vines should be raked between the rows for burning.

A small turning-plow or double-shovel cultivator may be used to narrow the rows to 6 or 8 inches in width. The plants in these narrow rows are then thinned out with a hoe. An effort is made to remove old plants and those which are small and weak. The soil will require the same cultivation and fertilizing as for a new planting. It should be borne in mind that strawberries are benefited by a rotation just as much as other crops.

Insects and Diseases.—Strawberries are usually rather

free from troublesome insects and disease but sometimes both do serious damage.

The majority of these troubles are controlled by proper rotations with other crops and by plowing up the patches after the first or second crop, rather than by means of extensive spray programs.

Incidentally it may be said that a one-crop system simplifies this problem to such an extent that in many of the large strawberry centers a majority of the growers are adopting it.

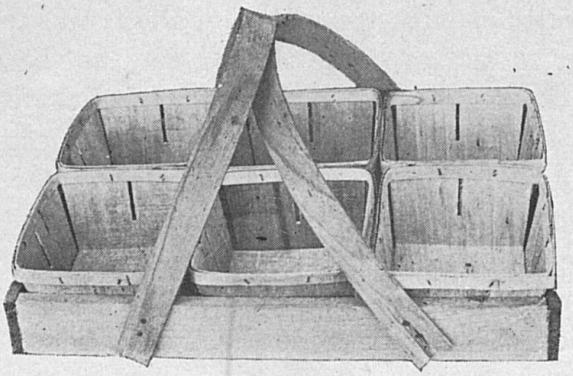
The strawberry leaf-roller is probably one of the most serious of the leaf-eating insects, all of which are usually controlled by spraying with arsenate of lead—2 lbs. of paste or 1 lb. of powder to 50 gallons of water. However, the first brood of the leaf-roller usually appears after the fruit is set and before picking time, so that arsenate of lead may not be recommended if the fruit is to be used. Fresh white hellebore—4 ozs. in 2 gallons of water—may be applied safely, even after the berries begin to ripen. In case of a bad infestation the vines should be mowed immediately after harvesting the fruit and burned over as soon as dry. There are three or possibly four broods of the leaf-roller in this latitude and they may be controlled by application of arsenate of lead. Applications must be made before the leaves are much rolled, to be effective. Fungous diseases, as leaf-spot or rust, may be controlled by applications of Bordeaux mixture.

Picking.—Many find it practicable to drive to a nearby town and bring the pickers to the strawberry field, and take them home again at night. Picking is light work and a nimble person is often able to earn $3 or $4 per day or sometimes more, in the height of the season. The usual price paid for picking is from about six to eight cents per gallon. Six cents is often paid to all pickers, and those that remain thru the entire season receive an extra cent, or seven cents for the season. This arrangement is often a valuable means of keeping the help during the last of the season when the berries are small and scattering. Either the owner or a competent foreman should devote his special

attention to the pickers. He must see that the vines are picked clean, that the berries are picked at the proper stage of ripeness, that they are picked with a short piece of stem attached, as the appearance, shipping and keeping qualities are injured considerably when slipped from the stem. These, as well as many other details must be quickly and accurately observed by the foreman.

Best results are gotten when the pickers are so organized that each one may be held responsible for his own work.

All progressive growers grade their berries in some fashion. The single baskets are sometimes repacked, but with competent



A Handy Picking Tray.

help they are graded to better advantage while being picked. A picking tray carrying several boxes is very convenient for this purpose as the culls or grades may be put into separate boxes. A uniformly graded pack is essential to obtain highest prices. The degree of ripeness will be governed by the market to which they are sent. If near by, they may be picked fully ripe, but not so ripe for distant markets. Care must be taken, however, not to pick too green, as the berries soon wither and are of little value. Berries should not be picked while wet and should be placed in the shade as soon as the boxes are filled. In a commercial plantation an inexpensive packing shed close by the plot is a valuable aid.

PACKAGES.—The standard 24-quart crate is the style commonly used in the State. It goes without saying that any package should be clean, neat and convenient to handle, as well as inexpensive.

MARKETING.—Most men find it easier to grow berries than to sell them.

Small growers should content themselves with local markets, for there is too much risk in shipping small consignments by express to commission men in distant cities. There are many ways of selling berries locally but it is largely for the individual to work out the details. Some cater to special customers, others



A Crate of "Fancy" Kentucky Berries.

peddle from house to house, or they may be sold to buyers on the open market; but one of the most satisfactory ways is to arrange with a retail grocer or fruit stand company to handle the entire crop. In this case it is essential to have a regular supply of berries thruout the season, from early to late. The berries must be of high quality, attractive in appearance, put up in neat packages, and guaranteed as represented.

The large grower is greatly relieved of the burden of marketing if he belongs to a co-operative organization such as the one at Bowling Green. This is by far the most satisfactory method of marketing strawberries. Each man grades his own berries

which are brought to refrigerator cars, inspected and grades verified, and the cars sold by the association manager. The most satisfactory method of selling in car lots is f. o. b. shipping point, to buyers who come to the strawberry center for that purpose.

Summary.

The experience of several years past suggests that strawberry growing for shipment may be more extensively developt as a leading industry, under co-operative methods.

Many local markets for these berries exist which can be profitably developt.

Every farm and suburban home can supply its own table bountifully at small cost.

Strawberries can be successfully grown on a wide variety of soils provided drainage and humus are supplied. Humus may be furnished either by barn manures or by plowing under green crops.

Applications of phosphate are needed in most soils outside of the Bluegrass Region.

Prepare the ground thoroly. Set out plants early; if possible before the middle of April.

Pistillate varieties will not produce fruit unless pollinized by a staminate sort planted nearby.

Cultivate regularly from spring to fall, to preserve soil moisture as well as to kill weeds.

The matted-row system of management is the most widely used method of handling the crop.

Commercial growers who ship their berries should agree on one or a very few varieties. Growers for home use or for a local market may profitably plant a wider range of kinds.

For shipping, the Aroma leads and Gandy follows, in popularity. For home and near-by markets, in addition to the above, selection may be made from St. Louis, Parsons, Haverland, Tennessee, Dunlap, Gibson, Wm. Belt, Bubach and Sample.

APPENDIX.

Manufacturers of Baskets and Crates.

The following list includes the names and addresses of some of the principal manufacturers of baskets and crates but is not submitted as a complete list.

Berlin Fruit Box Co., Berlin Heights, Ohio.

Burlington Basket Co., Burlington, Iowa.

Colby Hinkley Co., Benton Harbor, Michigan.

Cumberland Fruit Package Co., Cumberland, Wisconsin.

G. P. Reed, Inc., 199 Duane St., New York City, New York.

Mullen Paper Co., St. Joseph, Missouri.

New Albany Box & Basket Co., New Albany, Indiana.

Pierce Williams Co., South Haven, Michigan, also Jonesboro, Arkansas.

St. Louis Basket & Box Co., 2nd and Arsenal Sts., St. Louis, Missouri.

PUBLICATIONS OF INTEREST IN CONNECTION WITH THIS BULLETIN.

Books.

"Strawberry Growing," by S. W. Fletcher. Published by Macmillan Co., New York.

"The Strawberry in North America," by S. W. Fletcher. Published by Macmillan Co., New York.

"Modern Strawberry Growing," by A. E. Wilkinson. Published by Doubleday, Page Co., Garden City, New York.

"Bush Fruits," by F. W. Card. Published by Macmillan Co., New York.

Farmers' Bulletins.

Any of the following bulletins treating of matters of interest to the grower of strawberries may be secured free of cost by addressing the Division of Publications, U. S. Department of Agriculture, Washington, D. C.

Farmers' Bulletin No. 543, "Common White Grubs."

Farmers' Bulletin No. 644, "Strawberry Growing in the South."

Farmers' Bulletin No. 854, "Strawberry Culture in Tennessee, Kentucky and West Virginia."

Farmers' Bulletin No. 643, "Blackberry Culture."

Farmers' Bulletin No. 728, "Dewberry Culture."

U. S. Department of Agriculture Bulletins.

Department Bulletin No. 237, "Strawberry Supply and Distribution in 1914."

Department Bulletin No. 477, "Marketing and Distribution of Strawberries in 1915."

Department Bulletin No. 531, "Rhizopus Rot of Strawberries in Transit."

Kentucky
Agricultural Experiment Station
University of Kentucky, Lexington, Ky.

BULLETIN NO. 217

Profitable Dairy-Farm Organization in Kentucky

By

W. D. NICHOLLS and J. B. HUTSON

July, 1918
(95)

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* On leave of absence.

BULLETIN NO. 217

PROFITABLE DAIRY-FARM ORGANIZATION IN KENTUCKY

By W. D. NICHOLLS and J. B. HUTSON

Summary

From a detailed analysis of 162 dairy farms situated in the district furnishing the bulk of the milk supply of the city of Louisville the following conclusions are drawn:

Large production per cow is a fundamental factor in profitable dairy farming. P. 104-105.

Profits increase as crop yields increase. P. 105-106.

Farms having both crop yields and herd production better than the average made profits six times greater than the farms having crop yields and herd production less than the average. P. 106-108.

On an average, the good-sized farms made larger profits than the smaller farms. The dairy farm should afford a sufficient acreage of crops to employ the time of teams and men profitably and to furnish the major portion of the feed for the herd. P. 108-111.

On an average, good-sized herds were more profitable than small herds, but the size that any particular herd should be depends largely on the quality of the cows. P. 111-112.

On an average, the farms having good-sized capital were more profitable than those having small capital. P. 112-115.

Note:—Acknowledgment is hereby made for valuable co-operation given by the Office of Farm Management of the U. S. Department of Agriculture in collecting and checking the records of the farms in this survey. Messrs. B. F. Creech, W. D. Sutton, C. F. Park and J. C. Rundles assisted in collecting the field data.

Good pastures are a fundamental factor in securing profits in this region. The farms on which the pastures carried one cow to 1.3 acres made labor incomes twenty times as great as the farms on which the pastures carried only one cow to 4.4 acres. P. 115.

Crop yields on well stocked farms were considerably larger than on lightly stocked farms.

The proportion of the stock on a dairy farm which should be dairy cows depends mainly on the quality of the cows. With poor cows profits decrease as the proportionate number of dairy cows increases. With high-producing cows profits increase until the dairy cows reach 60 to 65 per cent. of all the farm animals. Beyond this percentage profits decrease. P. 117.

A few hogs on the dairy farm increase profits by utilizing products from the fields and the dairy which would otherwise go to waste.

Sheep were kept to advantage only on the larger farms where there was a sufficient number of pasture fields to permit the sheep and cattle to be kept separate. Sheep were very helpful in keeping down weeds. P. 119.

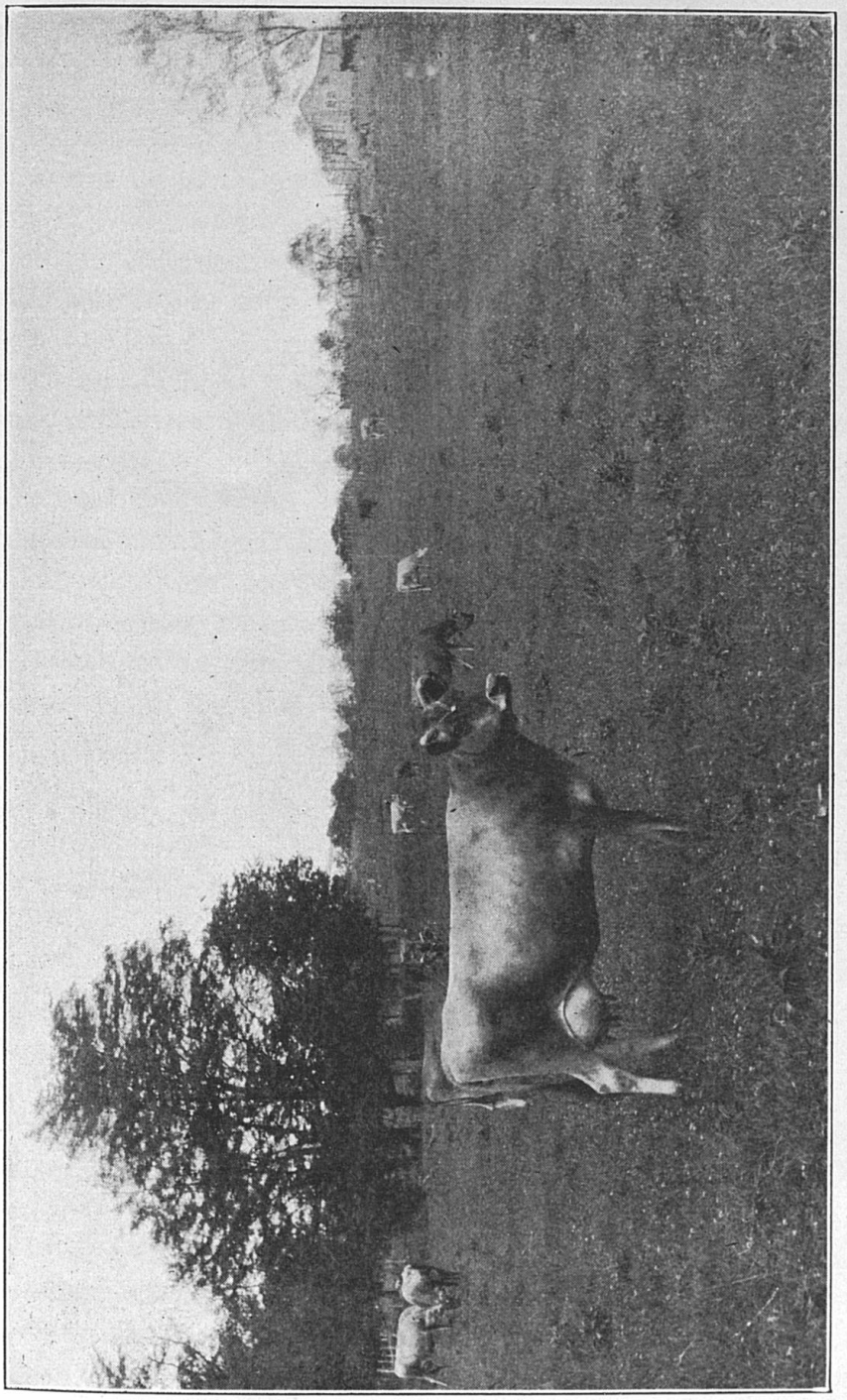
It was found profitable to secure part of the farm receipts from cash crops, but when too large a proportion of the receipts came from cash crops profits began to decline. On good-sized farms tobacco raised by cropper labor paid well, but when the crop was raised by the regular farm labor it seemed to interfere with the work of the dairy and other farm work. P. 120.

Profits increased in proportion to the returns per cow for $100 worth of feed. P. 120.

On most farms it pays to raise rather than buy the cows in the dairy herd. Profitable cattle raising is largely dependent upon an ample supply of skim-milk, pasture and cheap home-grown roughage. P. 121-122.

Pastures furnish by far the cheapest feed for milk production. P. 123-124.

Cows were kept in these herds an average of 4.8 years before being discarded. P. 124-125.



Jersey cows on pasture on a Shelby County farm.

The most profitable dairy farms had about three-fourths of their total capital in real estate and one-fourth in operating capital. P. 126.

The most profitable ten farms in the study had four times the labor income, twice the capital and crop area, 40 per cent. greater total area, were twice as heavily stocked, had 21 per cent. better crop yields, 26 per cent. greater receipts per cow, and carried 70 per cent. more cows per unit of pasture than did the average farm. P. 127.

Labor efficiency is a fundamental factor in profitable dairy farming. Greatest labor efficiency is attained when the operator works with the hired men.

The organization of successful dairy farms of various sizes is given on pp. 127 to 146. The success of these farms indicates that they are organized on substantially correct lines and a careful study of their organization will be very useful to other farmers in improving the organization and management of their own farms.

Introduction

In no other farm enterprise has scientific investigation been more productive of progress than in dairy farming. Studies in animal feeding have developed principles which have enabled feeders of dairy cattle to work with a definite knowledge of the character and amounts of feed which will give the maximum production of milk and butter fat. Chemical research has develop the Babcock test by which dairymen can accurately and cheaply determine the productiveness of the individual cows in their herds, being enabled thereby to select and breed intelligently for increased production. Research in dairy sanitation has taught the commercial dairyman how to produce milk of extreme palatability, wholesomeness and safety; so clean, indeed, that it may be kept sweet for weeks and even months. Further studies have shown that such milk may be produced not only in expensive plants with elaborate equipment but also that it may be produced in ordinary barns by simple and economical methods. So well, indeed, have dairy

investigators done their work that a fair working knowledge of the technical principles of dairying is now possest by a majority of dairy farmers.

But there is an important side of the dairy industry which has received but meager consideration. This is the business or economic side, which involves the question of organizing the dairy enterprise in relation to the farm as a whole, so that the entire farm business will return the greatest possible profit. It is the province of farm management investigators to work out well balanced plans of farm organization which will employ capital and labor, crops, stock and equipment in such proportions as will result in maximum efficiency. How large a dairy herd should be kept on a farm of a given size? Should Kentucky dairymen produce wheat, tobacco, hogs, sheep and other crops and stock for the market, or should they confine themselves to the production of milk as an exclusive enterprise? If diversity is advisable, how great should this diversity be? Does it pay, under Kentucky conditions, to raise the cows to be used in the dairy or is it more profitable to buy them? In what proportion should capital be distributed in land, buildings and live stock? What crops and what acreages of crops should be grown? How large should the dairy farm be for greatest profits? These are some of the questions which Kentucky dairy farmers wish to have answered, and it was to learn the answers to such questions that the investigations recorded on the following pages were carried on by the Department of Farm Management of the Kentucky Agricultural Experiment Station.

Method of the Investigation

The farm management survey method was employed in this study. Personal visits were made by the investigators to more than two hundred dairy farms and a detailed analysis was made of the business organization of each. Certain of these farms have for many years past returned net incomes ranging from $3,000 to $8,000 a year. Certain others, after the farm expenses were paid, returned no income at all. When the organization of the successful and the unsuccessful farms

is analyzed and compared, the reasons for the success of the one and the failure of the other are discovered. By analyzing and tabulating large numbers of survey records the various factors for successful dairy farming stand out clearly.

Description of the District Surveyed

The farms comprising this survey are located in Shelby, Spencer, Oldham and Hardin Counties, and are within a radius of approximately forty-five miles from Louisville. The latter city draws the major portion of its milk supply from these counties.

The soils of the district are mostly of limestone origin. In general, the surface is rolling and the greater portion of the farm area is very properly devoted to the grazing of live stock. Corn, wheat, tobacco, clover and timothy, cowpeas, orchard grass, and rye for grazing, are the chief crops grown. Wheat and tobacco are the principal money crops. Most of the feed crops are fed to stock. The farms for the most part are well improved. Most of the land is cleared and 85 to 90 per cent. is tillable.

Hogs and beef cattle are the principal live stock kept in connection with the dairy cattle. A few of the larger farms keep sheep. Grade Jersey cattle predominate but there are a considerable number of pure-bred Jerseys in the district. Shelby County has gained a wide reputation for its Jersey cattle.

On the farms studied 46 per cent. of the total receipts were secured from dairy products, 8.2 per cent. from dairy cattle, 10 per cent. from hogs, 4.5 per cent. from beef cattle, 1.4 per cent. from sheep, 8.4 per cent. from tobacco, 4.3 per cent. from wheat, 4 per cent. from feed crops, 2 per cent. from poultry and 11.2 per cent. from miscellaneous sources.

Of the total farms in the survey, one hundred obtained the greater part of the receipts from dairy products in the sale of whole milk shipped in cans to dealers in Louisville; fifty-three derived their principal dairy receipts from wholesale cream; three retailed all or the greater part of their milk, while six

derived the bulk of their dairy products receipts from the sale of butter.

The average price of milk for the year was 16½ cents per gallon delivered in cans f. o. b. cars at Louisville, the milk ranging from 4 to 5 per cent. in butter fat. The average price for 20 per cent. cream was 65 cents per gallon.

The average price of Burley tobacco for the season was 10½ cents per pound, and for wheat $1.06 per bushel. The average price of wheat bran was $26 per ton, cottonseed meal $35 per ton, corn 80 cents per bushel, clover and timothy hay $14 per ton.

How to Measure the Profitableness of a Farm

The most accurate measure of the financial success of a farm is the labor income made by its operator. By labor income is meant the amount of money a farmer has left after paying all business expenses of the farm and deducting interest on the money invested in the farm business. In addition to the labor income the farmer has the use of a house to live in and the products furnished by the farm, such as fruits, vegetables and dairy products. The labor income is comparable to the wages of a hired man when he gets a house, garden and some farm products.

The method of computing labor income is set forth in Table I which shows averages for the hundred and sixty-two dairy farms included in this study.

Table I.—Method of Computing Labor Income, 162 Ky. Dairy Farms

Average capital invested	$17,559
Average farm receipts	3,116
Average farm expenses	1,439
Receipts minus expenses (farm income)	1,677
Interest on average investment at 5 per cent	878
Labor income	799

The average capital was $17,559; the average receipts were $3,116; the average expenses, $1,439. The latter figures include all business or farm expenses, also the value of the labor

of members of the farm family except the operator. They do not include household or personal expenses. The difference between receipts and expenses is $1,677. This is the sum earned by the farmer's capital and labor. Since interest is a legitimate business charge, $878, or the interest on the total capital at 5 per cent., is deducted from the farm income, leaving $799, which is the farmer's labor income or the salary he received for his year's work.

Most Important Factors Affecting Dairy-Farming Profits

The factors which stand out most prominently in this study are herd production, crop yields and size of business. Other important factors are the utilization of pasture, the efficient use of labor, the proper rate of stocking the farm, a reasonable balance between crop and live-stock enterprises, and a proper balance between dairy cattle and other productive live stock, particularly hogs.

Effect of Herd Production on Profits

Milk production may be regarded as a manufacturing enterprise in which raw materials in the form of feed are made into milk, the finished product. The cow is the machine by which this manufacture is effected. A study was made to ascertain the range of efficiency among dairy cows and to determine the effect of productiveness of cows on profits. This factor is measured fairly accurately by the receipts per cow. For the region surveyed the average receipts per cow were $78.

Table II.—Relation of Receipts Per Cow to Labor Income

Receipts per Cow.	No. of farms.	Av. Receipts per cow.	Labor Income.
$50 and less	22	$39	$216
$51 to $60	25	58	289
$61 to $70	27	65	818
$71 to $80	32	75	816
$81 to $90	28	83	993
Over $90	28	111	1,480
All farms	162	78	799

Table II shows the relation of receipts per cow to profits. On twenty-two farms the receipts from dairy products were not over $50 per cow and on twenty-five other farms the receipts were between $50 and $60 per cow. The operators of these forty-seven farms received less for their services than their hired men. Since these farms are almost as large as the average it appears that their very low labor incomes are due mainly to the low production of their cows. The effect of increased production per cow is most strikingly shown by the increase in labor incomes in the first three groups. A study of the records on the basis of receipts per cattle unit showed a similar increase in profits as the receipts per cattle unit increased.

The Effect of Crop Yields on Profits

Ranking in importance with herd production, in this dairy district, is the yield of crops, which is the second fundamental factor in determining profits.

Crop Yields. In order to determine the influence that crop yields exert on profits, the yields on each farm are exprest on the percentage basis, 100 per cent. representing the average yield of the particular locality. This relative figure expressing the percentage of crops on individual farms compared with the average yield for all farms in the locality is termed the "crop index." The crop yield is determined for each county separately, and the crop index for a particular farm is based upon the average yield for that county.

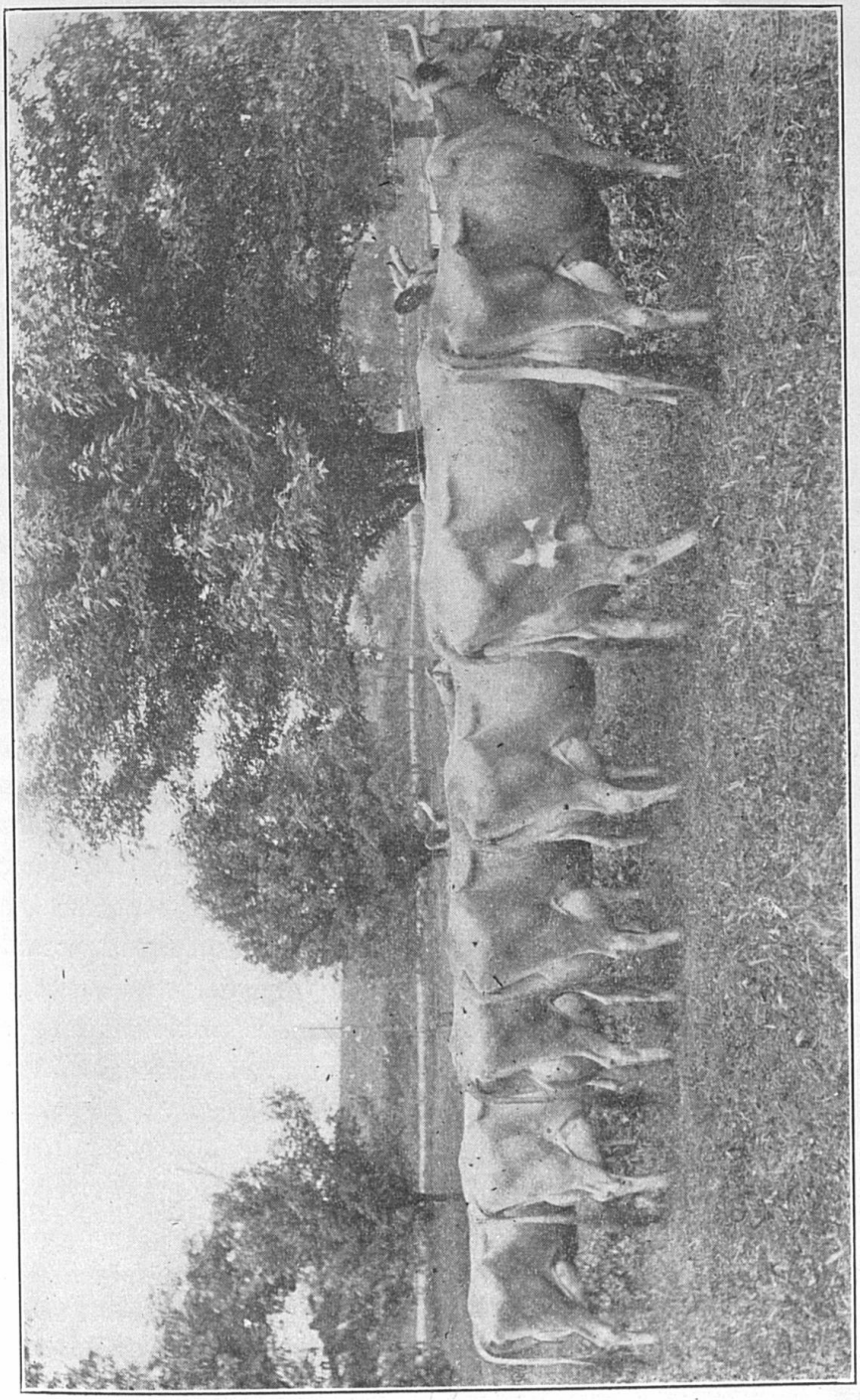
The average yields per acre for the different counties for the year 1915 were as follows: Hardin County, corn 28.6 bushels, corn silage 6.6 tons, oats 17.5 bushels, wheat 8.5 bushels, tobacco 828 pounds, hay 1.01 tons; Oldham County, corn 34.1 bushels, corn silage 6.3 tons, oats 19.7 bushels, wheat 10.6 bushels, hay 1.3 tons; Spencer County, corn 38.1 bushels, corn silage 9.2 tons, rye 4.5 bushels, wheat 10.9 bushels, tobacco 688 pounds, hay 1.2 tons; Shelby County, corn 48 bushels, corn silage 9.2 tons, wheat 11.6 bushels, rye 6.2 bushels, tobacco 1,126 pounds, hay 1.2 tons. The crop yield for 1915 was about a normal one for these counties.

Table III.—Relation of Crop Yields to Labor Income

Crop Index	No. Farms	Av. Size	Labor Income
Below 85%	39	185	$293
85 to 99%	42	190	528
100 to 115%	44	208	1,045
Over 115%	37	198	1,347

Table III shows the relation of crop yields to labor income. Since farms in the four groups shown in Table III are of about the same size the difference in labor incomes appears to be due principally to the difference in crop yields. It will be noted that the labor income increases as crop yields increase, the increase being most rapid until the yield is 15 per cent. above the average. From this point upward, the increase in labor income is more gradual, with increases in crop yields. The number of farms in the tabulation is too small to determine the point at which further increase in crop yields fails to increase labor income. Surveys in other regions show that in general it pays to increase crop yields until they are from 20 to 30 per cent. above the average for the region. When intensity is increased beyond this point the increased expense of raising the crop cuts down the profits.

The Combined Effect of Receipts Per Cow and Crop Yields on Profits. Table IV shows the combined effect of receipts per cow and crop yields on labor income. There were forty-one farms whose receipts per cow were below the average and whose crop yields were more than 10 per cent. below the average. The average labor income of these farms was only $298. There were twenty-seven farms with receipts per cow below the average and with crop yields more than 8 per cent. above the average. The average labor income of these farms was $865. There were fourteen farms with receipts per cow above the average, but with crop yields more than 10 per cent. below the average. It seems from these figures that the receipts per cow and crop yields have about the same influence on profits.



Seven pure-bred Jerseys, bred on one of the farms included in the survey. The butter records of these cows range from 68.6 lbs. to 85.8 lbs. butter in 30 days.

Table IV.—The Combined Effect of Receipts per Cow and Crop Yields on Labor Income

Receipts per Cow	Crop Index	No. of farms	Size	Labor Income
$78 and less	Below 90	41	193	$298
	90 to 108	28	168	415
	Over 108	27	207	865
Over $78	Below 90	14	187	657
	90 to 108	28	195	1,076
	Over 108	24	217	1,788

There are twenty-four farms with receipts per cow above the average and crop yields more than 8 per cent. above the average. The average income of these farms is $1,788. These figures show that as a rule dairy farmers having the two-fold handicap of low crop yields and low herd production made very low labor incomes. On the other hand, farmers securing good crop yields and good herd production secured excellent net returns.

The experience of the most successful farmers of the region indicates that crop yields are most economically increased by lengthening the time fields are kept in grass and by making a fuller use of all stable manure. The best farmers use rotations whereby the land is cropped in corn or tobacco not oftener than one year in four or five, the remainder of the period the land being devoted to wheat or rye one year and meadow and pasture two or three years. The more sloping fields are kept in permanent bluegrass. The best disposition of stable manure is to scatter it thinly on young clover and grass, first attention being given to thin or galled land on the breaks of the slopes.

Size of Farm Business

This factor exerted a marked influence on the profits from these dairy farms. There are several ways for measuring size in comparing size of farms and groups of farms. Among these are total acreage of the farm, gross income, crop area, size of the herd, total investment and amount of working capital employed. While no one of these methods is entirely satisfactory

when used alone, several of the methods, when used in connection with each other, afford a reliable means of measuring the size of business. The total acreage of the farm, the crop area, size of the herd and total investment furnish a good combination for comparing the influence of size of dairy farms.

Size of Farm

Good-sized farms, as a rule, return larger profits than small farms. Table V shows the relation of size of farm to labor income. With one exception the labor incomes increase as the size of the farm increases. The small labor income in the group of farms between 225 and 275 acres appears to be due to the fact that these farms had too large a part of their total capital invested in land, being more poorly stocked than either the next larger or next smaller groups. They also lacked sufficient equipment, as the investment in machinery was less per crop-acre than on the other farms.

Table V.—Relation of Size of Farm to Labor Income

No. of Acres	No. Farms	Av. Size	Labor Income
Less than 75	9	54	$200
75.1 to 125	42	106	398
125.1 to 175	31	150	809
175.1 to 225	30	200	980
225.1 to 275	19	243	767
275.1 to 325	14	304	1,181
Over 325	17	425	1,491

The effect of the size of the farm on the net earnings of the land per acre is shown in Figure 1. The maximum land earnings per acre are found in the group averaging 150 acres but the earnings per acre decrease very slightly until the group averaging 200 acres is reached. From this point the net earnings per acre decrease a little faster as the size of the farm increases, but the net profits per farm increase, altho the increase is not so marked above the 200 acre group as in the groups averaging less than 200 acres. It is interesting to note that not only are the profits per farm small in the groups averaging less

than 150 acres, but the land earnings per acre are also small. That is, after all expenses were paid there was very little surplus on the small farms.

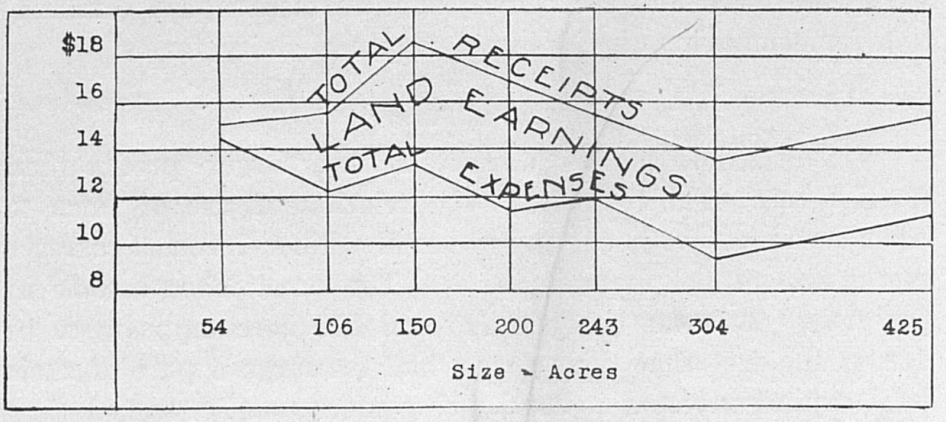


Fig. 1.—Relation of Size of Farm to Land Earnings Per Acre.

The upper broken line represents the total receipts per acre, the lower line the total expenses per acre. "Total Expenses" includes farm expenses as used elsewhere in this bulletin, interest on working capital and the estimated value of the operator's labor and managerial services. The space between the broken lines represents profits per acre, or the amount left over for the use of the land. This is termed "Land Earnings."

Crop Area

Table VI shows how the acreage in harvested crops affects profits on Kentucky dairy farms. By the term "harvested crops" is meant those crops in addition to pasture, woods and other land not cropped. It will be noted from the table that Labor Income increases as the acreage in crops increases. The main reason why the acreage in crops influences farm profits is that most of the economies in production depend upon this factor.

Table VI.—The Relation of Acreage in Crops to Labor Income

Crop Acreage	No. Farms	Aver. Crop Acreage	Labor Income
Less than 25	8	17.6	$183
25.1 to 50	41	39.5	325
50.1 to 75	35	63.7	778
75.1 to 100	23	88.8	834
100.1 to 125	31	112.2	1,050
Over 125	24	171.9	1,479

Unless there is a sufficient acreage of crops, machinery, horses and labor cannot be used to the best advantage and it is difficult or impossible to secure maximum profits from the operation of the farm. The influence of crop area on profits is shown graphically in Fig. 2.

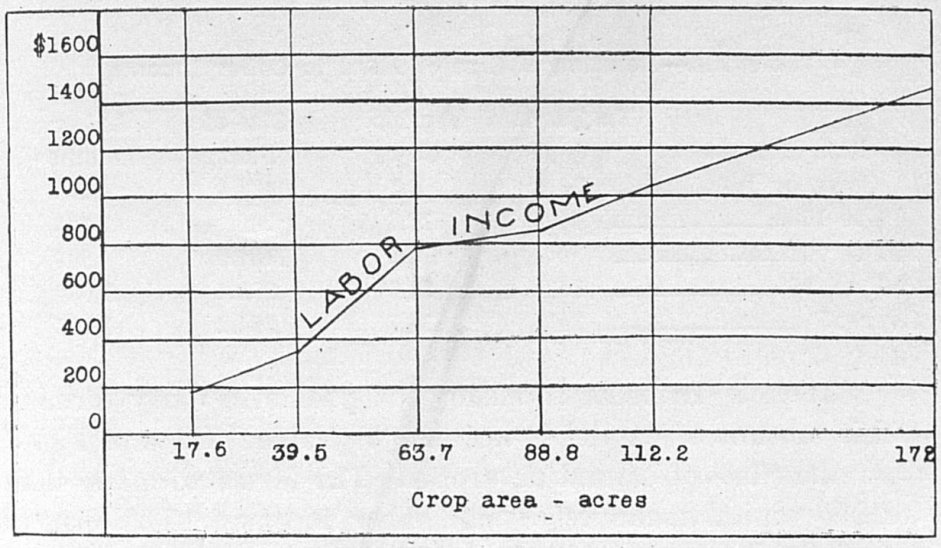


Fig. 2.—Relation of Crop Area to Labor Income.

Size of Herd. This investigation shows that with deep-milking cows good-sized dairy herds are more profitable than small herds. This is due largely to the fact that the expenses incurred for equipment, and the time required to care for and market the milk or cream are less per cow and per gallon of milk or cream when twenty to twenty-five cows are kept than when eight or ten are kept. Table VII shows that on farms of average size profits increase rapidly as the size of the herd increases until the herd reaches about eighteen cows.

In studying Table VII it will be noted that the size of farm accounts partially for the increase in labor income since, as the herd increased, the size of farm increased also. Really, the table shows the combined effect of size of farm and size of herd. However, to eliminate the effect of size of farms, we

may compare farms having small herds with farms of the same size having herds of normal size. In Table VII the groups averaging 6.7 and 12.8 cows per farm average 149 acres in size. The average labor income of these two groups with small herds is $266. Table V shows the 150-acre farms with herds of normal size had labor incomes averaging $809.

Table VII.—Relation of Size of Herd to Labor Income

Size of Herd	No. Farms	Av. No. Cows	Size of Farm	Labor Income
10 Cows or less	34	6.7	133.8	$133
10.1 to 15	44	12.8	160.	369
15.1 to 20	34	18.2	187.9	909
20.1 to 25	16	22.6	253.4	1,030
Over 25	34	34.7	284.2	1,757

Capital. In order to make good profits in dairy farming a fair amount of capital is necessary. Table VIII and Fig. 3 show the effect of capital on profits. The farms with less than $12,000 capital made very small labor incomes. The chances for profits increase rapidly from $12,000 to $17,000 capital, and then slowly, with further increases in capital.

Table VIII.—Relation of Capital to Labor Income

Capital	No. of Farms	Average Capital	Labor Income
Less than $5,000	11	$4,283	$119
$5,001 to $10,000	34	7,261	307
$10,001 to $15,000	41	12,245	482
$15,001 to $20,000	23	17,270	1,072
$20,001 to $25,000	25	22,391	1,264
Over $25,000	28	38,698	1,458

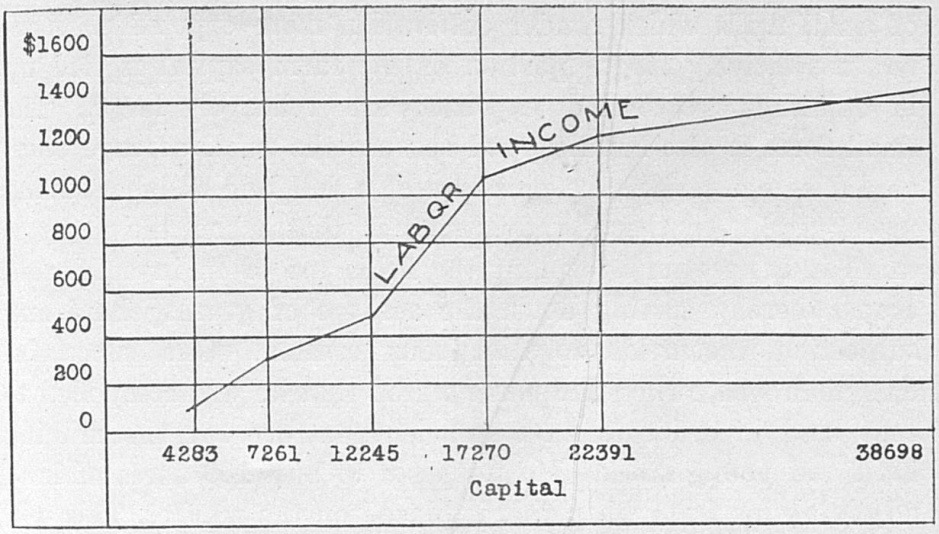


Fig. 3.—Relation of Capital to Labor Income.

THE ECONOMIC UNIT. It will be noted from Table II that the labor incomes increase as the size of the farm increases until the size reaches 200 acres. From this point profits increase less markedly with further increases in farm area. More than one-half of the group of farms averaging 200 acres in size made labor incomes of more than $1,000, and 10 per cent. had minus labor incomes. The farms which averaged more than 200 acres in size showed larger average labor incomes than the 200-acre group, but 20 per cent. of these large farms had minus labor incomes, showing that large farms give opportunity for large losses as well as for large profits.

There are several reasons why good-sized farms are more profitable than small farms. There is enough work on the good-sized farm to employ two or more men the year round. Considerably more work is accomplished per man on the two or three man farm than on the one man farm. Horses are also more efficient on the good-sized farm. The five or six-horse farm has an advantage over the two or three-horse farm, since it makes possible the more economical use of teams and machinery.

The very small farm is at a disadvantage not only in the utilization of man labor and horse labor, but also on account

of small fields which render cultivation more expensive. Then, too, a relatively larger portion of the farm capital is tied up in buildings. Overhead expenses are relatively large. The small farm is also handicapped because the small acreage operated does not justify the purchase of a full line of labor-saving machinery. Another disadvantage is that when the farm is small it is necessary to plant the fields too often in cultivated crops, thereby cutting down the acreage of grazing land and subjecting the fields to disastrous erosion. One successful dairyman who owned 170 acres stated that he was compelled to rent land in order to have sufficient pasture for the milking herd and young stock. He purposes to buy 100 acres of land adjoining his farm when this is placed on the market. This will make a farm of the size which, in his judgment, can be most economically operated.

While the very small farm is handicapped in a number of ways the unusually large farm also has some disadvantages. Often much time is lost going to and from the distant fields. Also it is often difficult to give adequate supervision to laborers and the element of personal interest on the part of hired men is apt to be lacking. A few very large farms in this region were successful but these were operated by men of unusual ability who were filling a demand for a special grade of milk which sold at a premium price. Because of market limitations there is room for only a few such farms in any region.

The authors do not wish to convey the impression that dairymen on small farms have no chance to make satisfactory profits. Several small farms in the district made excellent labor incomes. (See pages 132, 145, 146.)

Ways of Increasing the Size of the Farm Business. It is of intrest to note how some of the dairy farmers of this district, whose farm business was originally small, succeeded in increasing the size of their business. The plan followed most frequently was to go in debt and buy additional land. Most of the men who did this were able to increase their profits and eventually to pay off their mortgages. Some farmers increased the size of their farms by renting additional land.

Others went into debt for additional live stock and equipment. A few increased their business by cropping the land very intensively and stocking the farm heavily. When this plan was carried too far, however, soil fertility was decreased by too frequent cropping of the land in cultivated crops and by curtailing the pasture area. Too much feed had to be bought. Production costs increased and profits decreased. In a majority of cases the renting or buying of more land was more profitable than extreme intensity on a small area.

Pasture Utilization, Rate of Stocking the Farm, Diversity, Proper Combination of Crop and Live-Stock Enterprises and Other Factors

While this study shows that herd production, crop yields and size of business are the factors of fundamental importance in this region, there are numerous other factors which influence profits. Since some of these factors are correlated and some of them counteract the influence of others, it is difficult to determine the exact influence of each factor on profits. In an effort to meet this difficulty, the classifications for these minor factors are grouped and the results compared as they correlate, one with another.

Table IX.—Relation of Rate of Stocking the Farm to Labor Income

No. Productive Animal Units* per 100 Acres in Crops	No. Farms	Av. Size	Labor Income
Below 20	17	211	$100
20.1 to 30	31	219	570
30.1 to 40	40	198	810
40.1 to 50	36	204	942
50.1 to 60	20	148	1,118
Over 60	18	169	1,187
Average of all farms	162	196	799

Relation of Amount of Live Stock to Labor Income. Table IX shows the relation of amount of live stock kept to labor income. It will be noted that the more heavily stocked

*An animal unit is the equivalent of a mature cow or steer. One horse, 7 sheep, 14 lambs, 5 hogs, 10 pigs, 100 chickens, 2 head of yearling cattle or colts are equivalent to an animal unit. An animal unit in hogs, sheep or any other class of animal will require as much feed and make as much manure as a cow or steer.

farms are the more profitable. When the farms were classified on the basis of the number of animals to one hundred acres of land a similar effect on farm profits was shown. It should be said, however, that the rate of stocking the farm in any particular case will depend in large measure upon the quality of the live stock and upon the skill of the farmer in the management and in the buying and selling of live stock as well as upon the ability of the land to produce ample crops of grain, forage and pasture for the economical feeding of the live stock.

Table X.—Relation of Pasture Utilization to Labor Income

Pasture Area per Animal Unit	Av. Pasture Area per A. U.	Receipts per Cow	Labor Income
Over 4	4.4	64	$81
3.6 to 4	3.8	79	583
3.1 to 3.5	3.3	66	695
2.6 to 3	2.8	68	638
2.1 to 2.5	2.4	81	852
1.6 to 2	1.9	89	1,117
Less than 1.6	1.3	92	1,656

Table X shows the relation of pasture utilization to profits.

Table XI shows that the crop yields were considerably larger on the heavily stocked farms than on the lightly stocked farms. The farms with less than 15 animal units per 100 acres of improved land have crop yields 9 per cent. below the average, while those with more than 30 animal units per 100 acres of improved land have crop yields 22 per cent. above the average.

Table XI.—Effect of Amount of Live Stock Kept On Crop Yield

No. Animal Units per 100 Acres of Improved Land	Pasture Area per A. U.	Crop Acres per A. U.	Crop Index
Below 15	3.7	3.6	91
15.1 to 20	3.0	2.5	96
20.1 to 25	2.6	2.1	99
25.1 to 30	1.9	1.8	104
Over 30	1.4	1.6	122

Combined Effect of Rate of Stocking the Farm With Cattle and of Quality of Cattle, on Profits. The extent to which it will pay to specialize in the dairy enterprise as in any other enterprise will depend largely upon the quality of that enterprise. Table XII shows the combined effect of receipts per cow and percentage of animal units in cows, on labor income. The farms were first grouped on the basis of receipts per cow. The first group is composed of all farms whose receipts per cow are $78 or less, and the second group are those whose receipts per cow are more than $78. There are 36 farms in the low-producing group on which not over 59 per cent. of the productive animal units are in cows. The labor incomes of these farms average $721. There are 34 farms in this group on which from 59 to 69 per cent. of the productive animal units are in cows. The labor incomes of those farms average $428. There are 26 farms in the same group on which more than 69 per cent. of productive animal units are in cows. The labor incomes on these farms average only $269. With poor cows the chances for profits decreased as the number of cows increased.

Table XII.—Relation of Proportion of Farm Animals in Cows and Receipts per Cow, to Labor Income

Receipts per Cow	% Prod. A. U. in Cows	No. Farms	Labor Income
$78 and less	Not over 59	36	$721
	59.1 to 69	34	428
	Over 69	26	269
Over $78	Not over 59	20	1,158
	59.1 to 69	21	1,671
	Over 69	35	958

There are 76 farms with receipts per cow better than the average. Twenty of these farms had less than 59 per cent. of productive animal units in cows. The average labor income of these farms is $1,158. Twenty-one farms in this group have from 59 to 69 per cent. of their productive animal units in cows. The average labor income of these farms is $1,671.

There is a decrease in the labor incomes on the farms with more than 69 per cent. of productive animal units in cows. It appears that even with cows that produce better than the average it is usually unprofitable to increase the number of cows beyond the point where from 60 to 65 per cent. of the productive animal units are in cows, as the farm is apt to be thrown out of balance and the economical utilization of labor rendered more difficult. Evidently diversity is much more important on farms with low-producing cows than on farms with high-producing cows.

Table XIII.—Relation of Receipts from Hogs to Labor Income

Per Cent. Receipts from Hogs	No. Farms	Av. Size	Labor Income
None	20	140	$325
Less than 5	39	191	827
5.1 to 10	34	220	1,015
10.1 to 15	31	196	872
15.1 to 20	18	191	796
Over 20	20	224	704

Effect of the Number of Hogs Kept on Profits. Table XIII shows the relation of the percentage of receipts from hogs to profits on these dairy farms. There were 20 farms that sold no hogs.

These farms average 140 acres in size, with crop yields and receipts per cow about the average for the section. Their labor incomes average only $325. The average labor income for all farms of this size and quality is about $700. A few hogs would undoubtedly increase their chances for profits. The number of hogs on a dairy farm may easily become too great. Some hogs are useful and profitable in utilizing skim-milk, kitchen waste, undigested grain in the droppings of the cattle, and crops that would otherwise go to waste, but it appears that on the dairy farms of this region dairy cows gave more profitable returns for high grade concentrates than did hogs. As a minor enterprise hogs were profitable but not as a major enterprise. This is probably due to the fact that in the particular area studied the farms are better suited for the production of grass than grain

and when a large number of hogs were kept in connection with the other live stock, too much of the grass land was plowed.

Effect of Keeping Sheep, on Profits. This investigation showed that sheep were profitably kept on a few of the larger farms. There are some practical difficulties in handling sheep and dairy cattle together on farms of small and medium size. Cattle dislike to eat grass on which sheep are grazing. Only on farms where a sufficient number of pasture fields make possible the proper shifting and separating of the sheep and cattle can the two classes of stock be used advantageously together. Sheep can be handled to best advantage on the larger farms, but on any farm they are useful in keeping down weeds. The organization of a successful dairy farm keeping sheep is shown on page 144.

Table XIV.—Relation of Percentage of Receipts from Crops to Labor Income

Per Cent. Receipts from Crops	No. Farms	Av. Size	Labor Income
None	23	150	$577
Less than 10	41	170	793
10.1 to 20	38	211	954
20.1 to 30	30	225	821
Over 30	30	217	908

Proportion of Receipts From Crops. Table XIV shows the relation of the percentage of receipts from crops to labor income. The farms that sold no crops made, on an average, considerably smaller labor incomes than did those which sold some crops. There were 23 farms that sold no crops. These farms had average labor incomes of only $377, or less than one-half of all the farms in a region of that size. Yet when more than 15 per cent. of total receipts were derived from crops the chances for profits began to decrease.

While wheat and tobacco and other money crops were produced at a profit on many farms, these same crops failed to pay on a number of farms. On the good-sized farms tobacco raised by the tenant system usually paid well, but when raised with

wage labor that crop, as a rule, interfered seriously with other crops and with the dairy herd, and resulted in the neglect of crops and dairy herd, which more than offset the profit from the tobacco crop. Wheat which, in itself, was not a very profitable crop was, however, raised to good advantage in many cases, since it was utilized as a nurse crop for clover and grass and also furnished a supply of valuable straw for bedding and roughage.

Relation of Herd Receipts Per $100 Worth of Feed to Profits. Another factor which affected profits on these farms was the economy in the use of feed. The total value of all feed consumed by the dairy herd, including pasture, home-grown and purchased feeds, was computed for each farm. The receipts per cow per $100 worth of feed consumed also, were computed. The relation of receipts per $100 worth of feed to labor income is shown in Table XV. Twenty-four farms secured less than $100 dairy receipts for $100 worth of feed. These made labor incomes averaging $347. This income was possible only because these farms had other more profitable enterprises which partially offset the losses from the dairy. Thirty-eight farms secured $100 to $150 dairy receipts per $100 worth of feed, and made labor incomes averaging $699. Thirty-six farms secured $150 to $200 dairy receipts per $100 worth of feed and made labor incomes averaging $1,090. Thirty farms had receipts above $200 per $100 worth of feed and made labor incomes averaging $1,285.

The question naturally arises whether the larger receipts per $100 worth of feed were not due to heavier feeding. Other data show that this is not the reason. The herds that produced most per $100 worth of feed were fed no more heavily than the other herds. The data indicate that higher receipts were due to better cows and better selection and balancing of feeds.

Table XV.—Relation of Receipts Per $100 Worth of Feed to Labor Income*

Receipts per $100 Worth of Feed	No. of Farms	Average Size	Labor Income
Less than $100	24	195	$347
$100 to $150	38	194	699
$150 to $200	36	189	1,080
Over $200	30	185	1,285

Raising vs. Buying Cows. A study was made as to whether it was more profitable to raise or to buy cows used in the dairy. The farms were classified into groups, on the basis of the percentage of cows in the herd that were raised. Twenty-two farms raised one heifer for each two cows or less in the herd; 30 raised one heifer for each two to three cows; 26 one heifer for each three to four cows; 19 one heifer for each 4 to 5 cows; 21 one heifer for each 5 to 7 cows; 26 one heifer for 7 or more cows, and 18 farms raised no heifers. This classification indicated that the greatest profits accrued to those farmers who raised an average of one heifer to every four or five cows.

A close study of this question shows that profitable production of heifers is largely dependent upon having an ample supply of skim-milk, and ample pasture and cheap roughage. Farmers who shipped milk were handicapped because they were compelled to raise their calves on expensive whole milk. When grazing was restricted the cost of raising heifers was greatly increased. In many such cases dairymen raised no calves, since the necessity of purchasing high-priced feed made calf-raising very expensive. On larger farms calves could be raised profitably because, with an ample grazing area, the feed cost was reduced. Then, too, the calves, in many such cases, could be carried largely in stubble fields and other places where they secured grazing which otherwise would have been practically wasted. Where whole milk had to be fed and where the farm was already heavily stocked and grazing limited, the cost of raising heifers was almost prohibitive.

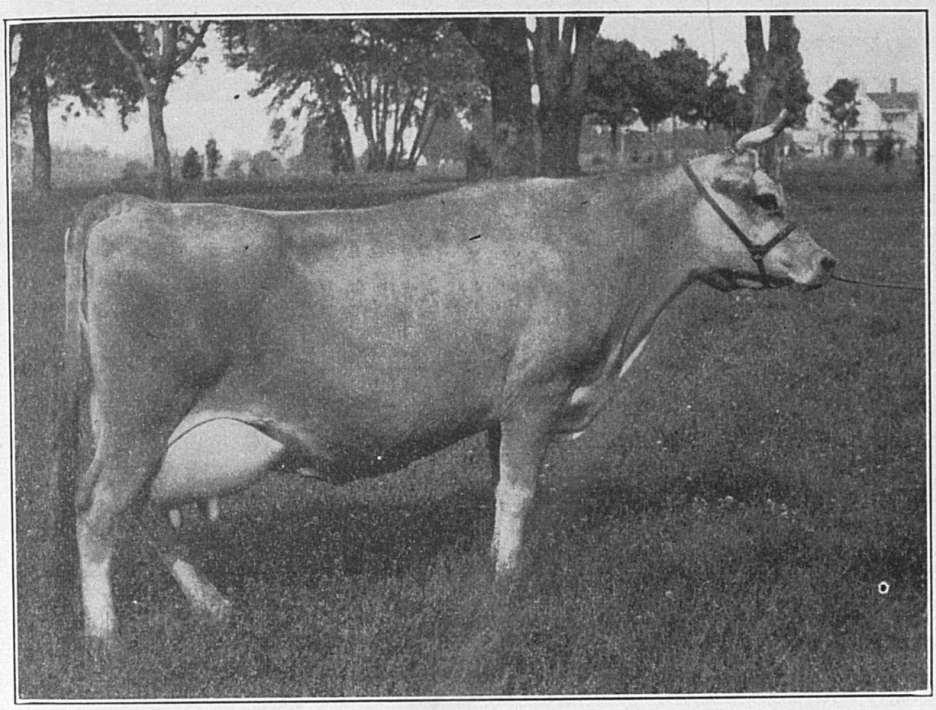
*The value of the feed consumed by the dairy herd was computed for only 128 of the 162 farms. Trustworthy data on feed were not available from the other farms.

A few farmers who had their farms stocked to the limit with mature cows rented grass for their calves and thus reduced the feed cost. One dairyman who was selling his milk at a high price and whose grazing area was limited, followed the plan of contracting with reliable men situated, usually, too far from a shipping point to engage in the shipping of milk, to raise his heifers, the consideration being from $40 to $50 each, the calf being taken at a few days of age and returned after dropping her first calf at about two years old. A modification of this plan was to sell the young calf at an agreed price, usually $10 to $12, the seller retaining an option upon the heifer when she dropped her first calf at a price varying from $50 to $60. This plan was found to work well.

Methods of Raising Calves. Those dairymen who shipped cream were best situated for calf-raising, on account of having an ample supply of skim-milk. The calves were allowed to suck the cow for a few days and were gradually transferred to skim milk. This transfer was completed at the end of two to three weeks, the subsequent diet of the calf consisting of skim milk supplemented by mill feeds and hay. Some of the best breeders of pure-bred cattle in the region followed this plan and were able to raise most excellent dairy cows at a relatively low cost. Skim-milk calves appeared, in some respects, even superior to those raised upon whole milk, it appearing that the skim-milk diet promoted large barrel development.

Some whole-milk dairymen, having no skim milk, raised calves from whole milk fed from a pail, the milk being gradually reduced and replaced by grain and hay as the calf became able to utilize these feeds. A persistent effort was made to get along with the minimum of whole milk in calf raising. Several dairymen followed the plan of putting two calves with one cow, allowing them to suckle until they could be weaned, the cow then being used to suckle one or two calves before the end of her lactation period.

As a rule, pure-bred bulls were used in this region and a high percentage of the heifer calves raised developed into good dairy cows.



Pure-bred Jersey cow from the district surveyed. She holds the State Jersey record for milk and butter.

Importance of Pastures in Profitable Dairying. The importance of pastures in profitable dairy farming in this region was shown by a comparison of the feed cost of milk per gallon, when produced on grain and hay, or grain, hay and silage, with the gallon cost when produced on pasture. Pasture was charged at two dollars per month per cow, purchased feeds at cost price and farm grown feeds at their value at the farm. This study showed that the feed cost per gallon was two and a half times as great when cows were on feed as when on pasture.

These results bear out the results of similar studies in other states. In a report of very extensive studies in the cost of milk production in Minnesota, Cooper* says: "The importance of pastures in the economy of the dairy farm is illustrated by the small quantity of grain and roughage fed during the pas-

*Minnesota Experiment Station Bulletin No. 124, "Cost of Producing Dairy Products," by Thos. P. Cooper, (now Dean and Director of the College of Agriculture and Agricultural Experiment Station, University of Kentucky), page 97.

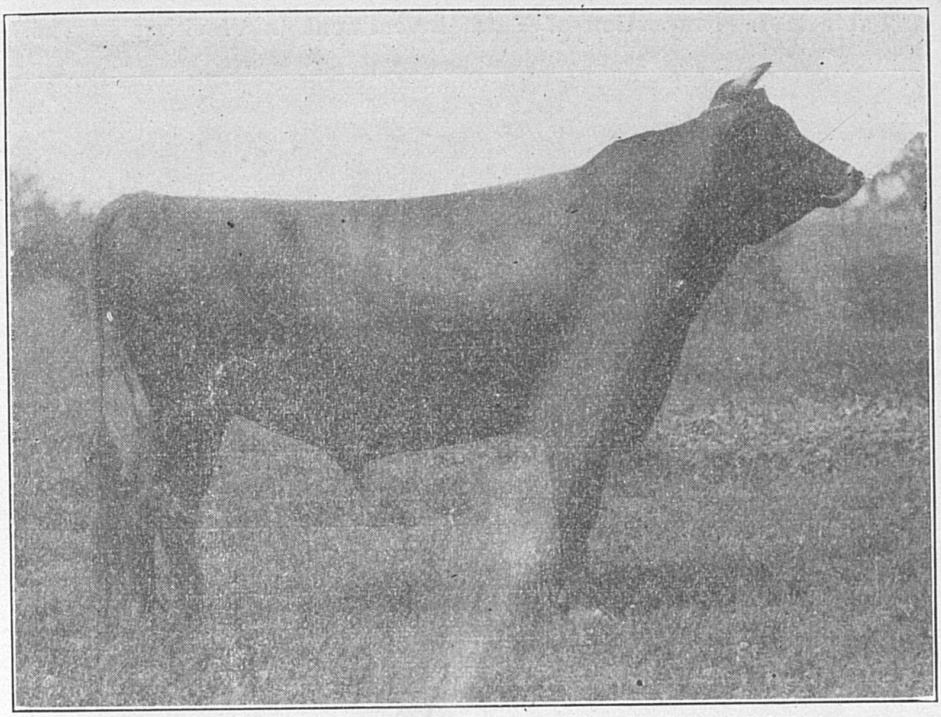
ture season; . . . for practically five months each year the cattle were supported almost entirely from the grass crop.'' On the same point Warren* states: ''Pastures furnish our cheapest feed. The pasture of one cow for one day costs three to six cents; hay or hay and silage, twelve to fifteen cents; grain, twelve to fifteen cents. A good pasture will replace all of the hay and much of the grain. Pasture produces more milk than other feed, at one-fifth to one-tenth the cost.''

The recent very marked advance in the prices of all grain and roughage feeds renders the use of pastures of even greater importance than the above data indicate. It is not intended, however, to draw the conclusion that some grain and soiling crops should not be fed when pastures are short, but rather to emphasize the large use which dairy farmers should make of pasturage, for the economical production of milk and young dairy stock.

Rate of Depreciation in the Dairy Herd. One of the heavy costs of milk production is the loss due to depreciation in value of cows that have to be discarded on account of poor production, udder troubles, failure to breed, and a large variety of other causes. Depreciation was greatest with Jersey cows because of their low value when sold for beef; thus, a Jersey cow costing a hundred dollars usually brings from forty to fifty dollars when sent to the shambles. Using the former figure, there is a depreciation of sixty dollars. The yearly depreciation is computed by dividing this difference by the number of years the cow remains in the herd. Figures obtained in this dairy district indicate that cows are kept in the herds on an average of 4.8 years. This would mean an average yearly depreciation on the Jersey cow mentioned of $12.50. If this cow had to be sold after two years the yearly depreciation cost would be $30.

The length of time cows remain in the herd as profitable producers is largely dependent upon the degree of care used in milking and feeding the herd. Depreciation is lowest when the owner gives his personal attention to the herd and highest when the herd is milked and cared for by hired employees.

*G. F. Warren, Cornell Experiment Station Bul. 280, page 355.



Pure-bred Jersey bull bred in the Kentucky dairy district. Junior champion, National Dairy Show.

Some dairymen were able to avoid a heavy yearly depreciation by using large cows carrying considerable Shorthorn blood. When such cows are sold they usually bring a price somewhere near the purchase price. Usually, such cows are not as persistent or as heavy milkers as the strictly dairy type of cow and this difference may offset the saving effected in yearly depreciation. There is, of course, the danger of bringing disease into the herd, when frequent purchases are made of outside cows.

Effect of Proportion of Working Capital to Total Capital on Profits. The working capital on these farms included the value of live stock, machinery, feed and supplies and cash necessary for operating expenses. Table XVI shows the effect of the proportion of working capital to total capital on labor income. Profits increased as the percentage of working capital increased until the latter reached 20 to 30 per cent. of the total capital. Above this point there was a marked decline in profits.

Table XVI.—Proportion of Total Investment in Working Capital

% Investment in Working Capital	Average Investment	Average Working Capital	Av. % Investment in Wkg Capital	Labor Income
Below 15%	$22,565	$2,846	12.6	$483
15.1 to 20%	17,920	3,161	17.6	869
20.1 to 25%	16,205	3,653	22.5	977
25.1 to 30%	17,017	4,575	26.9	1,074
Over 30%	7,290	2,555	35.0	433
All farms	17,555	3,341	19.0	799

Distribution of Capital on Dairy Farms. The percentage of distribution of the various divisions of fixed and working capital for dairy farms of various sizes is shown in Table XVII.

Table XVII.—Showing the Percentage Distribution of Capital on Dairy Farms

Farms Having Total Capital	Land	Dwelling	Other Bldgs.	Machinery	Cows	Other Live Stock	Feed and Sup.	Cash for Operating Expenses
	%	%	%	%	%	%	%	%
Below $5,000	51.2	17.3	9.7	2.7	7.2	7.6	2.6	1.7
$5,001 to $10,000	49.3	13.9	10.6	3.9	7.9	10.4	1.9	2.1
$10,001 to $15,000	62.2	10.3	9.0	2.5	6.3	7.1	1.9	.8
$15,001 to $20,000	62.6	8.1	9.1	3.2	5.7	7.8	2.0	1.4
$20,001 to $25,000	62.7	10.3	8.3	2.7	6.3	7.0	1.9	.6
Over $25,000	66.8	7.8	8.1	2.3	6.5	6.1	1.6	.7

Table XVIII.—Comparison of the Most Successful Ten Farms With The Average of All Farms—Kentucky Dairy District

	Average for 162 Farms.	Most Profitable 10 Farms.
Labor Income	$799	$2,919
Capital	$17,559	$36,262
Total acres in farm	196	274
Acres in crops	84	143
Number of cows	24	36
Total productive animal units	30	70
Number of men	2.7	5.8
Number of work stock	5.2	7.0
Crop yields	100%	121%
Receipts per cow	$78	$98
Receipts per cattle unit	$77	$89
Pasture per animal unit	2.7 A.	1.6 A.
Per cent. of receipts from crops	18.1	21.0
Per cent. of receipts from milk and its products	45.8	48
Per cent. of receipts from other cattle	12.7	11.0
Per cent. of receipts from hogs	10.5	12.6
Per cent. of receipts from other live stock	5.9	3.2
Value of feed per cow	$49	$47.20
Milk produced per $100 worth of feed	$163	$208

The Organization of Successful Individual Farms

Much of value concerning profitable farm organization and management may be learned from analyzing the organization of notably successful farms. The farm survey reveals these farms and their organization. From the 162 farms whose complete financial records were secured and tabulated, the 35 most profitable farms were selected and these visited again in the summer of 1917 and a second year's record secured. The 10 farms were then selected which made the best showing for the two years. Table XVIII shows a comparison of the various

factors on these 10 farms with the average of all farms in the survey.

It will be noted from this table that the most profitable 10 farms returned about four times the labor income, had about twice the amount of capital and crop area, 40% greater total area, were about twice as heavily stocked, had 21% greater crop yields, and had 26% greater receipts per cow than the average. These farms had 50% more cows than the average farm but about the same number of cows per 100 acres of land. They had one animal unit to 1.6 acres of pasture, as against one animal unit to 2.7 acres for the average farm. They received $208 for $100 worth of feed consumed by the dairy herd, as against $163 received on the average farm. Below are summarized the records of individual farms on which noteworthy results were secured.

A Successful Large Farm With A Pure-bred Jersey Herd

Farm No. 37. Farm Year Ending Jan. 1, 1916.

490 Acres of Rolling Land, 470 Acres Tillable.

Total capital $84,057.

Farm	$61,250
Tools and machinery	2,178
Feed and supplies	1,052
95 Cows	13,455
Young dairy stock	2,700
7 Head work stock	1,625
20 Brood sows	800
Other hogs	277
All else	720

Crops.	Yield per Acre
70 A. Corn for grain	70 Bu.
30 A. Corn for silage	8 T.
30 A. Wheat	20 Bu.
10 A. Oats for hay	2 T.
15 A. Cowpea hay	1½ T.
18 A. Clover hay	1½ T.
15 A. Timothy	1 T.
13 A. Tobacco	1655 Lbs.
10 A. Soy beans (silage)	6 T.
2 A. Potatoes	225 Bu.
Total crops	263 A.
Total pasture	202 A.

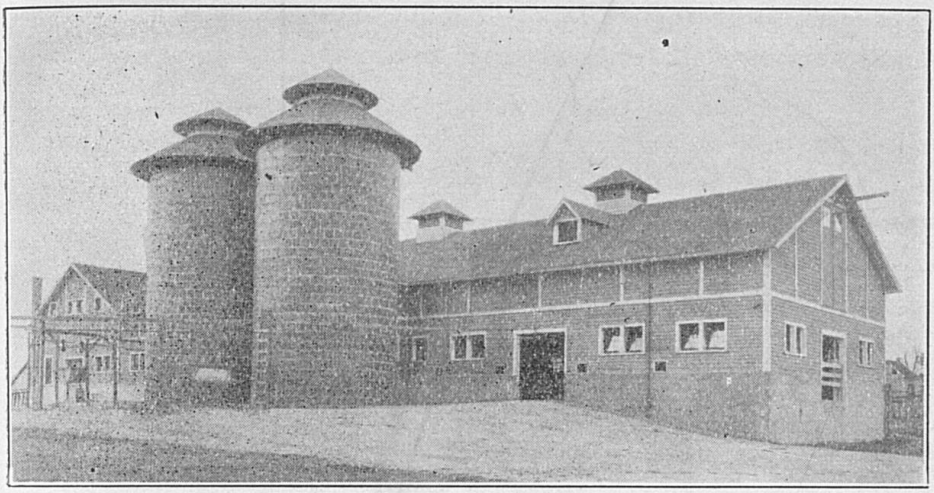
Crop index, 141.

Receipts per cow for cream	$136
Receipts per cow from dairy stock	15
Receipts per cattle unit	121
Acres of crops per A. U.	1.8
Acres of pasture per A. U.	1.4

Receipts		$22,005
Cream	$12,905	
Cattle sales	1,455	
Pure-bred hogs	1,725	
Wheat	1,844	
Corn	273	
Tobacco	1,400	
Potatoes	290	
Orchard and garden	90	
Increase in feed inv.	2,023	
Expenses		$10,902
Labor	$4,285	
Express on cream	333	
Feed	3,297	
Repairs on machinery	120	
Seeds	260	
Veterinary, medicine	150	
Advertising	353	
Registering cattle	39	
Threshing	196	
Pasture rent	150	
Gasolene	39	
Insurance	175	
Taxes	414	
Depreciation on bldgs and machinery	709	
Other expenses	282	
Farm income		11,103
Interest on capital		4,203
Labor income		$6,900

Herd—Pure-bred Jerseys.

Rotation—Corn or tobacco 1 year; wheat 1 year; clover and timothy 1 to 3 years.



Cow barn and silos on one of the better-equipped farms in the Kentucky dairy district.

This farm, in point of total capital employed, was the largest farm in the Survey and returned the largest labor income. The proprietor had operated a dairy on the place for many years and had built up the soil to a high state of fertility. Crop yields were 41% greater than the average for the section. Sweet cream of a high quality was shipped to Louisville, cream sales amounting to $12,905. The dairy herd consisted of 95 pure-bred Jersey cows and 23 animal units in young cattle and other dairy cattle. This herd represents many years of herd improvement, the success of which was attested by the fact that the returns per cow were 47% greater than the average for the section.

Sixty per cent. of the receipts came from the dairy, 8% from hogs, 18% from tobacco and wheat, and 9.2% from increased inventory of feed and supplies. It will be seen that the farm had good diversity as well as good size and production. Of the total expenses, labor comprised about two-fifths and purchased feed one-third. The labor employed was equivalent to 16.5 men for the year.

Of the total capital, seventy-three per cent. was invested in real estate and twenty-seven per cent. was operating capital. Fifty-six per cent. of the land was in crops and forty-two per

cent. in pasture. The labor income of $6,900 was more than eight and one-half times as great as the average for the section.

A Successful Diversified Dairy Farm

Farm No. 26. Farm Year Ending March 1, 1917.

400 Acres of Rolling Land; 397 Acres Tillable.

Total capital $60,980.

Farm	$50,000
Tools and machinery	1,119
Feed and supplies	405
34 Cows	2,720
Young dairy cattle	589
10 Head work stock	1,700
89 Ewes	1,116
9 Brood sows	270
Other hogs	500
Cash to run business	2,000
All else	561

Crops.	Yield per Acre
51 A. Corn for grain	50 Bu.
9 A. Corn (raised by cropper)	50 Bu.
9 A. Corn for silage	13 T.
30 A. Wheat	15 Bu.
20 A. Cowpea hay	½ T.
30 A. Tim. and Clov. hay	2 1-3 T.
15 A. Tobacco (raised by cropper)	1,167 Lbs.

Crop Index, 126.

Receipts per cow from milk	$94
Receipts per cow from dairy stock	$28
Receipts per cattle unit	$94
Per cent. of improved land in pasture	60
Acres of crops per A. U.	1.6
Acres pasture per A. U.	2.2

Receipts		$13,402
Milk	$3,208	
Herd increase	941	
Tobacco	3,224	
Wheat	438	
Gain on mules	1,260	
Lambs and ewes	850	
Hogs	1,650	
Wool	200	
Increase in feed and supplies	1,299	
All else	332	
Expenses		$5,686
Wage labor	$1,468	
Cropper labor	1,792	
Milk shipping	283	
Building and fence repairs	150	
Machinery repairs	125	
Corn and distillers' grains	565	
Horse-shoeing	25	
Veterinary	50	
Seeds	198	
Dairy supplies	35	
Twine, threshing, baling	100	
Fuel and oil	40	
Insurance and taxes	360	
Depreciation on bldgs. and tools	495	
Farm income		7,716
Interest on capital		3,049
Labor income		$4,667

Herd—Grade Jerseys, Holsteins and Shorthorns.

Rotation—Corn or tobacco 1 year; small grain 2 years; clover and grass 3 to 5 years.

This farm shows exceptional efficiency. The dairy here gave a return of $4,149, tobacco $1,612, net, above the share received by the cropper, wheat $438, mules $1,260, sheep and wool $1,050, and hogs $1,650. These figures show a marked diversity of enterprises on this farm.

The dairy herd consisted mainly of high-grade Jerseys with a few grade Holsteins and Shorthorns. Sweet milk was shipped. Twenty-two mules were bought in August, fattened on grass, corn and hay, and sold in January and February. Brood sows were bred to farrow in May and October, the pigs being sold in May and November, weighing about 180 pounds

per head. Twelve acres of tobacco and 10 acres of corn were grown by cropper labor, whose share of the crops amounted to $1,270. Four regular hands were employed by the year and two hundred dollars' worth of extra labor was hired.

The success of the farm was due to a good diversity of enterprises (both crop and stock), each contributing large returns; to good crop yields (26% better than the average); good herd production (22% better than the average); excellent returns from mules, hogs and sheep; good pasture utilization and good size of business. The labor income was $4,667.

A Successful Tenant Dairy-Farm

Farm No. 161. Farm Year Ending March 1, 1916.

400 Acres.

Crops.	Yield per Acre	Crops.	Yield per Acre
50 A. Wheat	12 Bu.	30 A. Timothy	1 T.
66 A. Corn	40 Bu.	20 A. Cowpeas	1½ T.
9 A. Silage corn	14½ T.	16 A. Tobacco	1,675 Lbs.
30 A. Oats (hay)	1 T.	6 A. Sorghum	5 T.
Total pasture	157 A.	Total crops	227 A.
Crop acres per An. Unit	2.8		
Pasture acres per An. Unit	2.0		

	Tenant		Landlord	
Capital		$5,091		$24,399
Farm			$21,075	
Machinery	$1,217			
Feed and supplies	634		634	
Cash	400			
44 Cows	1,606		1,606	
Heifers and bull	298		298	
7 Head of work stock	561		561	
8 Brood sows and other hogs	225		225	
200 Hens	150			
Receipts		$5,246		$4,822
Milk	1,818		1,818	
Poultry and eggs	280			
Sales and increase in dairy stock	528		538	
Colts	101		101	
Hogs	600		600	
Wheat	300		300	
Tobacco	1,288		1,288	
Sorghum	50		50	
Fruit	40			
All else	231		127	
Expenses		$1,699		$1,458
Labor	1,010		35	
Horseshoeing and machinery repairs	75			
Repairs of buildings and fences	30		75	
Mill feed	221		221	
Seed	70		435	
Twine and threshing	36		30	
Insurance			72	
Taxes			167	
Rent on pasture	135		135	
Depreciation	122		230	
All other expenses			58	
Farm income		$3,547		$3,364
Labor income	3,292			
Landlord's per cent. on investment			13.8	

Crop index, 111.
Receipts per cattle unit, $85.

This tenant farmer made a labor income of $3,292. Had he paid interest on the landlord's investment instead of a share of the farm proceeds, his labor income would have been $5,547. The excellent returns from the tobacco crop and dairy herd largely account for the large labor income. Twenty-five per cent. of the total receipts came from the tobacco crop, 45% from the dairy, and 12% from hogs. Crop yields were 11% better than the average and returns per cow were 10% better. The size of business and size of herd were nearly twice the average. The farm was considerably more heavily stocked than the average. It also showed excellent labor efficiency.

A Successful Small Tenant Dairy Farm

Farm No. 71. Farm Year Ending Mar. 1, 1916.
Topography Rolling; 121 Acres Share Rented.
Crop Index, 131.

Crops.	Yield per Acre
16 A. Corn	47 Bu.
6 A. Silage corn	17 T.
24 A. Rye (pastured)	4 T.
6 A. Rye hay	4 T.
5 A. Soy beans	2 T.
15 A. Other hay	2 T.
½ A. Sorghum	8 T.
8 A. Tobacco	1,500 Lbs.
Total crops	56½ A.
Total pasture	59½ A.

Receipts per cow from milk	$80
Receipts per cow from dairy stock	$30
Receipts per cattle unit	$79.40
Acres crops per An. Unit	1.3
Acres pasture per An. Unit	1.0

	Tenant		Landlord	
Capital		$2,165		$17,165
Farm			$15,000	
Machinery and tools	$320		320	
Feed and supplies	274		274	
25 Cows	825		825	
Young dairy stock	258		258	
6 Head work stock	438		438	
2 Brood sows	14		14	
Chickens	36		36	
Receipts		$2,358		$2,352
Milk	1,000		1,000	
Sales and increase of dairy stock	380		380	
Hogs	68		68	
Tobacco	720		720	
All else	170		184	
Expenses		730		362
Labor	455			
Horse-shoeing, machinery repairs	29		29	
Mill feed	37		37	
Seed	40		40	
Silo filling	25			
Insurance and taxes	78		78	
Depreciation	32		153	
All else	34		25	
Farm income		$1,628		$1,990
Interest on capital		108		
Labor income		1,520		
Landlord's per cent. on investment				11.6%

Herd—High grade Jerseys.

Rotation—Corn or tobacco 1 year; clover and grass 2 years; pasture 1 or 2 years.

If interest on the landlord's investment instead of a share of the proceeds had been paid by the operator his labor income would have been $2,653.

This is an excellent example of a well organized and profitable small dairy farm. The farm was share rented. Had the operator paid interest on the landlord's investment instead of a share of the farm proceeds his labor income would have been $2,653. The most notable feature of the farm is its marked labor efficiency. The work on the herd of 25 cows and the crops, which included 22 acres of corn, 8 acres of tobacco, 24 acres of rye (pastured), and 26 acres of hay, was done by the proprietor and one regular hired man, with $221 worth of extra labor for the busiest seasons. This remarkable efficiency would have been impossible had it not been for the fact that the proprietor gave close personal supervision and did a large share of the work himself. Other strong points were large crop yields and good herd production.

A Successful Large Crop and Dairy Farm

Farm No. 63. Farm Year Ending Mar. 1, 1916.

Topography Rolling; 311 Acres; 307 Acres Tillable.

Total capital $45,738.

Farm	$38,875
Tools and machinery	1,510
40 Cows	2,600
Young cattle	390
8 Head work stock	1,200
10 Brood sows	200
Feed and supplies	516
All else	447

Crops.	Yield per Acre
40 A. Corn for grain	50 Bu.
14. A. Corn for silage	9 T.
40 A. Wheat	8 Bu.
10 A. Rye	6 Bu.
10 A. Barley	25 Bu.
12 A. Oats hay	¾ T.
14 A. Timothy and clover	1½ T.
15. A. Tobacco	1,000 Lbs.
2 A. Sorghum	6 T.
Total crops	157 A.
Total pasture	147 A.

Crop index, 90.

Receipts per cow from cream	$107
Receipts per cow from stock	$16
Receipts per cattle unit	$99
Crop acres per A. U.	2
Pasture acres per A. U.	1.8

Receipts		$7,497
Cream	$4,274	
Dairy stock	620	
Hogs	878	
Poultry and eggs	102	
Tobacco	1,200	
Wheat	280	
Other receipts	143	
Expenses		$3,124
Labor	$1,850	
Feed	87	
Express on cream	131	
Seed	95	
Blacksmith and horse-shoeing	60	
Veterinary	30	
Twine and threshing	55	
Hay baling	70	
Insurance and taxes	275	
Depreciation bldgs. and machinery	353	
Other expenses	30	
Fertilizer	88	
Farm income		$4,373
Interest on capital		2,287
Labor income		$2,086

Herd—High-grade Jerseys.

Rotation—Corn or tobacco 1 year; wheat 2 years; clover and grass 2 to 4 years.

The strong points of this farm business are the excellent returns from the dairy herd and the good size of the business. This record demonstrates the advantage of diversity of enterprises as an assurance against loss. Despite the fact that crop yields for the year were 10% less than the average for the section, the diversified crop and stock system brought up the net proceeds and made possible an excellent labor income. Below is given the record of this farm for the following year.

Farm No. 63. Farm Year Ending Mar. 1, 1917.

311 Acres; 308 Acres Tillable.

Total capital $45,949.

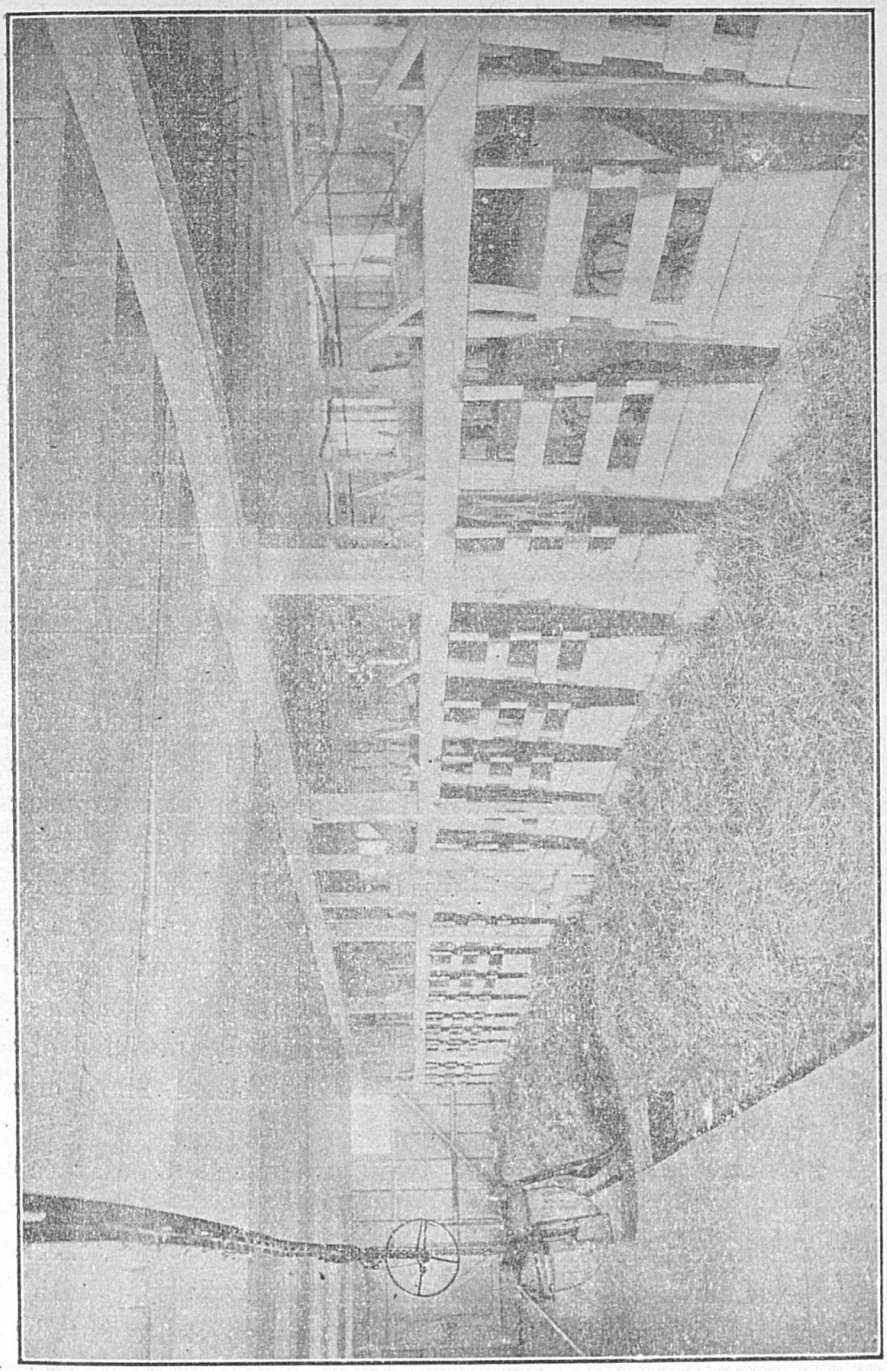
Farm	$38,875
Machinery	1,272
Feed and supplies	550
40 Cows	2,600
Other dairy stock	510
9 Head work stock	1,350
10 Brood sows and pigs	340
Poultry	52
All else	400

Crops.	Yield per Acre
52 A. Corn	60 Bu.
40 A. Wheat	10 Bu.
15 A. Silage corn	8 T.
7 A. Oats hay	2 T.
20 A. Tobacco	1,600 Lbs.
2 A. Sorghum	5 T.
Total crops	136 A.
Total pasture	169 A.

Receipts per cow for milk	$83
Receipts per cow for dairy stock	$25
Receipts per cattle unit	$80

Receipts		$12,584
Cream	$3,329	
Hogs	1,706	
Inc. dairy stock	1,000	
Poultry and eggs	196	
Tobacco	5,120	
Wheat	658	
Increase feed and supplies	265	
All else	310	
Expenses		$5,925
Labor (cropper)	$2,848	
Labor (wages)	1,290	
Repairs buildings	50	
Repairs machinery	75	
Repairs fences	50	
Purchased feed	438	
Horse-shoeing	30	
Veterinary	30	
Seeds	300	
Dairy supplies	25	
Threshing	24	
Insurance and taxes	318	
Depreciation on bldgs. and mach.	359	
All else	88	
Farm income		$6,659
Interest on capital		2,297
Labor income		$4,362

The larger labor income for this year was due mainly to increased returns from hogs, tobacco and wheat.



Interior of a dairy barn in the district surveyed.

A Well Organized, Diversified Dairy Farm

Farm No. 29. Farm Year Ending Mar. 1, 1916.
173 Acres; 160 Acres Tillable.

Total capital $24,853.

Farm	$20,000
Tools and machinery	863
26 Cows	1,820
Young dairy stock	800
Hogs (7 brood sows and other hogs)	750
Other stock	220
All else	400

Crops.	Yield per Acre
20 A. Corn	40 Bu.
10 A. Silage corn	7 T.
35 A. Wheat	17 Bu.
5 A. Tobacco	1,666 Lbs.
12 A. Hay	2 T.
Total crops	82 A.
Total pasture	78 A.
Crop index	125 A.
Receipts per cow from milk	$62
Receipts per cow from stock	$24
Receipts per cattle unit	$69

Acres of crops per A. U.	1.3
Acres of pasture per A. U.	1.2

Receipts		$5,714
Cream	$1,875	
Hogs	1,800	
Eggs	40	
Increase in young stock	409	
Wheat	750	
Tobacco	500	
Miscellaneous	340	
Expenses		$2,386
Labor	$898	
Feed	263	
Taxes and insurance	240	
Express on milk	125	
Repairs on bldgs.	100	
Repairs on fences and machinery	130	
Seed	128	
Threshing, silo filling	61	
Fuel and oil	60	
Depreciation on bldgs. and mach.	364	
All else	17	
Farm income		$3,328
Interest on capital		1,243
Labor income		$2,085

Herd—High-grade Jerseys.
Farm—One-half of area rolling; one-half bottom land.

Only about two-fifths of the total income of this farm was contributed by the dairy. In fact, the herd is kept mainly as a means of utilizing farm-grown roughage-feeds and to provide remunerative employment the year round. The herd was fed relatively little high priced, purchased feed, a fact which is reflected in the receipts per cow, which were $8 less than the average for the section. Cream for butter-making was shipped to Louisville. Hogs were the most profitable stock enterprise for the labor expended on them. They furnished one-third of the total receipts. Wheat and tobacco contributed 22% of the total receipts.

The strong points of the farm are excellent balance between crops and live stock, excellent crop yields (25% better than the average), excellent returns from hogs, and excellent labor efficiency. The proprietor worked regularly with his hired men. Other labor consisted of two men and a boy, hired by the year, and $100 worth of extra hired help. The next year's business was as follows:

Farm No. 29. Farm Year Ending Mar. 1, 1917.

Farm Area 173 Acres; 160 Acres Tillable.

Total capital $25,705.

Farm	$20,000
Machinery	880
Feed and supplies	426
33 Cows	2,310
Other dairy stock	274
6 Head work stock	800
7 Brood sows and other hogs	710
All else	305

Crops.	Yield per Acre
18 A. Corn	60 Bu.
7 A. Silage corn	16 T.
40 A. Wheat	15 Bu.
20 A. Clover and timothy	1½ T.
5 A. Cow-pea hay	2 T.
8 A. Tobacco	1,375 Lbs.
½ A. Sorghum	3 T.

Receipts per cow from milk	$73
Receipts per cow from dairy stock	$12
Receipts per cattle unit	$74

Receipts		$7,032
Cream	$2,401	
Dairy stock increase	398	
Colts	235	
Hogs	1,480	
Poultry	57	
Wheat	715	
Tobacco	1,555	
All else	191	
Expenses		$2,497
Labor	$1,432	
Repairs machinery	20	
Repairs buildings	75	
Repairs fences	40	
Bran	75	
Horse-shoeing	30	
Seed	50	
Dairy supplies	10	
Twine and threshing	51	
Taxes and insurance	230	
Depreciation on bldgs. and mach.	384	
All else	100	
Farm income		$4,535
Interest on capital		1,285
Labor income		$3,250

A Successful Diversified Dairy Farm

Farm No. 67. Farm Year Ending Mar. 1, 1916.

Topography Moderately Rolling.

170 Acres Owned; 20 Acres Rented; 187 Acres Tillable.

Total capital $25,792

Value of rented land	1,800
Farm	21,250
Tools and machinery	923
Feed and supplies	152
24 Cows	1,680
17 Heifers	495
5 Head work stock	1,005
3 Brood sows	180
All else	107

Crops.	Yield per Acre
31 A. Corn for grain	60 Bu.
6 A. Corn for silage	10 T.
45 A. Wheat	16 Bu.
5 A. Timothy hay	2 T.
20 A. Cow-pea hay	1½ T.
9 A. Tobacco	1,280 Lbs.
Total crops	116 A.
Total pasture	70 A.

Crop index, 128.

Per cent. tillable area in pasture	49.4
Receipts per cow from cream and milk	$75
Receipts per cow from dairy stock	$20
Income per cattle unit	$73
Acres crops per A. U.	2.2
Acres pasture per A. U.	1.3

Receipts		$5,279
Cream	$1,600	
Skim milk	200	
Dairy stock	475	
Hogs	1,085	
Wheat	650	
Tobacco	805	
Gain on mules	202	
All else	262	
Expenses		$2,111
Wage labor	401	
Cropper labor	402	
Repairs on bldgs. and fences	175	
Milk shipping	150	
Blacksmith and horse-shoeing	30	
Concentrated feeds	90	
Veterinary	9	
Seeds	191	
Twine and threshing	56	
Fuel and oil	25	
Taxes and insurance	183	
Cash rent	90	
Depreciation on bldg. and machinery	309	
Farm income		$3,168
Interest on capital		1,290
Labor income		$1,878

Crop Rotation—1st year corn or tobacco; 2nd, wheat; 3d and 4th, clover and grass.

Herd—High-grade Jerseys; pure-bred bull.

This farm is organized essentially like the preceding farm (No. 29). The good showing is due to good crop yields, fair production of the dairy herd, good returns from hogs, good diversity and good size of business. One hired man and the operator did the regular work, with $150 worth of extra help in rush periods. A tenant cropper raised the tobacco crop and did some farm work by the day for the farm owner. Labor was very efficient on this farm because the proprietor worked regularly with the hired men. By careful management expenses were kept down considerably lower than on the average farm. The cows kept are high-grade Jerseys, all the herd being raised.

A record taken on this farm the following year showed a labor income of $3,091. The crops grown were as follows: 22 acres clover and timothy hay, total yield 40 tons; 17 acres wheat, yield 400 bu.; 42 acres corn for grain, yield 1,615 bu.; 10 acres oats, yield 220 bu.; 10 acres cowpeas, yield 30 tons; 3.5 acres tobacco, yield 5,000 lbs.; and 6 acres orchard grass. The herd was of the same size as the preceding year. Receipts and expenses were as follows:

Receipts	
Skim milk	$288
Cream	2,000
Dairy stock	606
Hogs	1,085
Wheat	462
Corn	530
Tobacco	800
All else	622
Total receipts	$6,393
Total expenses	1,723
Farm income	4,670
Interest on capital	1,579
Labor income	$3,091

Expenses	
Labor	$866
Feed	64
Seed	110
Taxes and insurance	187
Depreciation on buildings and machinery	311
All else	185
Total expenses	$1,723
Receipts per cattle unit	$85

The larger labor income for the second year was due to better returns per cow, larger returns from other live stock, and from crops, and to a reduction of expenses amounting to nearly $400. This record shows careful management and marked efficiency of labor.

A Successful Dairy and Hog Farm

Farm No. 55. Farm Year Ending Mar. 1, 1916.

Topography Rolling.

215 Acres; 212 Acres Tillable.

Total capital $22,223.	
Farm	$17,200
Tools and machinery	822
Feed and supplies	716
30 Cows	1,800
Calves and other dairy stock	695
6 Head work horses	600
6 Brood sows and other hogs	220
100 Hens	50
All else	120

Crops.	Yield per Acre
40 A. Corn	50 Bu.
40 A. Oats hay	¾ T.
25 A. Cowpeas	2 1-5 T.
Total crops	105 A.
Total pasture	107 A.
Crop index, 106.	
Receipts per cow from cream	$80
Receipts per cow from dairy stock	$21
Receipts per cattle unit	$78
Acres crops per A. U.	1.9
Acres pasture per A. U.	1.9
Per cent. improved land in pasture	50

Receipts		$4,922
Cream	$2,400	
Calves and cow sales	625	
Colts	150	
Hogs	851	
Poultry and eggs	86	
Increase in feed and supplies	810	
Expenses		$1,949
Labor	$980	
Cream shipping	45	
Horse-shoeing	25	
Machinery repairs	30	
Repairs on bldgs	100	
Mill feed for cows	306	
Breeding fees	30	
Veterinary	15	
Seed	71	
Fertilizer	14	
Insurance and taxes	157	
Depreciation on machinery and bldgs	176	
Farm income		$2,973
Interest on capital		1,111
Labor income		$1,862

Herd—Grade Jerseys, Holsteins and Shorthorns.
Rotation—Corn 1 year; oats 2 years; clover and timothy meadow and pasture 3 years.

Crops on this farm were 6 per cent. better than the average and receipts per cow slightly above the average. The dairy and hogs contributed the major portion of the total receipts.

The following year this farmer made a labor income of $3,948. The same number of cows were kept but 9 acres of tobacco was grown. The crops grown, receipts and expenses were as follows:

Farm No. 55 in the Farm Year Ending March 1, 1917

Crops.	Yield per Acre
40 A. Corn	50 Bu.
15 A. Oats (hay)	1.5 T.
10 A. Rye	15 Bu.
10 A. Cowpeas	2 T.
9 A. Tobacco	1,425 Lbs.

Receipts per cow from milk and cream	$93
Receipts per cow from dairy stock	$38
Receipts per cattle unit	$96

Receipts		$7,534
Cream and skim milk	2,798	
Sales and gain of dairy stock	1,153	
Hogs	1,311	
Poultry and eggs	126	
Tobacco	1,924	
Rye	138	
All else	84	
Expenses		$2,437
Labor	$980	
Cream shipping	91	
Repairs on bldgs. mach. and fences	63	
Horse-shoeing	10	
Breeding fees	30	
Feed for cows	380	
Seed	50	
Taxes and insurance	162	
Decrease in feed and supplies	506	
Depreciation on bldgs and mach.	121	
All else	44	
Farm income		$5,097
Interest on capital		1,149
Labor income		$3,948

The labor of growing the crops and caring for the live stock on this farm was done by the proprietor and two men hired by the year, with $200 worth of extra labor. This extraordinarily high labor efficiency was due to good crop selection and labor distribution and to the further important fact that the farmer gave close personal supervision and did a large part of the work himself. The factors responsible for success on this farm were labor efficiency, excellent crop and stock production and good size and diversity of business.

A Successful Dairy Farm Having Excellent Crop and Herd Production

Farm No. 124. Farm Year Ending Mar. 1, 1916.

196 Acres Rolling Land; 194 Acres Tillable.

Total capital, $24,990.

Farm	$20,000
Tools and machinery	657
30 Cows	1,950
Young stock	260
10 Head work stock	1,300
3 Brood sows	75
Other stock	112
All else	536

Crops.	Yield per Acre
20 A. Corn for grain	50 Bu.
10 A. Corn for silage	9 T.
30 A. Wheat	19.5 Bu.
30 A. Rye (pastured)	
10 A. Clover hay	1 T.
Total crops	100 A.
Total pasture	93½ A.

Crop index, 139.

Receipts per cow from cream	$98
Receipts per cow from stock	$23
Receipts per cattle unit	$95
Acres of crop per A. U.	1.8
Acres of pasture per A. U.	1.6

Receipts		$5,073
Cream	$2,937	
Wheat	589	
Dairy stock	682	
Hogs	768	
Other receipts	97	
Expenses		$2,222
Labor	$640	
Express on cream	91	
Purchased feed	965	
Blacksmith and horse-shoeing	45	
Twine and threshing	34	
Machine hire (silo filling)	16	
Clover seed	65	
Taxes and insurance	126	
Depreciation on bldgs and mach.	176	
Other expenses	64	
Farm income		$2,851
Interest on capital		1,250
Labor income		$1,601

Herd—Grade Jersey cows.
Rotation—Corn 1 year; wheat 2 years; clover and grass 3 to 4 years.

This farm shows large crop yields and herd production, and good diversity, size of business and labor efficiency. A weak point was the excessive number of work stock kept. Seventy-one per cent. of the total receipts came from the dairy, 15% from hogs, and 12% from wheat. The labor income for the following year was $3,427.

A Well Balanced Diversified Dairy Farm

Farm No. 126. Farm Year Ending Mar. 1, 1916.

223 Acres Rolling Land; 218 Acres Tillable.

Total capital $24,151.	
Farm	$20,000
Tools and machinery	470
Feed and supplies	550
26 Cows	1,250
Young cattle	176
6 Head work stock	680
Hogs (6 brood sows and other hogs)	210
50 Sheep	400
Other stock	415

Crops.	Yields per Acre
23 A. Corn	50 Bu.
5 A. Silage corn	16 T.
16 A. Clover and timothy	1.2 T.
40 A. Wheat	10.6 Bu.
Total crops	84 A.
Total pasture	131 A.

Crop index, 110.

Receipts per cow from milk	$74
Receipts per cow from stock	$17
Receipts per cattle unit	$79
Acres of crops per A. U.	1.36
Acres of pasture per A. U.	2

Receipts		$4,374
Milk	$1,920	
Calves	144	
Hogs	298	
Sheep	565	
Young mules	231	
Wheat	420	
All else	796	
Expenses		$1,497
Labor	$606	
Feed bought	137	
Express on milk	180	
Seed	42	
Taxes and insurance	158	
Threshing, silo filling	42	
Depreciation on bldgs and mach.	257	
All else	75	
Farm income		$2,877
Interest on capital		1,208
Labor income		$1,669

Herd—Grade Jersey, Holstein and Shorthorn cows.
Crop rotation—Corn 1 year; wheat 2 years; clover and timothy 2 or 3 years.

This farmer started as a tenant. Later he purchased his present farm and paid for it from the proceeds of the farming and dairy business. Meanwhile he built up the run-down farm to a high state of productiveness.

The returns from the dairy were not extraordinary, being just about the average for the section. The herd is kept mainly as a means of utilizing farm-grown roughage and grass. Extra heavy feeding is not practist. Crop yields are 10% greater and capital one-third greater than the average.

The dairy contributed 53% of the total receipts, sheep 13%, hogs 7%, wheat 10%. Good diversity is thus shown. The farm also shows good labor efficiency. The labor is performed by the proprietor and one regular hand hired by the year. Seventy dollars' worth of extra labor was employed during rush seasons.

The land being rolling and subject to washing, 60% of the farm area is kept in grass. Corn is grown on the land only about once in four to six years, the rotation being, corn one year, wheat two years, clover and grass two or three years. A second year's record showed a labor income of $1,907.

A Successful Dairyman With A High-Producing Herd

Farm No. 103. Farm Year Ending Mar. 1, 1916.

Topography Rolling.

322 Acres; 319 Acres Tillable.

Total capital $16,765.

Farm	$12,000
Tools and machinery	528
Feed and supplies	992
28 Cows	1,400
Young dairy stock	635
8 Head work stock	877
155 Hens	93
All else	150

Crops.	Yield per Acre
70 A. Corn	35 Bu.
50 A. Wheat	12 Bu.
9 A. Oats	25 Bu.
33 A. Clover and timothy	1 T.
1⅛ A. Sorghum	4. T.
Total crops	123½ A.
Total pasture	119 A.

Crop index, 130.

Receipts per cow from milk	$136
Receipts per cow from dairy stock	$35
Receipts per cattle unit	$107
Acres crops per A. U.	2.3
Acres pasture per A. U.	2.2

49 per cent. of improved land in pasture.

Receipts		$5,511
Milk	$3,789	
Young stock increase and sales	992	
Poultry	146	
Wheat	441	
Eggs	80	
All else	63	
Expenses		$2,281
Labor	760	
Repairs on bldgs., fences and mach.	122	
Feed purchased	493	
Horse-shoeing	28	
Veterinary	12	
Seeds	147	
Fertilizers	55	
Milk shipping	315	
Twine and threshing	46	
Fuel and oil	10	
Taxes and insurance	107	
Depreciation on bldgs and machinery	186	
Farm income		$3,230
Interest on capital		838
Labor income		$2,392

Herd—Grade Holstein cows, pure-bred Holstein bull.
Rotation—Corn 1 year; small grain 2 years; grass 1, 2, or 3 years.

This Hardin County farm is valued at a little over $37 per acre. The total capital invested is a little less than the average of all farms in the survey. The large labor income is due mainly to exceptionally high production of the dairy herd and high crop yields. This farm is much less diversified than most of the other successful farms analyzed.

A Successful Dairy, Sheep, Hog and Crop Farm

Farm No. 165. Farm Year Ending Mar. 1, 1916.

350 Acres; 342 Acres Tillable.

Total capital $33,311.	
Farm	$28,000
Machinery	606
Feed and supplies	740
30 Cows	1,950
Other dairy stock	370
6 Head work stock	900
75 Ewes	450
3 Brood sows and other hogs	133
100 Chickens	62
All else	100

Crops.	Yield per Acre.
30 A. Corn	50 Bu.
30 A. Wheat	9 Bu.
50 A. Clover and timothy	1.6 T.
7 A. Tobacco	1,100 Lbs.
221 A. Pasture.	
Crop index, 95.	

Receipts per cow from milk	$67
Receipts per cow from dairy stock	$33
Receipts per cattle unit	$79

Receipts		$6,736
Milk and cream	$2,000	
Increase on dairy stock	1,005	
Colts	225	
Sheep and wool	1,062	
Hogs	492	
Poultry and eggs	88	
Tobacco	920	
Wheat	316	
Increase in feed and supplies	559	
All else	69	
Expenses		$2,623
Labor	$1,383	
Seed	125	
Repairs machinery and horse-shoeing	35	
Bran for cows	270	
Milk shipping	177	
Taxes and insurance	234	
Depreciation on bldgs and mach.	325	
All else	74	
Farm income		$4,113
Interest on capital		1,666
Labor income		$2,447

Much the greater part of the acreage of the farm was in grass. The dairy herd was kept mainly to utilize grass and farm-grown roughage. Only a small quantity of concentrated feed was purchased for the herd. Sheep were kept to eat the pasture not needed by the cows. The corn crop was fed to the dairy herd and to hogs.

A Successful Small Farm Combining Dairying, Hogs and Tobacco

Farm No. 139. Farm Year Ending Mar. 1, 1917.

126½ Acres; 122 Acres Tillable.

Total capital $17,281.

Farm	$12,500
Tools and machinery	543
20 Cows	1,553
4 Head work stock	775
8 Brood sows—other hogs	682
Young cattle	100
All else	1,128

Crops.	Yield per Acre
8 A. Corn (grain)	50 Bu.
9 A. Corn (silage)	8 T.
25 A. Wheat	10 Bu.
6 A. Clover	1.7 T.
4 A. Tobacco	990 Lbs.
½ A. Sorghum	4 T.

Crop index, 164.

Receipts per cow from milk	$94
Receipts per cow from stock	$25
Receipts per cattle unit	$82
Acres crops per An. Unit	1.3
Acres pasture per An. Unit	1.6

Receipts		$4,932
Milk	$1,876	
Calves	150	
Increase inventory on cows	357	
Hogs	1,474	
Eggs	50	
Wheat	367	
Tobacco	592	
All else	66	
Expenses		$2,231
Labor	$519	
Express	166	
Repairs on machinery	25	
Repairs on buildings	45	
Repairs on fences	50	
Corn	379	
Mill feed	450	
Horse-shoeing	20	
Seed	29	
Dairy supplies	15	
Machine hire	25	
Taxes and insurance	103	
All other expenses	405	
Farm income		$2,701
Interest on capital		864
Labor income		$1,837

Considering its area, this farm is one of the most efficient in the survey. While in acres it is only 65% as large as the average, the capital employed is nearly as great as the average. Crop yields were 64% better than the average, and receipts per cow nearly 7% better than the average. The farm shows good diversity and labor efficiency. Remarkably good returns were obtained from hogs, this farmer being regarded as the best hog man in his county. The tobacco crop contributed materially to the farm proceeds. The labor was performed by the proprietor and one man hired by the year and family labor worth $170. Mill feed worth $450 and corn worth $379 were purchased.

A Profitable Small Dairy and Hog Farm

Farm No. 129. Farm Year Ending March 1, 1917.

122 Acres; 121 Acres Tillable.

Total capital $11,052.

Farm	$8,540
Machinery	295
Feed and supplies	421
12 Cows	720
Young dairy stock	250
4 Head work stock	575
4 Brood sows and other hogs	208
All else	43

Crops.	Yield per Acre
20 A. Corn	40 Bu
20 A. Wheat	6 Bu.
10 A. Cowpea hay	2 T.
10 A. Clover and timothy hay	1 T.

Crop index, 97.

Receipts per cattle unit $109

Receipts		$3,403
Milk	$1,320	
Increase in dairy herd	395	
Hogs	1,262	
Poultry and eggs	59	
Expenses		$709
Labor hired	$338	
Milk shipping	124	
Horse-shoeing and repairs	25	
Seed	14	
Insurance and taxes	90	
Depreciation on bldgs and machinery	76	
All else	32	
Farm income		$2,694
Interest on capital		550
Labor income		$2,144

The good showing of this farm is due to heavy-producing cows, good receipts from hogs and to low expense charges. The operator did a large part of the farm and dairy work.

Kentucky
Agricultural Experiment Station
University of Kentucky, Lexington, Ky.

BULLETIN NO. 218

SOME EXPERIMENTS WITH TOMATOES

By

A. J. OLNEY



December 30, 1918
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BULLETIN NO. 218

Some Experiments With Tomatoes

By A. J. OLNEY

A series of experiments with tomatoes was started in the spring of 1916, the object being to determine the effect of various methods of pruning and staking on the yield of tomatoes, earliness of ripening and size of the individual fruits. Some data were obtained incidently on methods of raising plants, distances of planting, length of stakes in staking, etc.

All plants used in these experiments were started and grown under as uniform conditions as possible. The seeds were sown each year the first week in March in flats, and the seedlings were pricked out into pots when the second leaves appeared, except in a few cases in which they were pricked out into other flats, as indicated in the tables. The plants were grown in the greenhouse until after April 15th, when they were hardened off in cold frames and set in the field, as near the 10th of May as possible. Ten plants of each variety, with one alternate to be used in case of accident, were grown for the comparisons, in every instance.

The vines which were neither staked nor pruned are spoken of as "running." These were set in the field 4 feet apart, in rows 6 feet apart, except in the comparisons made on distance of planting. The vines which were staked and pruned were planted 2 feet apart, in rows 4 feet apart, except those grown in 1917, which were planted 2 feet apart, in rows 3 feet apart. These plants were allowed to grow until they were 12 to 15 inches in height, when they were pruned and tied to stakes with a soft cord. Comparisons were made of vines running and vines pruned to 1, 2 and 3 stems. Every comparison was made with the same variety and duplicated with a number of other varieties.

SEASON OF 1916

TABLE I. Flat-grown versus Pot-grown Plants, and Effect of Staking and Pruning. Yield in Pounds from Ten Plants.

VARIETY	Running Flatted.		Running Potted.		Staked, Potted One Stem		Staked, Potted Two Stems	
	Good	Culls	Good	Culls	Good	Culls	Good	Culls
Bonny Best	59.8	11.9	65.5	12.9				
Coreless	25.3	6.4	58.2	7.2	38.8	7.1	25.1	1.9
Crimson Cushion			75.1	2.8	44.9	5.3	59.1	7.7
Early Detroit			73.1	17.3	54.	10.7		
Early Freedom			49.1	14.1	41.1	11.1		
Early June			103.	18.6	65.9	4.9		
Globe			90.5	12.7				
Hummer	56.5	5.8	93.3	11.2	36.4	4.8	30.2	4.1
Mississippi Girl	69.7	18.2	75.1	23.2	57.1	8.2	73.1	10.
Ponderosa			35.	10.6				
Stone			54.	23.1				
Sunrise			60.1	1.3	56.1	2.5		
Victoria Whole Salad	47.1	5.1	128.2	5.1	60.5	1.9	51.4	.8
Average yield per plant, lbs.	5.17	.95	7.39	1.23	5.05	.63	4.78	.49
Estimated No. of plants per A.	1815				5445			
Estimated yield per A. marketable, lbs.	9,384		13,413		27,497		26,027	
Per cent marketable	84.5		85.7		88.8		90.7	

Conclusions. From the data shown in Table I, the results may be stated briefly as follows: Staking and pruning reduced the yield of marketable fruit per plant in every case, but the yield per acre was increased because of the greater number of plants. The results of the two methods of pruning were not conclusive this year. Pot-grown plants were more productive than flat-grown plants in every instance. The average increase over flat-grown plants was 2.2 lbs. per plant, or 43 per cent.

In addition to the data noted above on comparisons of pot-grown and flat-grown plants, special notes were taken with Matchless Red and Tenderloin varieties, which were staked and pruned to two stems, as follows:

Variety	Pot-Grown Plants	Flatted Plants
Matchless Red	4.6 lbs. per plant	3.5 lbs. per plant
Tenderloin	8.3 lbs. per plant	4.3 lbs. per plant
Average	6.45 lbs. per plant	3.9 lbs. per plant

The average increase in yield due to potting was 2.55 pounds per plant, or at the rate of 2.31 tons per acre, when plants are set 4 x 6 feet. If tomatoes were worth $15.00 per ton, the average increase in value would amount to $34.65 per acre by the use of pot-grown plants.

SEASON OF 1917

TABLE II. Effect of Staking and Pruning. Yield and Amount of Diseased, Sunscald and Wormy Fruit, in Pounds from Ten Plants.

VARIETY	RUNNING				TWO STEMS			
	Marketable	Diseased Specimens	Sun Scald	Wormy	Marketable	Diseased Specimens	Sun Scald	Wormy
Acme	140.1	10.1	3.1	.2	32.1			1.4
Beauty	147.5	12.1	4.1	.1	36.1			1.1
Beauty D.	142.1	3.1	6.1		32.6	3.4	.4	
Blue Ribbon Pioneer	139.4	6.5	2.4	.1	39.8	1.6		.1
Bountiful	167.1	8.8	6.5	.3	42.3	.2	1.4	
Chalk's Jewel	160.1	17.1	7.1	.5	56.3	6.1		2.9
Comet	131.5	2.5		.7	40.3		.1	
Crimson Cushion	191.7	7.9	5.9	.1	53.1		.4	2.3
Dwarf Champion	101.2	5.1	1.1	2.8	27.2	.6	.2	.6
Dwarf Giant	85.3	5.6	3.1	3.1	38.1	.3	1.1	1.3
Early Detroit	147.1	1.1	1.2	1.2	47.1	6.5	.4	.1
Early June	253.1	6.2	12.1	3.1	39.6	.1		2.1
Florida Special	202.2	7.9	3.1	3.1	48.6	9.6	.1	
Golden Queen	170.2	7.4	5.2	4.6	56.	3.1		.3
Greater Baltimore	106.1	2.1		.6	57.6	3.1	.8	.1
Stone	145.6	5.1	2.5	6.1	47.1	4.7		1.1
Tenderloin	115.4	3.1	1.1	1.9	68.1	8.7		4.3
Holmes Supreme	146.	.1	.4		46.3	.5		.2
John Baer	180.1	18.1	4.4	2.1	49.5	1.9		2.1
June Pink	305.1	12.1	18.1	5.9	58.1	.5		4.1
Mississippi Girl	106.8	.8	1.1	5.5	40.3	6.9		1.4
My Maryland	155.6	5.3	6.3	6.7	51.1	1.6		1.2
New Glory	190.1	5.3	1.1	1.1	50.1	.1		.2
Paragon	113.1	12.4	5.1		48.8	1.8		2.6
Perfection	138.6	5.6	2.4	1.2	39.2	3.5		.1
Prolific IXL	218.3	15.5	4.1	1.4	50.4	2.9		.5
Prosperity	140.1	1.1	1.5	5.1	49.1	2.1	.5	
Red Head	181.5	21.1	6.6	9.2	47.8	.1	.8	1.1
Stirling Castle	174.9	3.3	1.1	2.1	48.2			.9
Sunrise	172.6	5.	7.	.7	52.5	.9		.6
Superb Salad	162.1	3.2	.8		51.6	.3		
Trophy	140.3	5.7	6.2	2.6	34.1	1.2		2.2
Trucker's Favorite	124.5	10.6	1.2	.5	45.	6.6		.1
Average yield per plant, lbs.	15.74	.72	.40	.22	4.62	.24	.02	.01
Estimated No. of plants per A.	1815				7260			
Estimated yield per A. marketable (lbs.)	28,568				33,541			
Per Cent Marketable	92.2				92.7			

The results shown in Table II give comparative yields of thirty-three varieties. There was a greater difference in the yield per plant of running and pruned to two stems and, consequently, less difference in the calculated yields per acre for the season of 1917 than in 1916. The difference in the number of diseased specimens in the running and pruned tomatoes is very small, when the total yield of each is considered. While there was some soft rot in the unstaked plants, the amount of blossom-end rot was much greater on those that were staked. It should be noted, however, that there was practically no sun scald on the staked plants. It is not believed that the method of training the plants has much to do with the percentage of wormy fruit.

Further comparisons were made of pot-grown and flat-grown plants, using the Matchless Red and Tenderloin, as in 1916.

Variety	Pot-Grown Plants	Flat-Grown Plants
Matchless Red	6.5 lbs. per plant	3.9 lbs. per plant
Tenderloin	9.3 lbs. per plant	4.6 lbs. per plant
Average	7.9 lbs. per plant	4.25 lbs. per plant

The average increase in yield due to potting was 3.65 pounds per plant or 3.31 tons per acre, worth $49.65 at $15.00 per ton. Boyle* in his investigations in Indiana, found an increase of 4.1 tons per acre, by the use of plants grown in dirt bands over those transplanted into flats. The superiority of pot-grown plants is undoubtedly due to the fact that the plants may be set in the field without disturbing their root systems and, consequently, they receive very little, if any, check in their growth when transplanted.

*Boyle, J. G. Indiana Agri. Experiment Station Bulletin 165, page 809.

SEASON OF 1918

TABLE III. Effect of Staking and Pruning. Yield and Average Weight of Marketable Fruit, in Pounds from Ten Plants.

VARIETY	RUNNING			PRUNED TO TWO STEMS		
	Marketable	Culls	Average weight of 1 fruit. Ozs.	Marketable	Culls	Average weight of 1 fruit. Ozs.
Beauty	97.3	49.8	4.39	64.9	13.6	6.36
Bonny Best	100.7	92.	4.49	50.4	10.8	4.65
Chalk's Jewel	127.7	90.	4.82	46.	15.5	4.71
Coreless	111.7	33.	4.46	67.9	11.6	6.28
Crimson Cushion	116.	88.4	4.86	63.1	18.7	6.60
Dwarf Giant	82.3	51.4	7.15	53.7	7.3	6.87
Earliana	101.2	109.	4.38	41.9	11.	4.24
Earliana, Sunnybrook's	105.	119.8	5.27	45.7	11.5	3.91
Early Detroit	142.1	74.2	4.58	68.9	13.5	5.17
Early June	106.	66.6	4.96	47.4	8.	4.68
Fordhook First	103.2	95.1	4.04	48.9	15.9	4.62
Greater Baltimore	144.3	63.6	4.48	71.6	10.2	6.43
John Baer	115.2	93.9	4.92	53.6	13.6	4.68
Magnus	109.2	63.	4.51	60.1	10.	5.22
Manyfold	111.2	100.6	3.63	39.4	24.6	3.66
Mississippi Girl	134.	66.3	4.59	67.	13.2	5.86
My Maryland	114.5	66.4	5.51	56.	12.3	5.67
Ponderosa	110.9	96.8	5.68	59.3	18.1	9.67
Prolific IXL	88.5	66.2	5.22	39.6	8.4	4.43
Prosperity	87.6	77.	4.83	42.7	10.9	4.87
Puritan Hill	153.3	63.4	5.67	53.7	17.4	5.13
Red Head	138.6	105.7	4.17	50.1	13.	4.35
Santa Rosa	124.5	85.	6.59	65.	16.6	8.12
Shenandoah	105.5	111.7	8.61	54.7	7.9	7.88
Stokes Stone	126.	76.4	4.96	65.8	18.5	6.83
Superb Salad	322.7	13.5	1.99	47.5	1.6	1.80
Tenderloin	87.	112.	7.48	49.6	14.3	7.93
Average yield per plant, lbs.	12.1			5.5		
Estimated No. of plants per A.	1815			5445		
Estimated yield per A. marketable, lbs.	21,962			29,947.5		
Per cent marketable	60			80		
Average weight 1 fruit, Ozs.			5.04			5.58

Average increase of two stem over running, 7985.5 lbs. per acre.

Effect of Pruning and Staking on Yield. The records of 1918 substantiate those taken in 1916 and 1917, and show that the yield per acre is increased by staking and pruning, altho the yield per plant is reduced considerably. The increase in yield was due to the fact that a larger number of plants per

acre may be used when they are staked and pruned. The least productive varieties gave a larger yield of marketable fruit per plant, running, than the most productive varieties, staked and pruned. The average increase in yield per acre due to staking and pruning, for the twenty-eight varieties grown in the season of 1918, was 3.99 tons. If valued at $15.00 per ton, which is an average value for canning tomatoes, the increase would be worth $59.85. This would not pay for the stakes and the labor of staking and pruning; however, if sold at $1.00 or more per bushel, which some of our truckers realize, the increase by staking and pruning would approximate $100, or more, per acre. These results show that staking and pruning may be profitable for the home garden or very intensive trucking areas, but the price of stakes, additional labor involved and the greater number of plants required may make the cost too high even for truck gardening. For canning, staking and pruning, under the conditions of these experiments, are entirely out of the question.

The percentage of culls on the running vines was unusually high for this year on account of the large amount of sunscalded fruit caused by the extremely hot weather during the month of August, while the staked vines had few sunscalded tomatoes.

The data for Table IV. were taken to determine the effect of pruning to one, two and three stems, on the yield of marketable fruit. The plants staked and pruned were planted two feet apart in rows four feet apart and compared with the same variety running, except in the case of the Hummer variety. The running plants were set 4½ feet apart in rows 5 feet apart.

TABLE IV. Effect of Severity of Pruning on the Yield. Season of 1918.

GREATER BALTIMORE	Running	1 Stem	2 Stems	3 Stems
Per cent marketable	69.	88.	88.	88.
Average yield per plant	14.5 Lbs.	7.2 Lbs.	9.4 Lbs.	9.6 Lbs.
Estimated yield per A.	28,072 Lbs.	39,204 Lbs.	51,183 Lbs.	52,272 Lbs.
Average weight of one fruit	4.4 Ozs.	6.9 Ozs.	7.1 Ozs.	6.2 Ozs.

STOKES STONE	Running	1 Stem	2 Stems	3 Stems
Per cent marketable	62.2	78.8	78.9	74.6
Average yield per plant	12.6 Lbs.	3.9 Lbs.	6.5 Lbs.	6.2 Lbs.
Estimated yield per A.	24,394 Lbs.	21,236 Lbs.	35,393 Lbs.	33,759 Lbs.
Average weight of one fruit	5. Ozs.	6.1 Ozs.	6.8 Ozs.	5.8 Ozs.
PONDEROSA				
Per cent marketable	53.3	94.7	76.5	80.9
Average yield per plant	11.1 Lbs.	4.7 Lbs.	5.9 Lbs.	6.6 Lbs.
Estimated yield per A.	21,490 Lbs.	25,492 Lbs.	32,126 Lbs.	35,937 Lbs.
Average weight of one fruit	5.7 Ozs.	7.9 Ozs.	9.7 Ozs.	10.3 Ozs.
HUMMER				
Per cent marketable		80.3	74.4	78.7
Average yield per plant		3.6 Lbs.	4.9 Lbs.	5.4 Lbs.
Estimated yield per A.		19,602 Lbs.	26,681 Lbs.	29,403 Lbs.
Average weight of one fruit		5.1 Ozs.	5.7 Ozs.	4.1 Ozs.

In all cases except in the case of Stone pruned to three stems the yield per plant was reduced in proportion to the severity of the pruning. The running plants produced from two to three times as many marketable fruits per plant as the pruned plants. Those pruned to two stems produced an average of 1.82 pounds of marketable fruit per plant, more than those pruned to one stem. This would amount to a difference of 4.95 tons per acre. The difference in yield between those pruned to two stems and to three stems was not very great and, when the additional labor of pruning to three stems and tying up is considered, there is little to recommend this method over pruning to two stems. On the whole, pruning to two stems has given the best results.

The effect of pruning on the size of the fruit was noted only on the Matchless Red variety, in the years 1916 and 1917. Dur-

ing the season of 1918 records were kept for twenty-seven varieties, as shown in Table III.

TABLE V. Effect of Staking and Pruning on the Size of the Fruit.

	AVERAGE WEIGHT OF ONE FRUIT		
	Staked & Pruned, Two Stems	Running	Increase by Pruning
Year 1916, Matchless Red	5.15 Ozs.	4.91 Ozs.	.24 Ozs.
Year 1917, Matchless Red	5.13 Ozs.	4.68 Ozs.	.45 Ozs.
Year 1918, Average of 27 varieties	5.58 Ozs.	5.04 Ozs.	.54 Ozs.

It will be noticed by reference to Table III, that in twelve cases there was a very marked increase in the size of the fruit by pruning, while six cases showed the reverse to be true and nine showed only slight differences. Further records will be necessary to determine whether these differences were due to the variety or to environment influence. On the whole, the increase in size was very definite. The average increase in the size of the fruit for the twenty-seven varieties grown in 1918 was 10½ per cent. Lloyd and Brooks* in experiments covering three seasons, found that, "the pruning had but slight effect upon the size of the fruit."

From these results, the increase in the size of the fruit would probably not be a sufficient reason for staking and pruning.

The Effect of Staking and Pruning on Earliness of Ripening. In 1916 the effect of pruning on the earliness was noted with nine varieties, in 1917, with fourteen varieties, and in 1918, with twenty-seven varieties.

Cases which showed no increase in earliness by staking and pruning are indicated by zero in Table VI. There were thirteen instances where the ripening was delayed by staking and pruning and these are indicated by the figures in bold faced type.

The basis for determining the earliness of ripening was the earliest dates at which each variety produced 10, 25 and 50 per

*Lloyd & Brooks, Illinois Agri. Experiment Station, Bulletin 144, page 77.

cent of its crop. During the first two years of the experiment the average increase in earliness was very small, the greatest effect being shown with Stone, in 1917. More variation in the earliness occurred in 1918. There was a substantial increase in earliness by pruning with such varieties as Chalk's Jewel, Coreless, Early Detroit, John Baer, My Maryland, Magnus, Ponderosa, Puritan Hill, Red Head, Stone and Superb Salad, for this particular year. There is an indication that some varieties may be influenced more than others, but this is not constant in all cases.

These data show that staking and pruning increase the earliness of ripening, but the average increase is slightly more than three days for the three-year period, or an average of 3.6 days for the first 10 per cent of the crop, four days for first 25 per cent of the crop, and 2.4 days for the first 50 per cent of the crop.

TABLE VI. Number of Days Earlier Staked and Pruned to Two Stems Than Running.

VARIETY	INCREASE IN EARLINESS BY PRUNING OF YIELD OF								
	First 10% of Crop			First 25% of Crop			First 50% of Crop		
	1916	1917	1918	1916	1917	1918	1916	1917	1918
Acme		0			0			0	
Beauty		0	0		0	8		3	8
Bonny Best			3			**4**			**6**
Chalk's Jewel		7	10		7	14		3	**7**
Coreless	3		12	**2**		7	2		7
Crimson Cushion	7	0	0	2	2	2	3	4	**6**
Dwarf Giant			5			**5**			**12**
Earliana, Langdon's			3			4			5
Earliana, Sunnybrook's			3			9			0
Early Detroit	4	7	9	0	8	12	5	3	7
Early Freedom	4			0			0		
Early June	4	2	6	5	1	9	0	4	2
Fordhook First			3			7			**6**
Greater Baltimore		3	5		6	6		4	0
Hummer	3			0			2		
John Baer		**4**	6		0	14		3	3
June Pink		4			3			4	
Magnus			4			12			4
Manyfold			13			9			12
Mississippi Girl	**4**	7	5	0	6	0	3	6	4
My Maryland		3	9		7	12		5	4
Ponderosa			9			12			4
Prolific IXL		0	3		0	7		0	0
Prosperity			6			7			2
Puritan Hill			11			17			8
Red Head		0	10		5	7		7	4
Santa Rosa			9			7			**10**
Shenandoah			4			0			0
Stone		8	11		8	12		10	4
Sunrise	**4**			0			0		
Superb Salad			20			21			11
Tenderloin			0			0			0
Victoria Whole Salad	0			2			0		
Average increase in earliness	1.88	2.64	6.63	.77	3.79	7.63	1.66	4.00	1.56

EFFECT OF CLOSE PLANTING ON YIELD, IN POUNDS PER PLANT

	Plants 4½ x 5 ft. Running.	Plants 4½ x 5 ft. Two Stems.	Plants 2 x 4 ft. Two Stems.
Mississippi Girl	13.4 Lbs.	8.5 Lbs.	4.9 Lbs.
Greater Baltimore	14.5 Lbs.	9.9 Lbs.	4.9 Lbs.
Coreless	11.7 Lbs.	7.4 Lbs.	6.2 Lbs.
Stone	12.6 Lbs.	8.9 Lbs.	4.1 Lbs.
Average	13.05 Lbs.	8.67 Lbs.	5.02 Lbs.
Estimated yield per Acre	25,265 Lbs.	16,785 bLs.	27,334 Lbs.

The object of this experiment was to determine the effect of planting the pruned vines close together. In every case the yield per plant was increased by planting the greater distance apart. The increase, however, is not great enough to offset the smaller number of plants per acre and compares unfavorably with those unpruned and set out the same distance apart.

EFFECT OF LENGTH OF STAKE ON THE YIELD PER PLANT.

VARIETY	Stake 5′ 6″	Stake 4′ 2″
Coreless	3.3 Lbs.	3.9 Lbs.
Coreless	6.1 Lbs.	3.9 Lbs.
Greater Baltimore	4.5 Lbs.	4.4 Lbs.
Greater Baltimore	4.9 Lbs.	6.3 Lbs.
Hummer	4.9 Lbs.	3.9 Lbs.
Mississippi Girl	3.7 Lbs.	4.9 Lbs.
Average	4.57 Lbs.	4.55 Lbs.

It will be noticed that the length of stake between 4 ft. 2 in. and 5 ft. 6 in. has little effect on the total yield. The height the stake should be depends somewhat upon the variety. A 5 foot stake is a good length for average conditions.

Summary

Pot-grown plants are more productive than flat-grown plants.

Staking and pruning reduces the yield of marketable fruit per plant, but increases the yield per acre because of the greater number of plants that may be set.

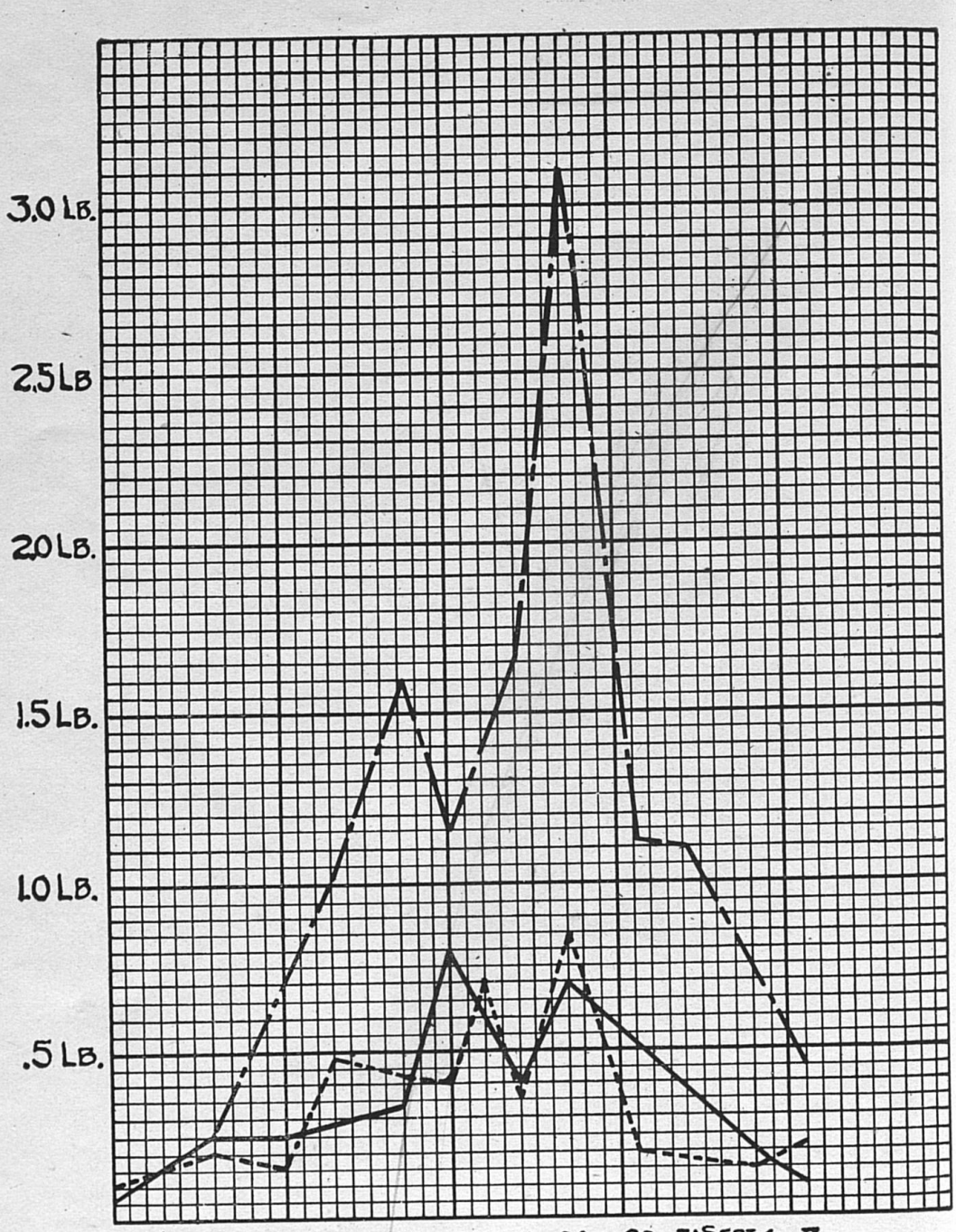
Pruning increases the size of the individual fruit.

Tomatoes staked and pruned ripen approximately one week earlier than those untrained.

It does not pay to stake and prune tomatoes grown for the canning factory.

It may pay to stake and prune tomatoes for the home garden or in very intensive trucking areas.

The cost of the stakes, the additional labor involved and the greater number of plants required may be the limiting factors for profitable staking and pruning.



COMPARISON OF RUNNING PLANTS WITH PLANTS STAKED AND PRUNED TO ONE AND TO TWO STEMS, ON THE BASIS OF YIELD PER PLANT. VARIETY USED – MATCHLESS RED.

——·——·—— RUNNING

——————— STAKED AND PRUNED TO ONE STEM

- - - - - - - - - - - - STAKED AND PRUNED TO TWO STEMS



FIG. I
Tomato Plant at Proper Stage for Suckering and Pruning

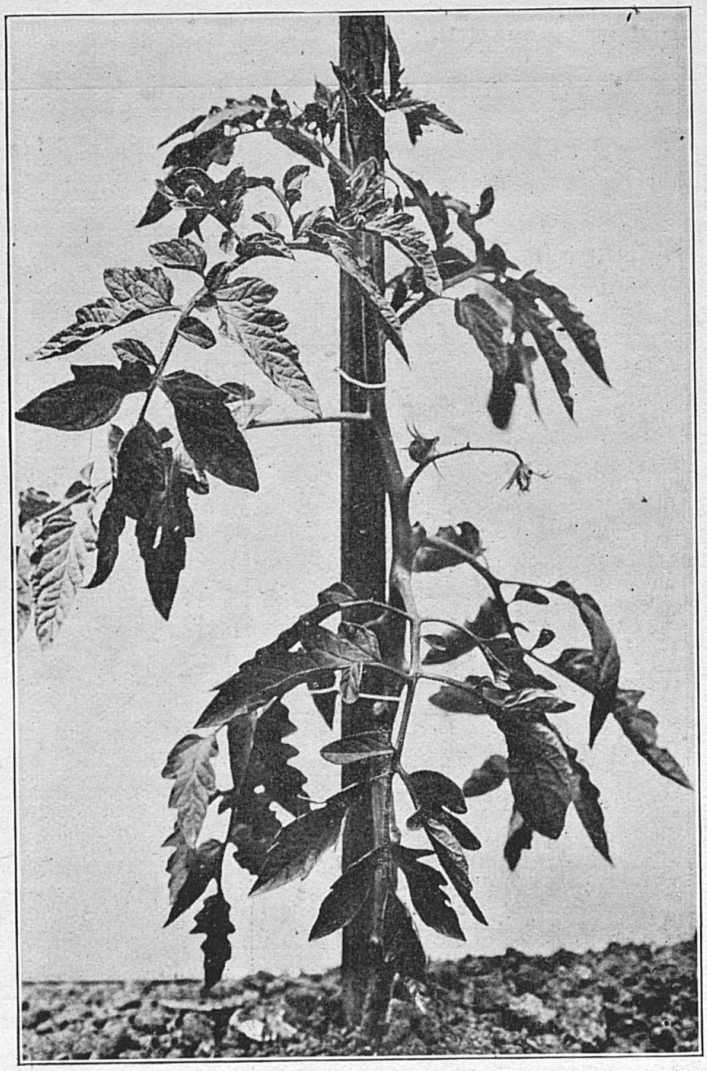


FIG. II
The Same Plant as in Fig. I, Suckered and Pruned to One Stem

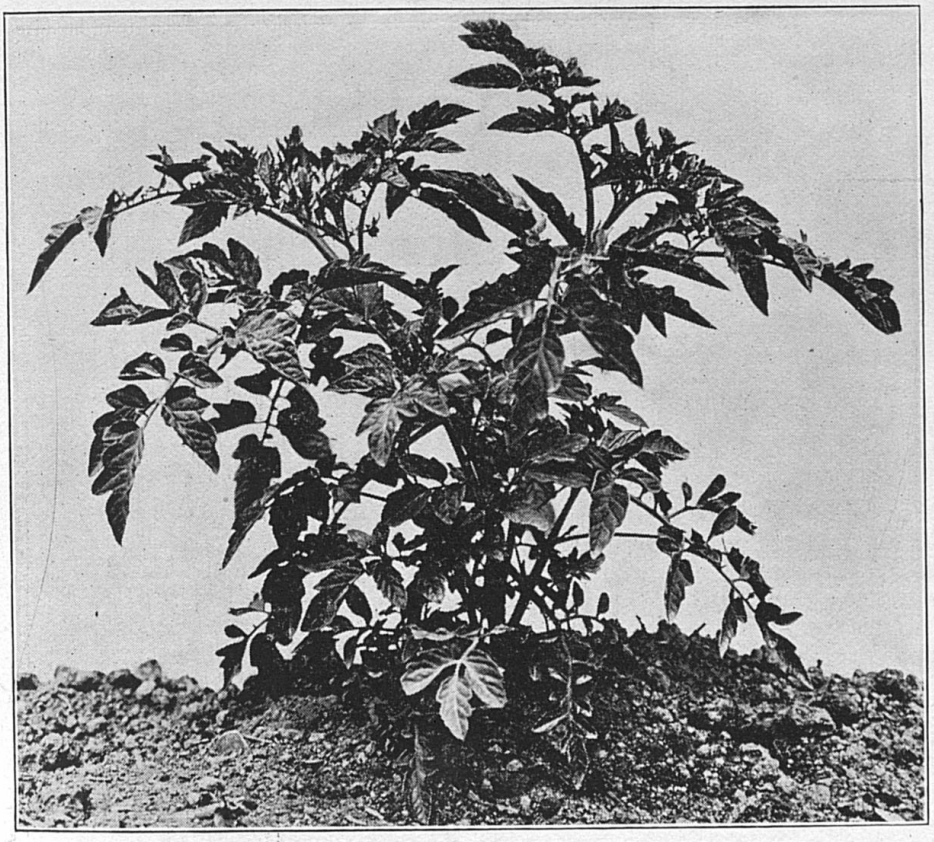


FIG. III
Tomato Plant at Proper Stage for Suckering and Pruning

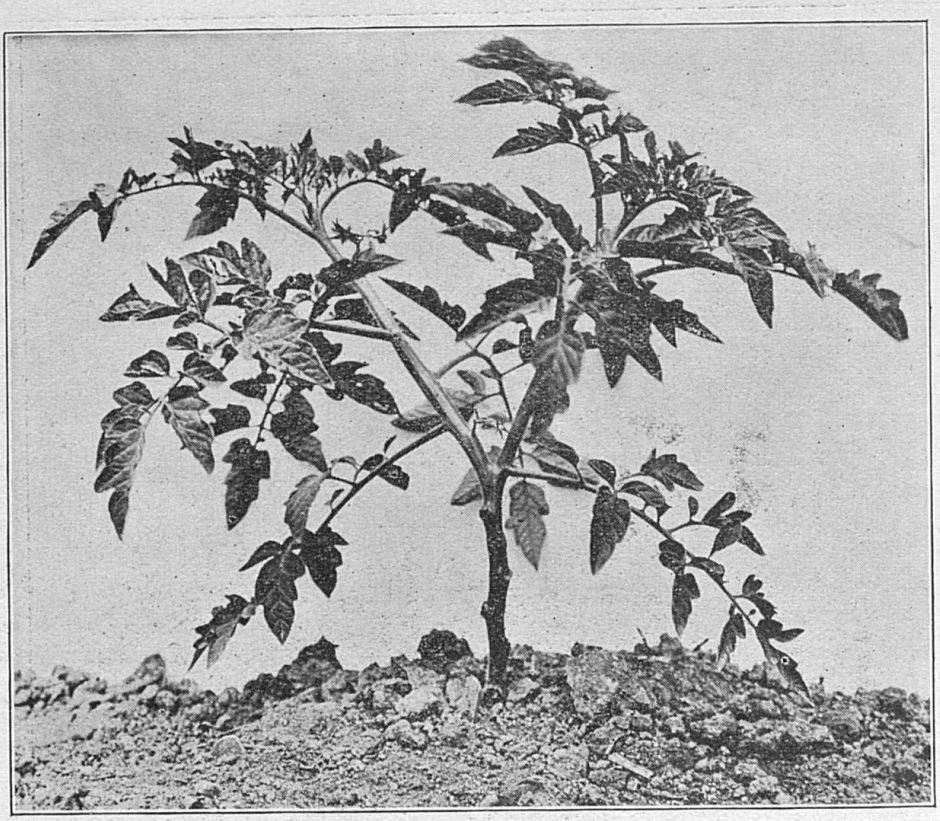


FIG. IV
The Same Plant as in Fig. III, Suckered and Pruned to Two Stems

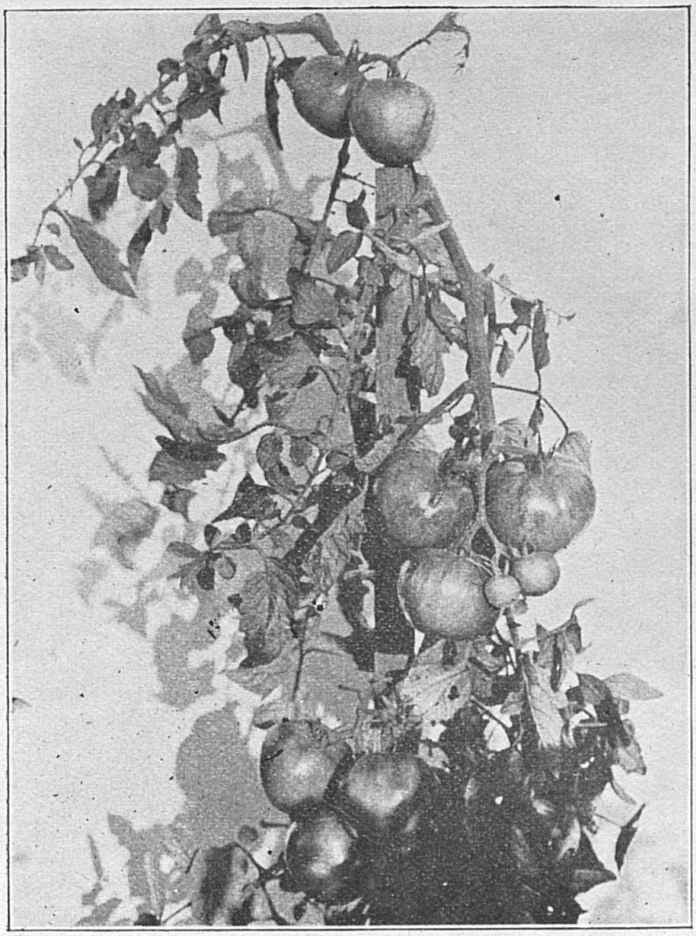


FIG. V
Tomato Plant Pruned to One Stem

Kentucky
Agricultural Experiment Station

University of Kentucky, Lexington, Ky.

BULLETIN NO. 219

Commercial Fertilizers

BY

H. E. CURTIS

AND

WM. RODES

DECEMBER 31, 1918

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BULLETIN NO. 219

COMMERCIAL FERTILIZERS

By H. E. CURTIS and WILLIAM RODES

Economic conditions generally, resulting from the war, have affected the fertilizer industry by greatly increasing the cost of raw materials and of labor, so that commercial fertilizers are necessarily sold at a higher price now than before the war. The supply of potash salts is quite limited and the cost of carriers of phosphorus and nitrogen has increased fully fifty per cent. The prices of farm products generally have doubled, however, so there is still a good margin for profit in the judicious use of fertilizers. Indeed, the farmer who has used commercial fertilizers profitably heretofore may reasonably expect to continue their use to equally good advantage. Moreover, patriotic reasons as well as labor conditions render the increased use of commercial fertilizers strongly advisable wherever crop yields can be increased thereby, in order to accomplish the greatest possible production of food from the land and labor available.

Farmers should study the fertilizer requirements of their soils before purchasing fertilizers of any character. Bulletin No. 193, on the Soils of Kentucky, and Bulletin No. 199, giving results of field experiments, will be useful in this connection and helpful suggestions may be had from the Experiment Station and from county agents. We may make the general statement here that, on all soils except the highly phosphatic ones of the Bluegrass Region, the best returns are to be expected from phosphatic fertilizers used after an application of ground limestone.

Buy Fertilizers Containing the Most Plant Food

The present state of transportation and labor conditions renders it more advantageous today than ever before to use the most concentrated forms of fertilizers. When a farmer buys a

ton of the average commercial fertilizer, he buys, in reality, not more than about 300 pounds of actual plant-food elements. For example, a ton of 16 per cent. acid phosphate, the best grade on the market, contains about 140 pounds of available phosphorus, or a ton of "2-8-2" fertilizer contains about 136 pounds of phosphorus, nitrogen and potassium. For the reason that the plant-food elements in fertilizers are, necessarily, in combination with other elements a fertilizer can never contain 100 per cent. of actual plant food. In buying a cheap or low grade fertilizer, still less plant food is obtained. The cost of sacking, handling and freighting is the same for a ton of either kind. 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, as a general rule, the higher the grade the cheaper can the plant food be bought. So farmers are advised to purchase only high grade fertilizers; that is, those containing high percentages of the elements which it is desired to obtain. This would mean, for example, the purchase of a 14 or 16 per cent. acid phosphate rather than a 10 or 12 per cent. grade. The best rule is to buy the fertilizer which will give the desired plant food elements at the lowest cost per pound, laid down at the farm where the fertilizer is to be used.

Abuses of the Fertilizer Trade

Without question, manufacturers could introduce reforms which would promote efficiency and economy in the fertilizer trade. There are too many low-grade fertilizers on the market and the attention of the farmer is called to those brands in the following tables which have less than 2 per cent. of ammonia and potash. Less than 2 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 pay an increased price for potash or ammonia in fertilizers containing less than about 1 per cent. of either of these ingredients.

A multiplicity of brand names is used by the manufacturers of commercial fertilizers. This is very undesirable, from

the users' standpoint, and should be remedied; for very often the same material is offered under two or three different names, thus giving the false impression that these are really different fertilizers, adapted to different uses. The guaranty under which a fertilizer is sold shows the amount of plant food in the fertilizer and this is the main thing the farmer should consider, when purchasing. In justice to the manufacturers it should be said that they are beginning to realize the importance of cutting down the number of brands.

Samples Analyzed During 1918

There were 724 different brands of commercial fertilizers registered during the year 1918. Of these 320 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), 125 acid phosphates or superphosphates, 169 nitrogenous superphosphates, 45 acid phosphate and potash mixtures, and 65 bones, tankage and non-acidulated bone and potash mixtures. Samples sent by manufacturers of the various brands registered have been analyzed, as well as samples collected by our inspectors from fertilizers found on sale in the State and those sent in by farmers. 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 guaranties, 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 several instances the deficiency in one ingredient, tho offset by a corresponding excess of the other ingredients, is still too great to be considered acceptable. Irregularities of this sort may be due to bad mixing at the factory. Some manufacturers 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 4 or 5 per cent. higher than the guaranty on available phosphoric acid.

In most of these the analysis shows that, while the amount of available phosphoric acid guaranteed is present, the insoluble and total phosphoric acid are both deficient. In some cases, however, the deficiency of 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. Altho the insoluble phosphoric acid is of relatively little value, at the same time we feel inclined to call especial attention to these guaranties and hope that purchasers of fertilizers will carefully study the analyses to see how the guaranties 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 sulfate.

Method of Reporting Results

In the statement of our analysis, nitrogen is separated into the various forms in which it occurs, namely nitrogen in nitrates, nitrogen in ammonia salts and nitrogen in organic matter. In bones, the bone phosphate of lime equivalent is given and the percentage of fineness is shown also, fine bone being that which passes thru a sieve with meshes one twenty-fifth inch square, and medium bone that which passes thru a sieve with meshes one-sixth inch square, but not including the fine bone. The analyses are grouped in 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 phosphates with potash.
Table 5. Acid phosphates with nitrogen.

Free Analysis of Fertilizers

The fertilizer law provides that the Experiment Station shall make free analyses of fertilizers for farmers who purchase them for their own use. It is hoped that those who purchase

fertilizers in quantity, at least, will take advange of this provision (section 8 of the fertilizer law) and send samples from the fertilizer sold them, to the Station for free analysis.

Essentials in Taking a Sample for Analysis

1. Take it at the time of purchase and, if possible, in the presence of the agent or seller. 2. Take a portion from not less than two bags, and from one additional bag for every ten purchased; mix these portions together and take at least a pint of this mixed sample, put it into a glass jar or a can, seal, label, box and forward by parcel post or express to the Experiment Station, 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 required with a sample for free analysis should not be put into the package with the sample, but is to be sent to the Experiment Station separately, *by mail.* It should be made out in accordance with the provisions of section 8 of the fertilizer law. 5. The label put on the sample by the sender should be such as to identify the sample and show by whom it was sent, without giving the name of the fertilizer or of the person from whom it was bought. 6. Be sure to save a license tag from one of the packages sampled, to be sent to the Director after the report of the analysis has been received from him.

Blank certificates will be sent free, upon application to the Station. The section of the fertilizer law describing the manner in which samples for free analysis are to be taken, is printed on the back of our blanks.

Index of Relative Value

The fertilizer law, in providing for the publication in a bulletin of the analyses of fertilizers made each year, requires that the "relative value" of each fertilizer be published with its analysis. Because of fluctuations in the market prices of the materials used in the manufacture of commercial fertilizers and especially on account of the abnormally high cost of potash salts brought about by war conditions, it would seem impractical and inexpedient, at this time, to attempt to compute money

values from the analyses of fertilizers. Accordingly, to comply with the requirement of the law referred to, we have adopted a system of relative values, based upon what we may term an "index of relative value" computed from the analysis by multiplying the percentage of each essential ingredient found in the analysis by a certain factor or "index," the sum of these products being taken as the "index of relative value." This "index" will not stand in any necessary relation to the present market price of the fertilizer, but does give an expression of its relative value, under normal conditions.

The following are the factors for computing the relative value indexes given in the tables of analyses:

Available phosphoric acid in mixed fertilizers	1.2
Available phosphoric acid in acid phosphates	1.0
Insoluble phosphoric acid in mixed fertilizers	0.4
Insoluble phosphoric acid in acid phosphates	nothing
Phosphoric acid in fine bone	0.8
Phosphoric acid in medium bone	0.6
Nitrogen in all fertilizers	3.5
Potash from sulfate, in all fertilizers	1.2
Potash from muriate, in all fertilizers	1.0

As an example of how to make the calculation, suppose the analysis shows that a fertilizer contains:

8.40 per cent. of available phosphoric acid.
4.75 per cent. of insoluble phosphoric acid.
1.58 per cent. of nitrogen.
1.34 per cent. of potash from muriate.

The index of relative value will be calculated as follows:

1.2 times 8.40 is	10.1
0.4 times 4.75 is	1.9
3.5 times 1.58 is	5.5
1.0 times 1.34 is	1.3
Sum	18.8

Therefore, the index of relative value for this fertilizer is 18.8.

The term "potash from muriate" does not necessarily indicate that the manufacturers used muriate of potash in making their mixture; they may have used sulfate of potash, or other salts of potash; but in all fertilizers where the term "potash from muriate" is used and the potash so classified, there is enough chlorin present to combine with all the potash. This chlorin may come either from salt in the tankage used or from such potash salts as muriate, kainit, carnallite, etc. As the objection to the use of muriate of potash arises from the chlorin present in this salt, it likewise follows that chlorin in a fertilizer is objectionable, whether put in as muriate of potash or in some other form. The use of sulfate of potash, where there is much chlorin present in other ingredients of the fertilizer, will not obviate the injurious effect of the chlorin; therefore we take this method of showing chlorin present by designating the potash as "from muriate."

Explanation of the Tables

In the tables of analyses, following the name of each brand, will be found the analysis of the sample, sent by the manufacturer at the time the fertilizer was entered for sale, which was accompanied by an affidavit declaring this to be a fair and true sample of the fertilizer which the manufacturer proposed to sell in the State, under that name, and giving the guaranteed analysis. Our analysis of this sample is the one 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. Such samples have been collected by our inspectors or sent in by farmers. The manufacturers' guaranty is printed last in *italic* figures.

The figures set in bold faced type in the table, 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 all the analyses of the same brand have been grouped together.

On account of the continued high prices of all materials used in the manufacture of fertilizers, as well as the increased

cost of labor and transportation, it has been deemed advisable to increase the factors for calculating the "index of relative value" of fertilizers, in order that it may be nearer the actual money value than it has been the past few years.

The figures adopted for the year 1919, which will be used in computing the relative values hereafter, until conditions require their adjustment, are as follows:

Available phosphoric acid in mixed fertilizers	1.5
Available phosphoric acid in acid phosphates	1.2
Insoluble phosphoric acid in mixed fertilizers	0.4
Insoluble phosphoric acid in acid phosphates	nothing
Phosphoric acid in bone	0.8
Nitrogen in all fertilizers	7.0
Potash in all fertilizers	6.0

On account of various war services rendered by our chemical force, I desire to give credit for chemical work done for this bulletin to the following men, in addition to Mr. Rodes, who is given credit on the title page.

Mr. Owen S. Lee, who was with the department until March, when he entered the service; Mr. J. R. Mitchell of the University, who worked with us during the vacation period, and Mr. Harry R. Allen who came to us in November.

TABLE I.

Station Number	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The American Agr'l Chem. Co., Inc., Cin. Sales Dept., Cincinnati, O.	
54937	A. A. C. Kentucky Tobacco Grower	Manufacturer
55570		W. H. Abbott, Sulphur
54949	Bowker's Complete Manure	Manufacturer
55577		Broadway Coal & Real Estate Co., Mayfield
55615		Carson Nash, Providence
54950	Bowker's Harvest Bone	Manufacturer
54951	Bowker's Grain and Grass Grower	Manufacturer
54952	Bowker's Crop and Cereal Grower	Manufacturer
54953	Bowker's General Crop	Manufacturer
54954	Bowker's Corn and Wheat Phosphate	Manufacturer
54955	Bowker's Tobacco and Truck Grower, 1916	Manufacturer
54956	Bowker's Tobacco Plant Manure	Manufacturer
54967	Bradley's Complete Manure	Manufacturer
54968	Bradley's Potato and Root Fertilizer, 1916	Manufacturer
54969	Bradley's Grain and Grass Grower	Manufacturer
54970	Bradley's General Crop	Manufacturer
54971	Bradley's Corn and Wheat Phosphate	Manufacturer
54972	Bradley's Tobacco and Truck Grower	Manufacturer
54973	Bradley's Tobacco Plant Manure	Manufacturer
54974	Bradley's Crop and Cereal Grower	Manufacturer
54985	Cleveland Dryer Wks. Complete Manure	Manufacturer
55581		J. A. Dodson, Maysville
55619		J. A. Dodson, Maysville

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
9.80	5.10	14.90		0.91	1.00	1.91	2.32	2.07		22.6	54937
10.15	1.05	11.20				1.82	2.21	1.22	0.85	21.2	55570
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*2.00*		*19.0*	
7.80	5.00	12.80				1.01	1.23	1.12		16.0	54949
7.70	5.10	12.80		0.20	0.75	0.95	1.15	0.93		15.5	55577
7.40	1.10	8.50		0.42	0.49	0.91	1.10	1.10		13.6	55615
7.00	*4.00*	*11.00*				*0.82*	*1.00*	*1.00*		*13.9*	
9.30	4.30	13.60				0.90	1.09	1.15		17.2	54950
8.00	*4.00*	*12.00*				*0.82*	*1.00*	*1.00*		*15.1*	
9.90	4.40	14.30		0.87	0.91	1.78	2.16	2.20		22.1	54951
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*2.00*		*19.0*	
9.50	4.30	13.80				1.83	2.22	1.22		20.8	54952
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*1.00*		*18.0*	
9.40	4.10	13.50		1.05	1.08	2.13	2.59	1.17		21.6	54953
8.00	*4.00*	*12.00*				*2.06*	*2.50*	*1.00*		*19.4*	
11.60	4.30	15.90				0.95	1.15	1.16		20.1	54954
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*1.00*		*17.5*	
11.60	4.80	16.40		1.02	1.55	2.57	3.12	0.44	0.98	26.5	54955
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*1.00*		*23.3*	
9.60	4.40	14.00		0.87	2.52	3.39	4.12		1.23	26.6	54956
8.00	*4.00*	*12.00*				*3.29*	*4.00*	*1.00*		*23.7*	
8.10	4.50	12.60				1.05	1.27	1.23		16.4	54967
7.00	*4.00*	*11.00*				*0.82*	*1.00*	*1.00*		*13.9*	
9.40	4.10	13.50				0.99	1.20	1.15		17.5	54968
8.00	*4.00*	*12.00*				*0.82*	*1.00*	*1.00*		*15.1*	
10.30	5.20	15.50		0.94	1.07	2.01	2.44	2.13		23.6	54969
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*2.00*		*19.0*	
9.30	4.70	14.00		1.12	0.95	2.07	2.51	1.19		21.5	54970
8.00	*4.00*	*12.00*				*2.06*	*2.50*	*1.00*		*19.4*	
12.40	3.90	16.30				1.20	1.46	1.16		21.8	54971
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*1.00*		*17.5*	
12.70	4.40	17.10		0.95	1.51	2.46	2.99	0.50	0.86	27.1	54972
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*1.00*		*23.3*	
9.60	4.30	13.90		0.86	2.43	3.29	3.99	0.54	0.59	26.0	54973
8.00	*4.00*	*12.00*				*3.29*	*4.00*	*1.00*		*23.7*	
10.20	3.20	13.40		0.83	2.51	3.34	4.05	0.54	0.64	26.5	54974
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*1.00*		*18.0*	
8.70	4.20	12.90				1.08	1.31	1.28		17.2	54985
10.90	1.80	12.70				0.93	1.13	1.18		18.2	55581
7.90	4.70	12.60			0.99	0.99	1.20	1.26		16.1	55619
7.00	*4.00*	*11.00*				*0.82*	*1.00*	*1.00*		*13.9*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The American Agr'l Chem. Co.	
54986	Cleveland Dryer Wks. Potato and Tobacco Fertilizer, 1916	Manufacturer
54987	Cleveland Dryer Wks. Grain and Grass Grower	Manufacturer
54988	Cleveland Dryer Wks. Crop and Cereal Grower	Manufacturer
54989	Cleveland Dryer Wks. General Crop	Manufacturer
54990	Cleveland Dryer Wks. Phospho Bone	Manufacturer
54991	Cleveland Dryer Wks. Tobacco and Truck Grower	Manufacturer
54992	Cleveland Dryer Wks. Tobacco Plant Manure	Manufacturer
55003	Red Line Complete Manure	Manufacturer
55586		The Cayce-Yost Co., Hopkinsville
55626		C. E. Owen, Madisonville
55004	Homestead A-1 Potash Fertilizer 1916	Manufacturer
55587		E. T. Waggener, Agt., Dixon
55005	Red Line Crop Grower	Manufacturer
55006	Michigan Carbon Wks. Crop and Cereal Grower	Manufacturer
55627		C. P. Clark, Owensboro, Ky.
55007	Homestead Bone Black Fertilizer, 1916	Manufacturer
55588		P. K. Hubbard, Munfordsville
55628		G. W. Miller, Elkton
55008	Michigan Carbon Wks. Corn and Wheat Phosphate	Manufacturer
55589		The Cayce-Yost Co., Hopkinsville
55629		V. D. Roberts, Somerset
55009	Homestead Tobacco Grower, 1916	Manufacturer
55590		Bedford & Tuttle, Winchester
55010	Michigan Carbon Wks. Tobacco Plant Manure	Manufacturer
55021	N. W. Horse Shoe Brand Dark Tobacco Grower	Manufacturer

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
9.40	4.60	14.00				1.12	1.36	1.11		18.2	54986
8.00	*4.00*	*12.00*				*0.82*	*1.00*	*1.00*		*15.1*	
9.80	5.10	14.90		0.90	0.85	1.75	2.12	2.18		22.1	54987
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*2.00*		*19.0*	
9.20	3.70	12.90				1.72	2.09	1.31		19.9	54988
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*1.00*		*18.0*	
10.10	3.50	13.60		1.05	1.19	2.24	2.72	1.18		22.5	54989
8.00	*4.00*	*12.00*				*2.06*	*2.50*	*1.00*		*19.4*	
11.90	4.00	15.90				1.17	1.42	1.19		21.2	54990
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*1.00*		*17.5*	
12.10	4.20	16.30		0.84	1.89	2.73	3.31	1.07		26.8	54991
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*1.00*		*23.3*	
10.00	3.30	13.30		0.77	3.23	4.00	4.86	0.89		28.2	54992
8.00	*4.00*	*12.00*				*3.29*	*4.00*	*1.00*		*23.7*	
8.00	4.60	12.60				1.23	1.49	1.16		16.9	55003
7.80	0.80	8.60		0.27	0.68	0.95	1.15	1.12		14.1	55586
8.85	0.60	9.45		0.38	0.61	0.99	1.20	1.13		15.5	55626
7.00	*4.00*	*11.00*				*0.82*	*1.00*	*1.00*		*13.9*	
9.50	4.20	13.70				1.20	1.46	1.09		18.4	55004
8.60	0.70	9.30				1.10	1.34	1.13		15.6	55587
8.00	*4.00*	*12.00*				*0.82*	*1.00*	*1.00*		*15.1*	
10.00	5.00	15.00		0.91	1.19	2.10	2.55	2.11		23.5	55005
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*2.00*		*19.00*	
9.20	4.00	13.20				1.89	2.29	1.17		20.4	55006
8.10	1.45	9.55		0.48	1.21	1.69	2.05	1.14		17.4	55627
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*1.00*		*18.0*	
9.70	4.00	13.70		1.05	1.23	2.28	2.77	1.16		22.4	55007
9.50	0.80	10.30	0.22	0.90	1.17	2.29	2.78	1.23		21.0	55588
9.90	0.65	10.55		1.21	0.74	1.95	2.37	1.18		20.2	55628
8.00	*4.00*	*12.00*				*2.06*	*2.50*	*1.00*		*19.4*	
11.80	4.10	15.90				1.18	1.43	1.07		21.0	55008
10.60	2.50	13.10		0.20	0.82	1.02	1.24	1.13		18.4	55589
10.85	1.45	12.30			0.93	0.93	1.13	1.15		18.0	55629
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*1.00*		*17.5*	
12.20	4.50	16.70		0.98	1.96	2.94	3.57	0.44	0.76	28.1	55009
10.50	4.90	15.40		1.17	0.46	2.63	3.19	0.74	0.47	25.1	55590
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*1.00*		*23.3*	
9.80	4.10	13.90		0.84	3.01	3.85	4.67	0.50	0.62	28.1	55010
8.00	*4.00*	*12.00*				*3.29*	*4.00*	*1.00*		*23.7*	
8.30	4.60	12.90				1.02	1.24	1.17		16.5	55021
7.00	*4.00*	*11.00*				*0.82*	*1.00*	*1.00*		*13.9*	

TABLE I.

Station Number	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The American Agr'l Chem. Co.	
55022	N. W. Horse Shoe Brand Potash Manure, 1916	Manufacturer
55634		Grayson County Supply Co., Leitchfield
55023	N. W. Horse Shoe Brand Corn and Wheat Grower	Manufacturer
55635		E. S. Ferrell, Buffalo
55024	N. W. Horse Shoe Brand Crop and Cereal Grower	Manufacturer
55025	N. W. Horse Shoe Brand Challenge Corn Grower, 1916	Manufacturer
55636		Grayson County Supply Co., Leitchfield
55026	N. W. Horse Shoe Brand Complete Fertilizer	Manufacturer
55027	N. W. Horse Shoe Brand Tobacco and Truck Grower	Manufacturer
55028	N. W. Horse Shoe Brand Tobacco Plant Manure	Manufacturer
55039	Packers Boar's Head Brand Complete Manure	Manufacturer
55040	Packers Boar's Head Brand Sure Growth Potash Manure, 1916	Manufacturer
55041	Packers Boar's Head Brand Corn and Wheat Grower	Manufacturer
55042	Packers Boar's Head Brand General Crop	Manufacturer
55043	Packers Boar's Head Brand Crop and Cereal Grower	Manufacturer
55044	Packers Boar's Head Brand Complete Fertilizer	Manufacturer
55045	Packers Boar's Head Brand Tobacco and Truck Grower, 1916	Manufacturer
55046	Packers Boar's Head Brand Tobacco Plant Manure	Manufacturer
	Armour Fertilizer Wks., Nashville, Tenn.	
54905	Armour's Dark Tobacco Grower	Manufacturer
54906	Armour's Corn and Tobacco Grower	Manufacturer

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
9.30	4.40	13.70				1.00	1.21	1.10		17.5	55022
9.10	1.10	10.20		0.32	0.65	0.97	1.18	1.12		15.9	55634
8.00	*4.00*	*12.00*				*0.82*	*1.00*	*1.00*		*15.1*	
9.70	4.80	14.50		0.84	0.96	1.80	2.19	2.20		22.1	55023
7.85	3.05	10.90		0.59	1.24	1.83	2.22	1.08		18.1	55635
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*2.00*		*19.0*	
9.30	3.90	13.20				1.80	2.19	1.23		20.3	55024
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*1.00*		*18.0*	
9.50	4.30	13.80		0.91	1.19	2.10	2.55	1.23		21.7	55025
9.55	0.65	10.20		0.98	0.93	1.91	2.32	1.07		19.5	55636
8.00	*4.00*	*12.00*				*2.06*	*2.50*	*1.00*		*19.4*	
11.70	4.30	16.00				1.11	1.35	1.12		20.8	55026
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*1.00*		*17.5*	
12.00	4.60	16.60		0.91	1.59	2.50	3.04	0.46	0.76	26.4	55027
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*1.00*		*23.3*	
9.70	3.90	13.60		0.93	2.57	3.50	4.25	0.44	0.71	26.7	55028
8.00	*4.00*	*12.00*				*3.29*	*4.00*	*1.00*		*23.7*	
8.20	5.20	13.40				0.99	1.20	1.22		16.6	55039
7.00	*4.00*	*11.00*				*0.82*	*1.00*	*1.00*		*13.9*	
9.50	4.70	14.20				1.00	1.21	1.23		18.0	55040
8.00	*4.00*	*12.00*				*0.82*	*1.00*	*1.00*		*15.1*	
9.90	4.80	14.70		0.84	1.11	1.95	2.37	2.07		22.7	55041
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*2.00*		*19.0*	
9.00	4.30	13.30		1.00	0.80	1.80	2.19	1.42		20.2	55042
8.00	*4.00*	*12.00*				*2.06*	*2.50*	*1.00*		*19.4*	
9.10	4.60	13.70				1.84	2.23	1.12		20.3	55043
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*1.00*		*18.0*	
11.50	4.50	16.00				1.06	1.29	1.20		20.5	55044
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*1.00*		*17.5*	
11.80	5.00	16.80		1.07	1.54	2.61	3.17	0.48	0.80	26.7	55045
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*1.00*		*23.3*	
9.90	4.50	14.40		0.91	2.96	3.87	4.70		1.30	28.8	55046
8.00	*4.00*	*12.00*				*3.29*	*4.00*	*1.00*		*23.7*	
11.70	3.90	15.60	0.21		1.20	1.41	1.71		0.67	21.3	54905
10.00	*4.00*	*14.00*				*1.23*	*1.50*		*0.50*	*18.5*	
11.70	4.30	16.00				0.45	0.55		1.14	18.5	54906
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Armour Fertilizer Works.	
54908 55639	Armour's Record Brand	Manufacturer J. L. Orr & Sons, Allensville
54909	Armour's Tobacco and Potato Grower	Manufacturer
55596		Millersburg Coal & Lumber Co., Millersburg
54913 55641	Armour's Golden Grain Grower	Manufacturer M. D. Jordan, Olive Hill
54914 55598	Armour's Tobacco Guano	Manufacturer Millersburg Coal & Lumber Co., Millersburg
54915	Armour's Wheat, Corn and Oats Special	Manufacturer
54922	Armour's Hemp Grower	Manufacturer
54935	Armour's Tobacco Grower	Manufacturer
55299 55601	Ideal High Grade Blood and Bone	Manufacturer T. J. Turley Hdw. & Impl. Co., Owensboro
55300	Ideal Tobacco Grower	Manufacturer
55303	Ideal Grain Grower	Manufacturer
55412	Armour's Dark Tobacco Special	Manufacturer
55447	Armour's Champion	Manufacturer
55450	Armour's Special Grain Grower Formula	Manufacturer
55451 55649	Armour's Wheat Grower	Manufacturer G. P. Heath, Bedford
54924	Tuscarora Champion	Manufacturer
54926 55604	Tuscarora Standard	Manufacturer R. J. Wilcox, Greensburg
54927	Tuscarora Golden Grain Grower	Manufacturer

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
10.70	3.90	14.60				0.94	1.14	1.07		19.0	54908
10.50	4.50	15.00				0.74	0.90	0.75		17.7	55639
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*1.00*		*17.5*	
11.00	4.20	15.20				1.70	2.06		2.09	23.3	54909
10.10	4.40	14.50		0.59	1.12	1.71	2.08	1.35		21.2	55596
10.00	*4.00*	*14.00*				*1.65*	*2.00*		*2.00*	*21.8*	
8.90	3.80	12.70	0.26		1.50	1.76	2.14	1.25		19.6	54913
8.00	4.00	12.00	0.21	0.37	0.94	1.52	1.85	0.83		17.4	55641
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*1.00*		*18.0*	
8.89	5.10	13.90	0.21		1.55	1.76	2.14	0.46	0.63	20.0	54914
8.10	5.40	13.50		0.67	0.78	1.45	1.76	0.69		17.7	55598
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*1.00*	*18.2*	
7.90	5.00	12.90	0.24		0.72	0.96	1.17	1.15		16.0	54915
7.00	*4.00*	*11.00*				*0.82*	*1.00*	*1.00*		*13.9*	
5.90	5.00	10.90	0.24		2.39	2.63	3.19	1.07		19.4	54922
6.00	*4.00*	*10.00*				*2.47*	*3.00*	*1.00*		*18.5*	
10.30	4.70	15.00	0.24		1.60	1.84	2.23	0.42	0.79	22.1	54935
10.00	*4.00*	*14.00*				*1.65*	*2.00*		*1.00*	*20.6*	
10.50	3.50	14.00		1.26	1.35	2.61	3.17	1.12		24.3	55299
10.50	3.00	13.50	0.20	1.83	0.62	2.65	3.22	0.90		24.0	55601
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*1.00*		*23.3*	
10.80	3.50	14.30		0.90	1.05	1.95	2.37		1.22	22.7	55300
10.00	*4.00*	*14.00*				*1.65*	*2.00*		*1.00*	*20.6*	
9.50	3.10	12.60		0.29	0.86	1.15	1.40	1.26		17.9	55303
8.00	*4.00*	*12.00*				*0.82*	*1.00*	*1.00*		*15.1*	
8.40	3.60	12.00				1.78	2.16		3.04	21.4	55412
7.00	*4.00*	*11.00*				*1.65*	*2.00*		*3.00*	*19.4*	
10.30	7.30	17.60				1.92	2.33	2.33		24.3	55447
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*2.00*		*21.4*	
8.60	6.30	14.90				0.61	0.74	1.56	0.68	17.4	55450
8.00	*4.00*	*12.00*				*0.41*	*0.50*	*2.00*		*14.6*	
11.60	7.20	18.80		0.60		0.60	0.73	1.43		20.3	55451
11.10	3.90	15.00				0.57	0.69	0.66		17.5	55649
11.00	*4.00*	*15.00*				*0.41*	*0.50*	*1.00*		*17.2*	
11.60	3.20	14.80				1.73	2.10	2.20		23.5	54924
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*2.00*		*21.4*	
8.20	4.00	12.20	0.21		1.70	1.91	2.32	2.08		20.2	54926
12.10	1.60	13.70		0.34	0.68	1.02	1.24	0.69		19.4	55604
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*2.00*		*19.0*	
9.00	3.80	12.80	0.20		1.63	1.83	2.22	1.07		19.8	54927
8.00	*4.00*	*12.00*				*1.65*	*2.00*	*1.00*		*18.0*	

TABLE I.

Station Number	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Armour Fertilizer Works.	
54928	Tuscarora Ammoniated Phosphate	Manufacturer
54934	Tuscarora Corn and Tobacco Grower	Manufacturer
55606		Dickinson Brothers, Glasgow
55452	Tuscarora Wheat Grower	Manufacturer
	The Cincinnati Phosphate Co., Cincinnati, Ohio.	
55337	High Grade Manure	*
55338	Grain and Grass Grower	*
55339	Conservation Brand	*
55340	Crop Booster	*
55346	Tobacco, Potato and Beet Grower	*
	Duncan & Brother, Lagrange, Ky.	
55422	Tiger Brand Special Tobacco Grower	*
55654		Manufacturer's warehouse
55423	Tiger Brand Tobacco Grower	*
	The Empire Guano Co., Nashville, Tenn.	
55534	Climax Grain Grower	Manufacturer
55535	Favorite Manure	*
55536	Red Banner Special	*
55537	Climax Tobacco Grower	Manufacturer
55538	Wheat, Oat and Corn Special	*
55539	Wheat and Corn Grower	Manufacturer
55540	Clover and Wheat Special	*
55541	High Grade Tobacco Grower	*
55542	Special Grain Grower	*

* Manufacturer failed to send sample as required by law.

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
8.10	3.90	12.00	0.26		0.75	1.01	1.23	1.14		16.0	54928
7.00	*4.00*	*11.00*				*0.82*	*1.00*	*1.00*		*13.9*	
12.20	3.80	16.00				0.64	0.78		1.07	19.7	54934
10.50	1.70	12.20				0.55	0.67	0.88		16.1	55606
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	
11.10	6.80	17.90				0.59	0.72	1.44		19.6	55452
11.00	*4.00*	*15.00*				*0.41*	*0.50*	*1.00*		*17.2*	
											55337
9.00	*1.00*	*10.00*				*1.23*	*1.50*	*1.00*		*16.5*	
											55338
9.00	*1.00*	*10.00*				*0.82*	*1.00*	*1.00*		*15.1*	
											55339
12.00	*1.00*	*13.00*				*0.82*	*1.00*	*1.00*		*18.7*	
											55340
10.00	*1.00*	*11.00*				*0.41*	*0.50*	*1.00*		*14.8*	
											55346
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*2.00*		*14.9*	
											55422
7.90	1.10	9.00	0.68		0.82	1.50	1.82	0.76	1.08	17.2	55654
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*2.00*	*19.4*	
											55423
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*1.00*	*18.2*	
11.40	5.20	16.60		0.39	1.11	1.50	1.82	2.50		23.5	55534
10.00	*5.00*	*15.00*				*0.82*	*1.00*		*1.00*	*18.1*	
											55535
10.00	*5.00*	*15.00*				*0.82*	*1.00*		*3.00*	*20.5*	
											55536
10.00	*5.00*	*15.00*				*1.65*	*2.00*		*2.00*	*22.2*	
9.20	7.10	16.30		0.28	1.23	1.51	1.83	2.01		21.2	55537
8.00	*7.00*	*15.00*				*0.82*	*1.00*		*1.00*	*16.5*	
											55538
7.00	*10.00*	*17.00*				*0.82*	*1.00*		*1.00*	*16.5*	
12.50	5.30	17.80		0.25	0.85	1.10	1.34	2.15		23.1	55539
11.00	*5.00*	*16.00*				*0.41*	*0.50*		*1.00*	*17.8*	
											55540
12.00	*5.00*	*17.00*				*0.82*	*1.00*		*2.00*	*21.7*	
											55541
8.00	*5.00*	*13.00*				*1.65*	*2.00*		*4.00*	*22.2*	
											55542
8.00	*5.00*	*13.00*				*0.82*	*1.00*		*2.00*	*16.9*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Empire Guano Co.	
55543	Climax Formula	*
55544	Red Banner Tobacco Grower	Manufacturer
55545	Blood, Bone and Potash	Manufacturer
55548	Magic Grain Grower	Manufacturer
	Evansville Packing Co., Evansville, Ind.	
55428	Bone, Phosphate and Potash	Manufacturer
55658		Eldred Hardware Co., Princeton
55429	Harvest King	Manufacturer
55430	Three B	Manufacturer
55659		C. L. Ringo, Blackford
55431	Corn and Wheat Special	Manufacturer
55432	Half and Half Mixture	Manufacturer
55434	Leader	Manufacturer
55436	Farmers Pride	Manufacturer
	Federal Chemical Co., Inc., Louisville, Ky.	
55052	Blue Grass Tobacco Grower	Manufacturer
55053	Tobacco, Truck and Tomato Fertilizer	Manufacturer
55661		McCauley & Cain, Versailles
55054	Potato and Tobacco Fertilizer	Manufacturer
55662		Terrell Bros., Bedford
55062	Clay Land High Grade Tobacco Formula	Manufacturer
55068	Double Value Tobacco Grower	Manufacturer
55069	Daybreak A-1 Champion	Manufacturer
55070	Standard Crop Maker	Manufacturer

* Manufacturer failed to send sample as required by law.

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
											55543
9.00	*5.00*	*14.00*				*1.65*	*2.00*		*1.00*	*19.8*	
9.30	4.30	13.60	0.31	0.35	1.54	2.20	2.67	2.87		23.5	55544
8.00	*5.00*	*13.00*				*1.65*	*2.00*		*2.00*	*19.8*	
9.80	4.20	14.00		0.48	1.63	2.11	2.56	2.79		23.6	55545
8.00	*5.00*	*13.00*				*1.65*	*2.00*		*2.00*	*19.8*	
17.10	4.30	21.40		0.29	0.86	1.15	1.40	1.50		27.8	55548
14.00	*5.00*	*19.00*				*0.50*	*0.61*		*0.50*	*21.2*	
14.30	0.70	15.00				1.54	1.87	0.74	1.02	24.8	55428
6.20	1.70	7.90			1.24	1.24	1.51	1.20		13.7	55658
7.00						*0.82*	*1.00*	*1.00*		*12.3*	
11.80	1.00	12.80				1.41	1.71	0.74	1.89	22.5	55429
8.00						*1.00*	*1.21*	*2.00*		*15.1*	
12.00	1.00	13.00				2.05	2.49	0.76	1.73	24.8	55430
8.50	1.30	9.80				1.82	2.21	1.56		18.7	55659
8.00						*1.65*	*2.00*	*2.00*		*17.4*	
13.20	0.80	14.00				0.86	1.04	0.84	2.00	22.4	55431
12.00						*0.82*	*1.00*	*3.00*		*20.3*	
13.10	0.60	13.70				2.90	3.52	0.52	0.59	27.3	55432
10.00						*2.47*	*3.00*	*1.00*		*21.7*	
13.40	0.50	13.90				3.11	3.78	0.62	0.80	28.8	55434
9.00						*2.47*	*3.00*	*1.00*		*20.5*	
15.40	0.80	16.20				1.11	1.35	0.64	0.57	24.0	55436
12.00						*0.82*	*1.00*	*1.00*		*18.3*	
12.15	4.65	16.80				1.25	1.52	0.42	2.24	23.9	55052
10.00	*4.00*	*14.00*				*0.41*	*0.50*		*1.50*	*16.8*	
10.10	5.40	15.50				2.70	3.28	0.42	2.14	26.7	55053
9.60	4.10	13.70	0.47		0.48	0.95	1.15	0.96		17.5	55661
9.00	*4.00*	*13.00*				*1.65*	*2.00*		*1.00*	*19.4*	
12.35	3.85	16.20				2.55	3.10	0.64	1.11	27.3	55054
10.20	1.60	11.80	1.28		0.73	2.01	2.44	0.93		20.9	55662
10.00	*4.00*	*14.00*				*2.06*	*2.50*		*1.00*	*22.0*	
11.05	12.75	23.80				1.35	1.64	0.43		23.5	55062
8.00	*8.00*	*16.00*				*1.23*	*1.50*		*0.50*	*17.7*	
10.60	9.20	19.80				2.15	2.61		2.37	26.8	55068
9.00	*9.00*	*18.00*				*1.65*	*2.00*		*1.00*	*21.4*	
17.20	3.90	21.10				0.98	1.19		1.56	27.5	55069
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
17.00	4.00	21.00				0.98	1.19		1.35	27.1	55070
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Federal Chemical Co., Inc.	
55071	Standard Tobacco Fertilizer	Manufacturer
55072	Standard Wheat and Corn Maker	Manufacturer
55670		McGlothlan & Son, Irvington
55692		G. W. Maraman & Sons, Shepherdsville
55073	Daybreak Wheat and Corn Special	Manufacturer
55671		Johnson & Morgan Co., Elizabethtown
55693		Johnson & Morgan Co., Elizabethtown
55074	Daybreak Cracker-Jack	Manufacturer
55075	Royal Tobacco Compound	Manufacturer
55076	Royal Wheat and Grain Special	Manufacturer
55090	Daybreak Champion Grain Grower	Manufacturer
55678		Jackson Hdw. & Grocery Co., Dixon
55091	Daybreak Special Tobacco Grower	Manufacturer
55679		McGlothlan & Son, Irvington
55092	Daybreak Tobacco Formula	Manufacturer
55093	Favorite Tobacco Mixture	Manufacturer
55418	Special High Grade Tobacco Grower	*
55475	Daybreak Favorite	Manufacturer
55495	Liberty Wheat and Corn Grower	Manufacturer
55099	1st Prize Corn and Wheat Champion	Manufacturer
55100	Mogul Tobacco Fertilizer	Manufacturer
55101	Mogul Mixture	Manufacturer
55102	1st Prize Corn, Wheat and Oats Grower	Manufacturer

* Manufacturer failed to send sample as required by law.

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
18.60	4.50	23.10				0.97	1.18		1.33	29.1	55071
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
17.25	4.30	21.55				0.96	1.17		1.20	27.2	55072
12.15	4.70	16.85				0.47	0.57	0.47		18.6	55670
13.00	0.60	13.60			0.65	0.65	0.79	0.47		18.6	55692
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
16.40	4.00	20.40				1.00	1.21		1.56	26.7	55073
9.85	6.90	16.75				0.46	0.56	0.79		17.0	55671
12.00	2.10	14.10				0.57	0.69	1.15		18.4	55693
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	
14.40	4.90	19.30				1.20	1.46		1.85	25.7	55074
13.00	*4.00*	*17.00*				*0.41*	*0.50*		*1.00*	*19.8*	
15.70	7.10	22.80				1.09	1.32		2.25	28.2	55075
10.00	*4.00*	*14.00*				*0.41*	*0.50*		*1.50*	*16.8*	
15.40	4.00	19.40				1.55	1.88		1.77	27.6	55076
12.00	*4.00*	*16.00*				*0.82*	*1.00*		*1.00*	*20.1*	
13.60	9.20	22.80				1.04	1.26		1.19	25.1	55090
8.30	16.10	24.40				0.60	0.73	0.38		18.9	55678
9.00	*9.00*	*18.00*				*0.41*	*0.50*		*0.50*	*16.4*	
10.75	12.35	23.10		1.00		1.00	1.21		1.45	23.1	55091
8.00	10.90	18.90	0.20		0.44	0.64	0.78	0.80		17.0	55679
8.00	*8.00*	*16.00*				*0.41*	*0.50*		*1.00*	*15.4*	
11.80	12.30	24.10		0.93		0.93	1.13		1.43	24.1	55092
8.00	*8.00*	*16.00*				*0.41*	*0.50*		*1.00*	*15.4*	
11.90	10.60	22.50		1.89		1.89	2.29		2.00	27.5	55093
8.00	*8.00*	*16.00*				*1.23*	*1.50*		*0.50*	*17.7*	
											55418
10.00	*4.00*	*14.00*				*2.47*	*3.00*		*1.00*	*23.5*	
11.30	7.20	18.50		1.46		1.46	1.77	3.72		25.3	55475
11.00	*4.00*	*15.00*				*0.82*	*1.00*		*3.00*	*21.3*	
10.80	11.50	22.30		1.31		1.31	1.59	1.51		23.7	55495
8.00	*8.00*	*16.00*				*0.41*	*0.50*		*1.00*	*15.4*	
16.20	4.10	20.30		0.97		0.97	1.18	0.44	0.68	25.7	55099
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
16.20	4.30	20.50				0.94	1.14		1.00	25.7	55100
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
18.00	3.00	21.00		0.91		0.91	1.11		1.17	27.4	55101
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
14.35	5.45	19.80				0.97	1.18		2.05	25.3	55102
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Federal Chemical Co., Inc.	
55103	1st Prize Grain Maker	Manufacturer
55104	1st Prize Tobacco Compound	Manufacturer
55105	1st Prize Wheat and Grain Special	Manufacturer
55117	Mogul Grain Grower	Manufacturer
55118	1st Prize Special Tobacco Grower	Manufacturer
55119	Blue Ribbon Tobacco Formula	Manufacturer
55120	Premium Tobacco Mixture	Manufacturer
	Fox Chemical Co., Branch Federal Chemical Co., Inc., Louisville, Ky.	
55126	Fox Ideal Fertilizer	Manufacturer
55127	Fox Crop Maker	Manufacturer
55128	Fox Ideal Tobacco Fertilizer	Manufacturer
55129	Early Harvest Wheat and Corn Maker	Manufacturer
55704		Holloway & Co., Franklin
55130	Fox Blood, Bone Phosphate and Potash	Manufacturer
55705		Skaggs, Franklin & Nunn, Horse Cave
55131	Red Fox Grain and Grass Grower	Manufacturer
55132	Fox Soil Builder	Manufacturer
55133	Red Fox Tobacco Compound	Manufacturer
55134	Fox Wheat and Grain Special	Manufacturer
55147	Fox Ideal Grain Grower	Manufacturer
55709		M. L. Spurling, Campbellsville
55148	Fox Special Tobacco Grower	Manufacturer
55686		F. A. Joyce, Bedford

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia	From Muriate.	From Sulfate.	Index of Relative Value.	Station Number.
13.90	4.90	18.80		1.21		1.21	1.47		2.38	25.7	55103
13.00	*4.00*	*17.00*				*0.41*	*0.50*		*1.00*	*19.8*	
14.05	7.15	21.20				1.05	1.27	0.60	2.15	26.6	55104
10.00	*4.00*	*14.00*				*0.41*	*0.50*		*1.50*	*16.8*	
14.10	5.30	19.40		1.39	0.21	1.60	1.94		2.06	27.1	55105
12.00	*4.00*	*16.00*				*0.82*	*1.00*		*1.00*	*20.1*	
13.25	8.85	22.10		0.91	0.47	1.38	1.68	0.58	0.55	25.5	55117
9.00	*9.00*	*18.00*				*0.41*	*0.50*		*0.50*	*16.4*	
10.60	12.00	22.60				1.02	1.24	0.72	0.91	22.9	55118
8.00	*8.00*	*16.00*				*0.41*	*0.50*		*1.00*	*15.4*	
11.65	11.75	23.40		0.73	0.23	0.96	1.17		1.46	23.8	55119
8.00	*8.00*	*16.00*				*0.41*	*0.50*		*1.00*	*15.4*	
12.65	10.75	23.40		1.43	0.35	1.78	2.16	0.93		26.6	55120
8.00	*8.00*	*16.00*				*1.23*	*1.50*		*0.50*	*17.7*	
16.40	4.20	20.60				0.93	1.13	0.50	0.65	25.9	55126
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
15.40	4.80	20.20				1.02	1.24		0.54	24.6	55127
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
14.80	4.70	19.50		0.52	0.52	1.04	1.26		1.23	24.8	55128
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
16.50	4.00	20.50		0.76	0.21	0.97	1.18	0.50	0.68	26.1	55129
13.67	3.80	17.47				0.58	0.70	0.57		20.5	55704
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
15.80	4.20	20.00		0.99		0.99	1.20	0.52	1.32	26.2	55130
11.30	3.90	15.20				0.57	0.69	1.19		18.3	55705
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	
15.40	4.40	19.80		0.97		0.97	1.18		1.90	25.9	55131
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	
14.00	4.60	18.60		1.24		1.24	1.51	0.56	1.86	25.8	55132
13.00	*4.00*	*17.00*				*0.41*	*0.50*		*1.00*	*19.8*	
14.00	6.20	20.20		0.95	0.20	1.15	1.40	0.50	2.02	26.2	55133
10.00	*4.00*	*14.00*				*0.41*	*0.50*		*1.50*	*16.8*	
14.00	5.00	19.00		1.55		1.55	1.88		1.84	26.4	55134
12.00	*4.00*	*16.00*				*0.82*	*1.00*		*1.00*	*20.1*	
12.90	9.00	21.90		0.70	0.40	1.10	1.34	0.58	0.56	24.2	55147
9.60	12.10	21.70				0.47	0.57	0.45		18.5	55709
9.00	*9.00*	*18.00*				*0.41*	*0.50*		*0.50*	*16.4*	
11.80	11.20	23.00				1.00	1.21	1.09		23.2	55148
8.70	11.20	19.90			0.60	0.60	0.73	0.93		18.0	55686
8.00	*8.00*	*16.00*				*0.41*	*0.50*		*1.00*	*15.4*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Fox Chem. Co., Branch Federal Chem. Co., Inc.	
55149	Fox Tobacco Formula	Manufacturer
55150	Early Garden Tobacco Mixture	Manufacturer
55483	Fox Formula	Manufacturer
	Globe Fertilizer Co., Branch Federal Chemical Co., Inc., Louisville, Ky.	
55156	Globe Good Luck Fertilizer	Manufacturer
55722		Wallace Hardware Co., Central City
55157	Progress Fertilizer	Manufacturer
55711		Pearson & Breedlove, Franklin
55158	Progress Tobacco Fertilizer	Manufacturer
55159	Eagle Fertilizer	Manufacturer
55160	Globe Blood, Bone Phosphate and Potash	Manufacturer
55161	Globe Grain and Grass Grower	Manufacturer
55723		Wallace Hardware Co., Central City
55162	Globe Money-Maker	Manufacturer
55163	Old Cap's Tobacco Compound	Manufacturer
55164	Globe Wheat and Grain Special	Manufacturer
55178	Globe Tip-Top Grain Grower	Manufacturer
55716		The Hafendorfer-Thornton Co., Owensboro
55179	Kentucky Standard Tobacco Grower	Manufacturer
55717		Planters Hardware Co., Hopkinsville
55180	Braden Tobacco Formula	Manufacturer
55718		J. B. Benjamin, Providence
55181	Big Spread Tobacco Mixture	Manufacturer
55487	Braden Formula	Manufacturer

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
11.40	11.20	22.60		0.60	0.40	1.00	1.21	0.54	0.78	23.1	55149
8.00	*8.00*	*16.00*				*0.41*	*0.50*		*1.00*	*15.4*	
11.00	11.00	22.00		1.83		1.83	2.22	0.64	0.56	25.3	55150
8.00	*8.00*	*16.00*				*1.23*	*1.50*		*0.50*	*17.7*	
12.10	5.10	17.20		1.48		1.48	1.80	3.14		24.9	55483
11.00	*4.00*	*15.00*				*0.82*	*1.00*		*3.00*	*21.3*	
15.10	5.30	20.40		0.73	0.26	0.99	1.20	0.78	0.90	25.7	55156
13.50	3.50	17.00				0.51	0.62	0.47		19.9	55722
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
16.40	4.20	20.60		0.63	0.41	1.04	1.26		1.14	26.4	55157
11.80	6.80	18.60				0.45	0.55	0.54		19.0	55711
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
14.80	6.00	20.80		0.81	0.20	1.01	1.23	0.70	0.50	25.0	55158
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
14.70	5.50	20.20		0.81	0.24	1.05	1.27		1.12	24.9	55159
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
14.90	5.50	20.40		0.88	0.33	1.21	1.47	0.74	1.02	26.3	55160
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	
14.10	5.70	19.80		0.88	0.24	1.12	1.36	0.68	1.08	25.1	55161
12.50	4.40	16.90				0.47	0.57	0.98		19.4	55723
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	
13.00	4.80	17.80		0.98	0.32	1.30	1.58		1.84	24.3	55162
13.00	*4.00*	*17.00*				*0.41*	*0.50*		*1.00*	*19.8*	
14.70	6.50	21.20		0.98	0.23	1.21	1.47	0.60	1.90	27.4	55163
10.00	*4.00*	*14.00*				*0.41*	*0.50*		*1.50*	*16.8*	
14.10	5.30	19.40		1.12	0.54	1.66	2.02	0.54	1.50	27.2	55164
12.00	*4.00*	*16.00*				*0.82*	*1.00*		*1.00*	*20.1*	
11.80	10.20	22.00		1.02		1.02	1.24		1.20	23.3	55178
8.80	14.30	23.10				0.57	0.69	0.63		18.9	55716
9.00	*9.00*	*18.00*				*0.41*	*0.50*		*0.50*	*16.4*	
11.70	11.10	22.80		0.77	0.22	0.99	1.20	0.64	0.53	23.2	55179
8.80	9.80	18.60				0.49	0.59	0.90		17.1	55717
8.00	*8.00*	*16.00*				*0.41*	*0.50*		*1.00*	*15.4*	
11.70	10.70	22.40		1.03		1.03	1.25	0.68	0.47	23.2	55180
8.60	9.60	18.20				0.55	0.67	0.61		16.7	55718
8.00	*8.00*	*16.00*				*0.41*	*0.50*		*1.00*	*15.4*	
10.80	10.00	20.80		1.93		1.93	2.34	0.79		24.5	55181
8.00	*8.00*	*16.00*				*1.23*	*1.50*		*0.50*	*17.7*	
12.00	5.40	17.40		1.32		1.32	1.60	3.10		24.3	55487
11.00	*4.00*	*15.00*				*0.82*	*1.00*		*3.00*	*21.3*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Groves Fertilizer Wks., Cincinnati, Ohio.	
55217	Groves Half and Half	Manufacturer
55719		Troutman Bros., Shepherdsville
55727		Troutman Bros., Shepherdsville
55221	Harvest King	Manufacturer
55731		Minges Hardware Co., Newport
55222	Economy Brand	Manufacturer
55720		Troutman Bros., Shepherdsville
55732		Troutman Bros., Shepherdsville
	Hopkins Fertilizer Co., New Albany, Ind.	
55309	Potato and Tobacco Grower No. 1	Manufacturer
55315	Half and Half No. 1	Manufacturer
55316	Potato and Tobacco Grower	Manufacturer
55738		J. D. Ashcraft, Irvington
55317	Wheat and Corn Grower No. 2	Manufacturer
55739		J. D. Ashcraft, Irvington
55746		Pickerill & Twyman, Hodgenville
55318	Blood, Bone and Potash	Manufacturer
55319	Special Truck Grower	Manufacturer
55320	Potato and Tobacco Special	Manufacturer
55321	Wheat and Corn Grower	Manufacturer
55322	Kentucky Tobacco Grower	Manufacturer
55740		The Jenkins-Essex Co., Elizabethtown
55323	High Grade Tobacco Grower	Manufacturer
55741		J. D. Ashcraft, Irvington
55324	Special Potato Grower	Manufacturer
	International Agri. Corp., Florence, Ala.	
55402	Old Hickory Blood and Bone	*

* Manufacturer failed to send sample as required by law.

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
10.70	5.90	16.60				1.01	1.23	1.11		19.9	55217
8.30	9.10	17.40				0.84	1.02	1.07		17.6	55719
9.20	8.50	17.70				0.98	1.19	0.90		18.8	55727
		16.00				*0.82*	*1.00*	*1.00*		*13.5*	
9.20	1.00	10.20				0.90	1.09	1.23		15.8	55221
11.20	2.40	13.60				1.10	1.34	0.89		19.1	55731
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*1.00*		*13.9*	
10.10	0.90	11.00				0.86	1.04	1.17		16.7	55222
11.20	2.40	13.60				0.88	1.07	1.10		18.6	55720
12.20	0.90	13.10				1.00	1.21	1.07		19.6	55732
10.00	*1.00*	*11.00*				*0.82*	*1.00*	*1.00*		*16.3*	
13.50	0.20	13.70		1.19	0.39	1.58	1.92	0.50	1.39	24.0	55309
11.00	*1.00*	*12.00*				*0.82*	*1.00*		*2.00*	*18.9*	
8.60	7.60	16.20	0.23	0.59	1.04	1.86	2.26	0.74	0.67	21.4	55315
6.00	*7.00*	*13.00*				*1.65*	*2.00*		*1.00*	*17.0*	
13.60	0.50	14.10		1.22	0.32	1.54	1.87	0.63		22.5	55316
12.30	0.70	13.00	0.61		0.31	0.92	1.12	0.60	0.87	19.9	55738
11.00	*1.00*	*12.00*				*0.82*	*1.00*		*1.00*	*17.7*	
11.40	0.20	11.60	0.26		0.32	0.58	0.70	0.44	0.82	17.2	55317
11.20	0.90	12.10	0.28		0.34	0.62	0.75	0.62	0.63	17.4	55739
11.90	1.40	13.30			0.54	0.54	0.66	0.72	0.68	18.3	55746
10.00	*1.00*	*11.00*				*0.41*	*0.50*		*1.00*	*15.0*	
9.70	0.20	9.90		1.18	0.38	1.56	1.89		1.38	18.8	55318
9.00	*1.00*	*10.00*				*0.82*	*1.00*		*1.50*	*15.9*	
11.60	0.20	11.80		1.78	0.36	2.14	2.60	0.48	0.55	22.6	55319
11.00	*1.00*	*12.00*				*1.65*	*2.00*		*0.50*	*20.0*	
9.30	0.20	9.50	0.26	1.99	0.39	2.64	3.20	0.62	0.60	21.8	55320
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*1.00*	*17.0*	
10.70	0.20	10.90		0.42	0.34	0.76	0.92	0.44	0.78	17.0	55321
10.00	*1.00*	*11.00*				*0.41*	*0.50*		*0.50*	*14.4*	
6.40	0.20	6.60	0.55	0.48	0.51	1.54	1.87	0.68	1.83	16.0	55322
6.30	0.50	6.80	1.02		0.47	1.49	1.81	0.68	2.45	16.6	55740
6.00	*1.00*	*7.00*				*1.65*	*2.00*		*2.00*	*15.8*	
8.30	0.30	8.60	0.23	1.00	0.38	1.61	1.95		1.34	17.3	55323
8.70	0.40	9.10	0.35		0.42	0.77	0.93	1.30		14.6	55741
8.00	*1.00*	*9.00*				*0.82*	*1.00*		*1.00*	*14.1*	
10.80	0.20	11.00	0.39	1.84	0.34	2.57	3.12	0.64	2.02	25.1	55324
10.00	*1.00*	*11.00*				*2.06*	*2.50*		*1.00*	*20.8*	
10.00	*1.00*	*11.00*				*0.82*	*1.00*	*1.00*		*16.3*	55402

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Jarecki Chemical Co., Cincinnati, Ohio.	
55325	Lake Erie Guano with Phosphate and Potash	*
55326	Number One Formula	*
55327	Middle West Formula	*
55328	Tobacco and Truck Grower	*
55749		Fremds Grocery Co., Eminence
55329	Little Giant	*
55750		F. A. Joyce, Bedford
55335	Fish Phosphate and Potash Tobacco and Potato Food	*
55336	Indian Brand Tobacco and Potato Fertilizer	*
	The Kaufman Fertilizer Co., Cincinnati, Ohio.	
55348	Corn, Wheat and Oats Grower	*
55349	Harvest King	*
55350	Complete Ration	*
55351	Special Potato and Tobacco Fertilizer	*
55352	Banner Crop Grower	*
	Kentucky Fertilizer Co., Branch Fedtral Chem. Co., Inc., Louisville, Ky.	
55187	O. K. Special Mixture	Manufacturer
55188	O. K. Crop Maker	Manufacturer
55189	Old Reliable Tobacco Fertilizer	Manufacturer
55190	Gold Medal Wheat and Corn Maker	Manufacturer
55191	O. K. Grain Grower	Manufacturer
55192	O. K. Corn, Wheat and Oats Grower	Manufacturer
55753		Chiles-Thompson Co., Mt. Sterling
55760		D. L. D. Sandefur, Beaver Dam

* Manufacturer failed to send sample as required by law.

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
											55325
9.00	*1.00*	*10.00*				*1.23*	*1.50*	*1.00*		*16.5*	
											55326
9.00	*1.00*	*10.00*				*0.82*	*1.00*	*1.00*		*15.1*	
											55327
12.00	*1.00*	*13.00*				*0.82*	*1.00*	*1.00*		*18.7*	
											55328
9.50	1.50	11.00	0.40		0.62	1.02	1.24	0.80	1.36	18.0	55749
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*2.00*		*14.9*	
											55329
11.50	1.40	12.90				0.61	0.74	0.90		17.4	55750
10.00	*1.00*	*11.00*				*0.41*	*0.50*	*1.00*		*14.8*	
											55335
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*1.00*		*13.9*	
											55336
9.00	*1.00*	*10.00*				*2.47*	*3.00*	*3.00*		*22.9*	
											55348
9.00	*1.00*	*10.00*				*1.23*	*1.50*	*1.00*		*16.5*	
											55349
9.00	*1.00*	*10.00*				*0.82*	*1.00*	*1.00*		*15.1*	
											55350
12.00	*1.00*	*13.00*				*0.82*	*1.00*	*1.00*		*18.7*	
											55351
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*2.00*		*14.9*	
											55352
10.00	*1.00*	*11.00*				*0.41*	*0.50*	*1.00*		*14.8*	
15.40	4.00	19.40		0.63	0.33	0.96	1.17	0.70	0.56	24.8	55187
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
16.10	4.00	20.10		0.62	0.34	0.96	1.17	0.58	0.78	25.3	55188
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
15.80	4.20	20.00		0.63	0.33	0.96	1.17	0.78	0.60	25.5	55189
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
15.70	4.10	19.80		0.66	0.32	0.98	1.19	0.74	0.56	25.3	55190
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
15.40	4.40	19.80		0.69	0.37	1.06	1.29	0.70	1.47	26.4	55191
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	
14.70	4.40	19.10		0.66	0.40	1.06	1.29	0.84	0.87	25.0	55192
10.90	2.50	13.40				0.56	0.68	0.65		16.7	55753
12.30	4.70	17.00				0.59	0.72	1.14		19.9	55760
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Kentucky Fertilizer Co., Br. Federal Chem. Co., Inc.	
55193	O. K. Old Reliable	Manufacturer
55194	Level Best Tobacco Compound	Manufacturer
55195	O. K. Wheat and Grain Special	Manufacturer
55208	O. K. Gold Medal Grain Grower	Manufacturer
55209	O. K. Special Tobacco Grower	Manufacturer
55757		I. K. Miller & Sons, Campbellsville
55210	O. K. Tobacco Formula	Manufacturer
55211	Farmer's Friend Tobacco Mixture	Manufacturer
55491	O. K. High Grade Mixture	Manufacturer
	Louisville Fert. Co., Inc., "Armour Owned," Louisville, Ky. and Nashville, Tenn.	
54836	Louisville Tobacco Grower	Manufacturer
54837	Eagle Special Crop Grower	Manufacturer
54838	Louisville Standard	Manufacturer
55773		Haselden Bros., Lancaster
54839	Eagle Special Corn and Wheat Grower	Manufacturer
54840	Eagle Truck Grower	Manufacturer
54841	Eagle Potato and Tobacco Grower	Manufacturer
54849	Eagle Ky. Grain and Tobacco Guano	Manufacturer
54850	Eagle Tobacco and Potato Grower	Manufacturer
54851	Eagle Slaughter House Bone	Manufacturer
54854	Blue Grass Tobacco	Manufacturer
55769		McClure & Simms, Springfield
55229	Tobacco Special	Manufacturer
55770		J. W. Webb & Son, Vanceburg

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
11.70	6.80	18.50		0.83	0.41	1.24	1.51	0.74	1.45	23.6	55193
13.00	*4.00*	*17.00*				*0.41*	*0.50*		*1.00*	*19.8*	
12.70	7.10	19.80		0.69	0.33	1.02	1.24	0.78	1.97	24.8	55194
10.00	*4.00*	*14.00*				*0.41*	*0.50*		*1.50*	*16.8*	
12.80	5.70	18.50		1.19	0.46	1.65	2.00	0.76	1.53	26.0	55195
12.00	4.00	*16.00*				*0.82*	*1.00*		*1.00*	*20.1*	
14.00	7.80	21.80		0.87	0.27	1.14	1.38		1.02	25.1	55208
9.00	*9.00*	*18.00*				*0.41*	*0.50*		*0.50*	*16.4*	
11.00	12.50	23.50		0.62	0.37	0.99	1.20	0.58	0.62	23.0	55209
8.20	14.20	22.30				0.62	0.75	0.79		18.4	55757
8.00	*8.00*	*16.00*				*0.41*	*0.50*		*1.00*	*15.4*	
8.05	13.25	21.30		0.58	0.40	0.98	1.19		1.27	19.9	55210
8.00	*8.00*	*16.00*				*0.41*	*0.50*		*1.00*	*15.4*	
10.90	10.30	21.20		1.85		1.85	2.25		0.77	24.6	55211
8.00	*8.00*	*16.00*				*1.23*	*1.50*		*0.50*	*17.7*	
15.10	2.30	17.40		1.08	0.37	1.45	1.76	3.45		27.6	55491
11.00	*4.00*	*15.00*				*0.82*	*1.00*		*3.00*	*21.3*	
10.90	2.20	13.10				0.77	0.93		2.06	19.1	54836
10.00	*4.00*	*14.00*				*0.82*	*1.00*		*2.00*	*18.9*	
10.80	2.50	13.30				0.98	1.19		1.09	18.2	54837
10.00	*4.00*	*14.00*				*0.82*	*1.00*		*1.00*	*17.7*	
9.10	2.10	11.20				1.00	1.21	0.50	0.72	16.6	54838
8.70	1.10	9.80			0.82	0.82	1.00	0.54	0.56	15.0	55773
8.00	*4.00*	*12.00*				*0.82*	*1.00*		*1.00*	*15.3*	
7.00	1.80	8.80				1.01	1.23		1.18	14.1	54839
7.00	*4.00*	*11.00*				*0.82*	*1.00*		*1.00*	*14.1*	
9.00	1.50	10.50	0.33		0.39	0.72	0.87	0.54	1.47	16.2	54840
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*2.00*	*15.0*	
8.30	1.60	9.90				0.70	0.85		1.12	14.4	54841
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*1.00*	*13.8*	
9.90	6.40	16.30	0.20		1.59	1.79	2.17		1.72	22.8	54849
9.00	*4.00*	*13.00*				*1.65*	*2.00*		*1.50*	*20.0*	
8.60	6.40	15.00	0.29		1.45	1.74	2.11		1.03	20.2	54850
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*1.00*	*17.2*	
8.90	6.20	15.10	0.27		1.43	1.70	2.06		2.15	21.7	54851
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*2.00*	*19.4*	
10.90	1.70	12.60				0.64	0.78		2.54	19.1	54854
11.50	1.30	12.80	0.22		0.50	0.72	0.87	0.90	1.24	19.2	55769
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*3.00*	*16.2*	
10.30	0.60	10.90	0.43		1.91	2.34	2.84		1.60	22.7	55229
9.40	0.80	10.20		1.07	1.05	2.12	2.57	0.79		19.8	55770
8.00	*4.00*	*12.00*				*2.06*	*2.50*		*1.00*	*19.6*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Louisville Fertilizer Co., Inc., "Armour Owned."	
55274	Louisville Tobacco Grower Special	Manufacturer
55771		The Shelby County Feed & Grain Co., Shelbyville
55276	Grigsby's Special Corn and Wheat Grower	Manufacturer
55780		Grigsby & Co., Bardstown
55442	Wheat King	Manufacturer
55781		Irvington Hdw. & Impl. Co., Irvington
55457	Eagle Grain Grower Special	Manufacturer
55458	Eagle Wheat Grower	Manufacturer
55459	Eagle Soluble Bone	Manufacturer
55501	Eagle Ammoniated Potash Mixture	Manufacturer
54855	Bear Special Crop Grower	Manufacturer
55783		Irvington Hdw. & Impl. Co., Irvington
54856	Bear Special Corn and Wheat Grower	Manufacturer
54857	Bear Truck Grower	Manufacturer
54858	Bear Potato and Tobacco Grower	Manufacturer
55784		Wm. Leaming, Hodgenville
55802		Wm. Leaming, Hodgenville
54867	Bear Tobacco and Potato Grower	Manufacturer
54868	Bear Slaughter House Bone	Manufacturer
54869	Bear Ky. Grain and Tobacco Guano	Manufacturer
55437	Bear Tobacco and Potato Grower	Manufacturer
55463	Bear Grain Grower Special	Manufacturer
55464	Bear Wheat Grower	Manufacturer

BLE I.

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
11.40	2.20	13.60	0.41		1.39	1.80	2.19		1.62	22.8	55274
Grain											
12.40	0.50	12.90		0.69	0.80	1.49	1.81	0.94		21.2	55771
10.00	*4.00*	*14.00*				*1.65*	*2.00*		*1.00*	*20.6*	
10.60	2.40	13.00				0.89	1.08		1.03	18.0	55276
10.50	1.20	11.70				0.91	1.10	0.48	1.06	18.0	55780
10.00	*4.00*	*14.00*				*0.82*	*1.00*		*1.00*	*17.7*	
10.00	1.10	11.10				0.76	0.92	0.64	0.48	16.3	55442
Irving-											
9.20	1.20	10.40				0.41	0.50	0.61		13.6	55781
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*1.00*	*13.8*	
8.60	6.10	14.70	0.20		0.47	0.67	0.81	0.98		16.1	55457
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*1.00*	*13.8*	
11.90	6.50	18.40		0.65		0.65	0.79	2.12	0.51	21.9	55458
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	
9.40	6.20	15.60				1.17	1.42	1.83		19.7	55459
8.00	*4.00*	*12.00*				*0.82*	*1.00*		*1.50*	*15.9*	
13.80	6.10	19.90				0.42	0.51		1.86	22.7	55501
12.00	*4.00*	*16.00*				*0.41*	*0.50*		*2.00*	*19.8*	
11.00	2.40	13.40				0.92	1.12		1.16	18.8	54855
Irving-											
10.80	0.60	11.40				0.81	0.98	0.56	1.78	18.7	55783
10.00	*4.00*	*14.00*				*0.82*	*1.00*		*1.00*	*17.7*	
7.10	1.90	9.00				0.95	1.15		0.99	13.8	54856
7.00	*4.00*	*11.00*				*0.82*	*1.00*		*1.00*	*14.1*	
9.00	1.60	10.60	0.25		0.40	0.65	0.79		2.08	16.2	54857
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*2.00*	*15.0*	
8.20	1.50	9.70	0.22		0.45	0.67	0.81	0.46	0.60	14.0	54858
10.40	0.10	10.50				0.40	0.49	0.62	0.49	15.1	55784
10.10	0.10	10.20				0.51	0.62	0.48	0.48	15.0	55802
8.00	*3.00*	*11.00*				*0.41*	*0.50*		*1.00*	*13.4*	
8.70	6.10	14.80	0.32		1.48	1.80	2.19		1.11	20.5	54867
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*1.00*	*18.2*	
9.00	5.90	14.90	0.30		1.51	1.81	2.20		1.95	21.8	54868
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*2.00*	*19.4*	
10.20	6.00	16.20				1.82	2.21		1.58	22.9	54869
9.00	*4.00*	*13.00*				*1.65*	*2.00*		*1.50*	*20.0*	
11.00	1.00	12.00		1.69		1.69	2.05		2.26	22.2	55437
10.00	*4.00*	*14.00*				*1.65*	*2.00*		*2.00*	*21.8*	
9.10	6.40	15.50				0.56	0.68		0.70	16.3	55463
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*1.00*	*13.8*	
12.30	7.00	19.30				0.57	0.69		1.44	21.3	55464
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Louisville Fertilizer Co., Inc.	
55465	Bear Grain Grower Formula	Manufacturer
55467	Bear Grain Special	Manufacturer
55503	Bear Ammoniated Potash Mixture	Manufacturer
54870	Jones Special Crop Grower	Manufacturer
54871	Jones Special Corn and Wheat Grower	Manufacturer
54872	Jones Truck Grower	Manufacturer
54873	Jones Potato and Tobacco Grower	Manufacturer
	Morris & Co., Chicago, Ill.	
55289	Special Big Three	*
55291	Big Five—Bone, Tankage and Potash	*
55294	Big Eight—Phosphate and Potash	*
55295	Special Big Nine—Manure and Potash	*
55797		Redman & Burba Co., Hodgenville
55800		Grayson County Supply Co., Leitchfield
55296	Big Ten—Manure and Potash	*
	Rasin Monumental Co., (Subsidiary Va.-Car. Chem. Co., Inc.), Cincinnati, Ohio.	
55377	Rasin's Farmers Success	Manufacturer
55804		Martin-Hodgkins Supply Co., Winchester
55378	Rasin's Reliable Wheat and Corn Fertilizer	Manufacturer
55379	Rasin's Big Giant Phosphate	Manufacturer
55380	Rasin's General Favorite	Manufacturer
	Read Phosphate Co., Nashville, Tenn.	
55505	Corn, Wheat and Oat Grower	*

* Manufacturer failed to send sample as required by law.

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
8.90	6.60	15.50				0.62	0.75	0.54	1.64	18.0	55465
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*2.00*	*15.0*	
10.80	6.20	17.00				0.92	1.12	0.80	1.55	21.3	55467
10.00	*4.00*	*14.00*				*0.82*	*1.00*		*2.00*	*18.9*	
13.80	5.80	19.60				0.39	0.47	0.54	1.28	22.3	55503
12.00	*4.00*	*16.00*				*0.41*	*0.50*		*2.00*	*19.8*	
10.90	3.00	13.90				0.85	1.03		1.05	18.6	54870
10.00	*4.00*	*14.00*				*0.82*	*1.00*		*1.00*	*17.7*	
6.90	2.20	9.10				0.85	1.03	0.44	0.55	13.4	54871
7.00	*4.00*	*11.00*				*0.82*	*1.00*		*1.00*	*14.1*	
8.70	2.30	11.00	0.20		0.40	0.60	0.73		2.25	16.2	54872
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*2.00*	*15.0*	
8.00	2.10	10.10	0.20		0.48	0.68	0.83		1.11	14.2	54873
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*1.00*	*13.8*	
											55289
11.00	*2.00*	*13.00*				*0.41*	*0.50*		*3.00*	*19.0*	
											55291
7.00	*3.00*	*10.00*				*2.47*	*3.00*		*1.00*	*19.5*	
											55294
7.00	*1.00*	*8.00*				*0.82*	*1.00*		*1.00*	*12.9*	
											55295
13.50	1.30	14.80				0.66	0.80	1.23		20.3	55797
11.90	2.50	14.40				0.67	0.81	0.86	0.79	19.4	55800
11.00	*2.00*	*13.00*				*0.41*	*0.50*		*1.00*	*16.6*	
											55296
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*2.00*	*18.6*	
8.80	2.90	11.70			0.96	0.96	1.17	0.64	0.55	16.4	55377
10.50	2.90	13.40				0.97	1.18	0.54	0.43	18.2	55804
8.00	*1.50*	*9.50*				*0.82*	*1.00*	*1.00*		*14.1*	
8.80	2.40	11.20				0.97	1.18	0.92	1.46	17.6	55378
8.00	*1.50*	*9.50*				*0.82*	*1.00*	*2.00*		*15.1*	
9.80	1.90	11.70			1.01	1.01	1.23	1.44	1.95	19.8	55379
8.00	*1.50*	*9.50*				*0.82*	*1.00*	*3.00*		*16.1*	
9.40	0.70	10.10			2.07	2.07	2.51	1.00	1.20	21.3	55380
8.00	*1.50*	*9.50*				*1.65*	*2.00*	*2.00*		*18.0*	
											55505
7.00	*10.00*	*17.00*				*0.82*	*1.00*		*1.00*	*16.5*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Read Phosphate Co.	
55506	Kentucky Tobacco Grower	Manufacturer
55806		Barren Co. Grocery & Hdw. Co., Glasgow
55817		Heber Young, Bowling Green
55507	Soluble Bone	*
55508	Blood and Bone No. 1	Manufacturer
55509	Standard Tobacco Grower	Manufacturer
55807		Heber Young, Bowling Green
55510	Blood and Bone Special	Manufacturer
55511	Farmers Special Manure	*
55808		J. C. Dunavent, Eminence
55512	Corn and Wheat Grower	Manufacturer
55514	High Grade Ammoniated Dissolved Bone	*
55515	Red Diamond Special	*
55516	High Grade Tobacco Grower	*
55520	Standard Grain Manure	Manufacturer
55528	Matchless Grain Grower	Manufacturer
55814		Barren County Grocery & Hdw. Co., Glasgow
	The Smith Agri. Chem. Co., Columbus, Ohio.	
55420	Smith's Tobacco Grower	Manufacturer
	Southern Fertilizer Co., Louisville, Ky.	
55409	Elk General Crop Grower	*
55410	Elk Corn and Wheat Grower	*
55840		B. F. Beard & Co., Hardinsburg
55426	Elk Special Tobacco Grower	*
55824		Conrad, Payne & Co., Cloverport

* Manufacturer failed to send sample as required by law.

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
9.50	6.90	16.40			1.48	1.48	1.80	2.13		21.5	55506
8.80	7.40	16.20	0.26		0.66	0.92	1.12	0.93		17.7	55806
9.35	7.65	17.00			0.94	0.94	1.14	0.67		18.2	55817
8.00	*7.00*	*15.00*				*0.82*	*1.00*		*1.00*	*16.5*	
											55507
8.00	*5.00*	*13.00*				*0.82*	*1.00*		*2.00*	*16.9*	
9.40	4.10	13.50	0.33	0.35	1.39	2.07	2.51	2.75		23.5	55508
8.00	*5.00*	*13.00*				*1.65*	*2.00*		*2.00*	*19.8*	
9.60	4.10	13.70	0.46	0.32	1.46	2.24	2.72	2.75		23.8	55509
8.85	2.05	10.90	0.72		0.81	1.53	1.86	1.98		18.8	55807
8.00	*5.00*	*13.00*				*1.65*	*2.00*		*2.00*	*19.8*	
11.30	5.50	16.80		0.20	1.25	1.45	1.76	2.39		23.2	55510
10.00	*5.00*	*15.00*				*0.82*	*1.00*		*1.00*	*18.1*	
											55511
11.50	1.80	13.30	0.31		0.44	0.75	0.91	1.64	1.05	20.1	55808
10.00	*5.00*	*15.00*				*0.82*	*1.00*		*3.00*	*20.5*	
12.70	5.10	17.80		0.21	0.85	1.06	1.27	1.98		23.0	55512
11.00	*5.00*	*16.00*				*0.41*	*0.50*		*1.00*	*17.8*	
											55514
10.00	*5.00*	*15.00*				*1.65*	*2.00*		*2.00*	*22.2*	
											55515
10.00	*3.00*	*13.00*				*2.47*	*3.00*		*3.00*	*25.5*	
											55516
8.00	*5.00*	*13.00*				*1.65*	*2.00*		*4.00*	*22.2*	
9.50	3.50	13.00		0.38	1.63	2.01	2.44	2.72		22.6	55520
9.00	*5.00*	*14.00*				*1.65*	*2.00*		*1.00*	*19.8*	
17.10	4.60	21.70		0.41	0.86	1.27	1.54	1.70		28.5	55528
9.60	8.60	18.20			0.60	0.60	0.73	0.64		17.7	55814
14.00	*5.00*	*19.00*				*0.50*	*0.61*		*0.50*	*21.2*	
8.15	2.05	10.20				0.93	1.13	1.07	0.40	15.4	55420
8.00						*0.82*	*1.00*	*1.00*		*13.5*	
											55409
10.00	*1.00*	*11.00*				*0.41*	*0.50*		*1.00*	*15.0*	
											55410
8.60	0.30	8.90		0.46	0.51	0.97	1.18	0.97		14.8	55840
7.00	*1.00*	*8.00*				*0.82*	*1.00*		*1.00*	*12.9*	
											55426
12.00	0.60	12.60			0.53	0.53	0.64		1.51	18.3	55824
10.00	*1.00*	*11.00*				*0.41*	*0.50*		*1.00*	*15.0*	

TABLE I.

Station Number	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Swift & Co., Inc., National Stock Yards, Ill.	
55231	Swift's Ammoniated Bone, Phosphate and Potash	Manufacturer
55232	Swift's Diamond "K" Grain Grower	Manufacturer
55825		J. L. Shadoan & Co., Frazer
55234	Swift's Complete Fertilizer	Manufacturer
55827		Goodman Bros. Co., Shelbyville
55842		J. L. Shadoan & Co., Frazer
55242	Swift's Diamond "W" Vegetable and Tobacco Grower	Manufacturer
55830		C. S. Brent Seed Co., Paris
55243	Swift's Champion Wheat and Corn Grower	Manufacturer
55244	Swift's Special Grain Fertilizer	Manufacturer
55846		J. L. Shadoan & Co., Frazer
55245	Swift's Superphosphate	Manufacturer
55831		B. F. Beard & Co., Hardinsburg
55246	Swift's Diamond "A" Potato and Tobacco Fertilizer	Manufacturer
55832		Dickinson Bros., Glasgow
55247	Swift's Special Grain and Grass Grower	Manufacturer
55248	Swift's Diamond "M" Grain Grower	Manufacturer
55249	Swift's Tomato and Vegetable Fertilizer	Manufacturer
55250	Swift's Red Steer Grain Grower	Manufacturer
55833		I. F. Tabb, Mt. Sterling
55251	Swift's Special Superphosphate	Manufacturer
55252	Swift's Diamond "W" Tobacco Grower	Manufacturer
55834		A. M. Napierale Co., Eminence
55411	Swift's Pulverized Sheep Manure	Manufacturer
55839		W. T. Kirkman, Elkton

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
11.05	2.90	13.95				1.88	2.28	0.58		21.6	55231
10.00	*3.00*	*13.00*				*1.65*	*2.00*	*0.50*		*19.5*	
11.66	3.64	15.30				0.80	0.97		1.17	19.6	55232
11.80	4.40	16.20				0.96	1.17	0.62		19.9	55825
12.00	*3.00*	*15.00*				*0.82*	*1.00*	*1.00*		*19.5*	
8.12	3.18	11.30				0.86	1.04	0.64	0.95	15.8	55234
8.10	0.90	9.00				0.91	1.10	0.66		13.9	55827
9.00	1.20	10.20				1.01	1.23	1.33		16.2	55842
8.00	*3.00*	*11.00*				*0.82*	*1.00*	*1.00*		*14.7*	
11.05	3.25	14.30				1.91	2.32	2.82		24.1	55242
9.50	3.70	13.20				1.43	1.74	0.92	1.33	20.4	55830
8.00	*3.00*	*11.00*				*1.65*	*2.00*		*3.00*	*20.2*	
14.50	3.50	18.00				1.83	2.22	0.54	1.46	27.5	55243
12.00	*3.00*	*15.00*				*1.65*	*2.00*	*2.00*		*23.4*	
11.85	3.65	15.50				1.78	2.16	1.02	0.88	24.0	55244
9.70	1.20	10.90				1.76	2.14	1.72		20.0	55846
10.00	*3.00*	*13.00*				*1.65*	*2.00*	*2.00*		*21.0*	
9.95	3.85	13.80				1.77	2.15	2.11		21.8	55245
8.95	3.90	12.85				1.61	1.95	1.74		20.0	55831
8.00	*3.00*	*11.00*				*1.65*	*2.00*	*2.00*		*18.6*	
10.70	3.70	14.40				2.34	2.84	0.88		23.4	55246
12.50	1.30	13.80				1.62	1.97		0.49	21.8	55832
8.00	*3.00*	*11.00*				*2.47*	*3.00*		*1.00*	*20.7*	
12.70	3.40	16.10				1.87	2.27	0.78	0.90	25.0	55247
10.00	*3.00*	*13.00*				*1.65*	*2.00*	*1.50*		*20.5*	
13.70	3.40	17.10				1.80	2.19	1.66		25.8	55248
11.00	*3.00*	*14.00*				*1.65*	*2.00*	*1.00*		*21.2*	
10.50	3.60	14.10				2.23	2.71	1.08		22.9	55249
8.00	*3.00*	*11.00*				*2.47*	*3.00*		*0.50*	*20.1*	
10.05	4.00	14.05				1.74	2.11	0.80		20.6	55250
9.80	4.20	14.00				1.66	2.02	0.72		20.0	55833
9.00	*3.00*	*12.00*				*1.65*	*2.00*	*1.00*		*18.8*	
8.70	3.70	12.40				1.77	2.15	0.89		19.0	55251
8.00	*3.00*	*11.00*				*1.65*	*2.00*	*1.00*		*17.6*	
9.50	2.90	12.40				1.60	1.94	1.22		19.4	55252
9.40	1.10	10.50				1.67	2.03		0.88	18.6	55834
8.00	*3.00*	*11.00*				*1.65*	*2.00*		*1.00*	*17.8*	
1.30	0.30	1.60				1.70	2.06	0.82	1.36	10.1	55411
1.60	0.20	1.80				1.70	2.06	0.68	1.18	10.1	55839
1.00	*1.00*	*2.00*				*1.65*	*2.00*	*1.50*		*8.9*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Swift & Co., Inc.	
55383	Pioneer Special Grain and Grass Grower	Manufacturer
55391	Pioneer No. 1 Grain Grower	Manufacturer
55392	Pioneer No. 2 Grain Grower	Manufacturer
55393	Pioneer No. 3 Grain Grower	Manufacturer
55394	Pioneer Wheat and Corn Grower	Manufacturer
55395	Pioneer General Crop Grower	Manufacturer
55396	Pioneer 1-8-1 Brand	Manufacturer
55397	Pioneer 2-8-1 Brand	Manufacturer
	Tennessee Chem. Co., Inc., (Armour Owned), Louisville, Ky., and Nashville, Tenn.	
54881	Louisville Tobacco Grower	Manufacturer
54882	Ox Special Crop Grower	Manufacturer
55862		W. F. Grainger, Franklin
54883	Louisville Standard	Manufacturer
54884	Ox Special Corn and Wheat Grower	Manufacturer
55863		Dickey & Martin, Munfordville
54885	Ox Truck Grower	Manufacturer
54886	Ox Potato and Tobacco Grower	Manufacturer
55852		C. R. Hutchison, Columbia
54894	Ox Ammoniated Alkaline Bone	Manufacturer
54895	Ox Ky. Grain and Tobacco Guano	Manufacturer
54896	Ox Tobacco and Potato Grower	Manufacturer
54897	Ox Slaughter House Bone	Manufacturer
54899	Ox Dark Tobacco Grower	Manufacturer

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
12.70	3.40	16.10				1.87	2.27	0.78	0.90	25.0	55383
10.00	*3.00*	*13.00*				*1.65*	*2.00*	*1.50*		*20.5*	
10.05	4.00	14.05				1.74	2.11	0.80		20.6	55391
9.00	*3.00*	*12.00*				*1.65*	*2.00*	*1.00*		*18.8*	
11.66	3.64	15.30				0.80	0.97		1.17	19.6	55392
12.00	*3.00*	*15.00*				*0.82*	*1.00*	*1.00*		*19.5*	
13.70	3.40	17.10				1.80	2.19	1.66		25.8	55393
11.00	*3.00*	*14.00*				*1.65*	*2.00*	*1.00*		*21.2*	
11.85	3.65	15.50				1.78	2.16	1.02	0.88	24.0	55394
10.00	*3.00*	*13.00*				*1.65*	*2.00*	*2.00*		*21.0*	
9.95	3.85	13.80				1.77	2.15	2.11		21.8	55395
8.00	*3.00*	*11.00*				*1.65*	*2.00*	*2.00*		*18.6*	
8.12	3.18	11.30				0.86	1.04	0.64	0.95	15.8	55396
8.00	*3.00*	*11.00*				*0.82*	*1.00*	*1.00*		*14.7*	
9.50	2.90	12.40				1.60	1.94	1.22		19.4	55397
8.00	*3.00*	*11.00*				*1.65*	*2.00*		*1.00*	*17.8*	
10.65	2.40	13.05				0.88	1.07		2.15	19.4	54881
10.00	*4.00*	*14.00*				*0.82*	*1.00*		*2.00*	*18.9*	
10.90	2.80	13.70				0.87	1.06		1.24	18.7	54882
10.80	3.40	14.20				0.65	0.79	1.51		18.1	55862
10.00	*4.00*	*14.00*				*0.82*	*1.00*		*1.00*	*17.7*	
8.20	2.60	10.80				0.90	1.09		1.00	15.2	54883
8.00	*4.00*	*12.00*				*0.82*	*1.00*		*1.00*	*15.3*	
6.90	2.50	9.40				0.83	1.01	0.46	0.52	13.3	54884
7.30	0.70	8.00				0.85	1.03	0.74		12.8	55863
7.00	*4.00*	*11.00*				*0.82*	*1.00*		*1.00*	*14.1*	
8.70	2.00	10.70	0.26		0.33	0.59	0.72		2.11	15.8	54885
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*2.00*	*15.0*	
8.20	2.10	10.30				0.72	0.87		1.07	14.5	54886
10.10	0.70	10.80				0.59	0.72	0.60		15.1	55852
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*1.00*	*13.8*	
12.90	3.60	16.50	0.22		0.48	0.70	0.85		2.26	22.1	54894
12.00	*4.00*	*16.00*				*0.41*	*0.50*		*2.00*	*19.8*	
10.90	5.10	16.00	0.27		1.58	1.85	2.25		1.73	23.7	54895
9.00	*4.00*	*13.00*				*1.65*	*2.00*		*1.50*	*20.0*	
8.90	5.90	14.80	0.32		1.37	1.69	2.05		1.21	20.4	54896
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*1.00*	*18.2*	
9.30	6.00	15.30				1.65	2.00		1.95	21.7	54897
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*2.00*	*19.4*	
11.60	4.20	15.80	0.22		1.20	1.42	1.72		0.61	21.3	54899
10.00	*4.00*	*14.00*				*1.23*	*1.50*		*0.50*	*18.5*	

TABLE I.

Station Number	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Tennessee Chemical Co.	
54900	Ox Kentucky Tobacco Special	Manufacturer
54903	Ox Tankage Phosphate and Potash	Manufacturer
54904	McChesney's Special Tobacco Grower	Manufacturer
55230	Louisville Tobacco Grower Special	Manufacturer
55858		Lebanon Carriage & Implement Co., Lebanon
55306	McChesney's Tobacco Grower	Manufacturer
55859		N. Wood, Trenton
55414	Ox Tobacco Special	Manufacturer
55444	Ox Wheat King	Manufacturer
55470	Ox Grain Grower Special	Manufacturer
55471	Ox Special Grain Formula	Manufacturer
55504	Ox Wheat Grower	Manufacturer
	Virginia-Carolina Chem. Co., Inc., Cincinnati, Ohio.	
55364	V-C Complete Manure	Manufacturer
55891		Taylor County Supply Co., Campbellsville
55365	V-C Champion Corn and Wheat Grower	Manufacturer
55892		Junction City Lumber Co., Junction City
55366	V-C Farmer's Friend	Manufacturer
55893		Junction City Lumber Co., Junction City
55367	V-C Beef, Blood and Bone, B. B. B.	Manufacturer
55877		W. T. Kirkman, Elkton
55370	V-C Gem Fertilizer for Tobacco	Manufacturer
55879		W. S. Overstreet, LaGrange

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
12.70	4.30	17.00	0.25		1.26	1.51	1.83	0.73		23.0	54900
12.50	*4.00*	*16.50*				*1.23*	*1.50*		*0.50*	*21.5*	
12.10	4.60	16.70	0.25		0.28	0.53	0.64	0.54	0.54	19.4	54903
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	
10.40	3.00	13.40	0.21		0.66	0.87	1.06	0.46	0.54	17.8	54904
10.00	*4.00*	*14.00*				*0.82*	*1.00*		*1.00*	*17.7*	
13.50	1.20	14.70	0.59		1.44	2.03	2.46	0.50	0.80	25.3	55230
11.30	1.20	12.50				0.81	0.98	0.83		17.7	55858
10.00	*4.00*	*14.00*				*1.65*	*2.00*		*1.00*	*20.6*	
12.10	4.10	16.20				0.50	0.61	0.50	0.61	19.1	55306
11.50	4.00	15.50				0.58	0.70		0.67	18.2	55859
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	
8.36	6.20	14.56				1.68	2.04	1.43		19.7	55414
10.00	*4.00*	*14.00*				*1.65*	*2.00*		*1.00*	*20.6*	
10.80	1.20	12.00				0.62	0.75	0.48	0.43	16.6	55444
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*1.00*	*13.8*	
8.80	5.90	14.70				0.61	0.74	1.01		16.1	55470
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*1.00*	*13.8*	
9.00	6.20	15.20				0.64	0.78	0.62	1.54	18.0	55471
8.00	*4.00*	*12.00*				*0.41*	*0.50*		*2.00*	*15.0*	
12.60	6.00	18.60				0.44	0.53	0.64	1.11	21.0	55504
12.00	*4.00*	*16.00*				*0.41*	*0.50*		*2.00*	*19.8*	
8.40	2.70	11.10	0.22		0.72	0.94	1.14	1.14		15.6	55364
10.40	2.50	12.90				0.93	1.13	0.54	0.55	17.9	55891
8.00	*1.50*	*9.50*				*0.82*	*1.00*	*1.00*		*14.1*	
9.10	2.50	11.60	0.20		0.75	0.95	1.15	1.24	1.02	17.7	55365
10.90	0.90	11.80				0.74	0.90	0.56	1.24	18.1	55892
8.00	*1.50*	*9.50*				*0.82*	*1.00*	*2.00*		*15.1*	
9.30	2.00	11.30				1.20	1.46	1.14	2.58	20.4	55366
9.80	0.70	10.50				0.71	0.86	0.88	1.43	17.1	55893
8.00	*1.50*	*9.50*				*0.82*	*1.00*	*3.00*		*16.1*	
8.50	2.00	10.50	0.38		1.56	1.94	2.36	1.12	1.58	20.8	55367
8.30	2.70	11.00				1.46	1.77	1.16	0.77	18.2	55877
8.00	*1.50*	*9.50*				*1.65*	*2.00*	*2.00*		*18.0*	
14.30	1.20	15.50	0.55		1.37	1.92	2.33	0.98	0.48	25.9	55370
11.00	3.00	14.00				1.63	1.98	0.74	0.40	21.3	55879
9.00	*1.50*	*10.50*				*1.65*	*2.00*		*1.00*	*18.4*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Mt. Pleasant Branch, Va.-Car. Chem. Co., Mt. Pleasant, Tenn.	
55283	Mt. Pleasant Black Patch Tobacco Grower	*
55884		J. W. James, Rapids
55284	Mt. Pleasant Burley Special Tobacco Grower	*
55285	Mt. Pleasant Truck Growers' Choice	*
55406	Mt. Pleasant Burley Tobacco Grower	*
	Wood, Stubbs & Co., Inc., Louisville, Ky.	
55259	Acme Wheat and Corn Fertilizer	Manufacturer
55260	Acme Grain and Grass Grower	Manufacturer
55261	Acme A-1 Bone, Blood and Potash	Manufacturer
55263	Acme Special Truck Grower	Manufacturer
55264	Acme Potato and Tobacco Grower	Manufacturer
55265	Acme Special Potato Grower	Manufacturer
55266	Acme High Grade Vegetable Grower	Manufacturer
55267	Acme Extra High Grade Potato Grower	Manufacturer

* Manufacturer failed to send sample as required by law.

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia	POTASH.		Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulfate.		
											55283
7.90	13.90	21.80		0.22	0.38	0.60	0.73	1.08		18.2	55884
7.00	*1.50*	*8.50*				*0.41*	*0.50*		*1.00*	*11.6*	
											55284
8.00	*1.50*	*9.50*				*1.23*	*1.50*		*1.50*	*16.3*	
											55285
8.00	*1.50*	*9.50*				*0.82*	*1.00*		*3.00*	*16.7*	
											55406
8.00	*1.50*	*9.50*				*1.65*	*2.00*		*3.00*	*19.6*	
16.60	3.90	20.50		0.60	0.39	0.99	1.20		1.16	26.3	55259
11.50	*4.00*	*15.50*				*0.41*	*0.50*		*0.50*	*17.4*	
17.70	2.40	20.10		0.73	0.33	1.06	1.29		1.82	28.1	55260
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.4*	
15.10	6.10	21.20		0.81	0.28	1.09	1.32		2.62	27.5	55261
10.00	*4.00*	*14.00*				*0.41*	*0.50*		*1.50*	*16.8*	
16.90	0.90	17.80		2.11	0.40	2.51	3.05		2.52	32.5	55263
11.50	*4.00*	*15.50*				*1.65*	*2.00*		*0.50*	*21.8*	
12.30	6.60	18.90		1.94	0.22	2.16	2.62		2.73	35.6	55264
9.00	*4.00*	*13.00*				*1.65*	*2.00*		*1.00*	*19.4*	
15.10	3.30	18.40		2.63		2.63	3.19		2.73	31.9	55265
10.00	*4.00*	*14.00*				*2.06*	*2.50*		*1.00*	*22.0*	
11.90	3.90	15.80		3.52	0.41	3.93	4.77	0.88	4.27	35.6	55266
9.00	*4.00*	*13.00*				*2.47*	*3.00*		*1.00*	*22.3*	
11.10	7.80	18.90		3.33	0.47	3.80	4.61	1.00	2.04	33.2	55267
8.00	*4.00*	*12.00*				*3.29*	*4.00*		*1.00*	*23.9*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The American Agricultural Chem. Co., Cin. Sales Dept., Cincinnati, Ohio.	
54936	A. A. C. Raw Bone	Manufacturer
54957	Bowker's Ground Bone	Manufacturer
55616		Claypool-Hendricks Hdw. Co., Bowling Green
54975	Bradley's Ground Bone	Manufacturer
55578		Cooper-Craycroft & Co., Vine Grove
54993	Cleveland Dryer Wks. Ground Bone	Manufacturer
55620		Taylor County Supply Co., Campbellsville
55011	Michigan Carbon Wks. Ground Bone	Manufacturer
55591		The Cayce-Yost Co., Hopkinsville
55630		E. P. Barnes & Son, Beaver Dam
55029	N. W. Horse Shoe Brand Ground Bone	Manufacturer
55047	Packers Boar's Head Brand Ground Bone	Manufacturer
	Armour Fertilizer Works, Nashville, Tenn.	
54919	Armour's Bone Meal	Manufacturer
55600		Finley Hardware Co., Madisonville
55644		W. S. Overstreet, Lagrange
54920	Armour's Bone Meal Special	Manufacturer
55645		The Jenkins-Essex Co., Elizabethtown
54921	Armour's Raw Bone Meal	Manufacturer
55646		The Jenkins-Essex Co., Elizabethtown
55448	Armour's Bone Meal and Potash	Manufacturer
54930	Tuscarora Bone Meal	Manufacturer
55650		Dickinson Bros., Glasgow
54931	Tuscarora Raw Bone Meal	Manufacturer

BONES, TANKAGE, &c.

PERCENTAGE OF FINENESS		Total Phosphoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia.	POTASH		Index of Relative Value.	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulfate.		
66.00	34.00	25.00	54.59	3.85	4.67			31.7	54936
		20.00	*43.67*	*3.29*	*4.00*			*23.5*	
70.00	30.00	22.20	48.48	2.71	3.29			25.9	54957
73.00	27.00	21.20	46.30	2.57	3.12			24.8	55616
		20.00	*43.67*	*2.47*	*3.00*			*20.7*	
70.00	30.00	22.60	49.35	2.71	3.29			26.2	54975
64.00	36.00	19.90	43.46	2.89	3.51			24.6	55578
		20.00	*43.67*	*2.47*	*3.00*			*20.7*	
73.00	27.00	23.60	51.55	2.80	3.40			27.4	54993
78.00	22.00	21.00	45.86	2.55	3.10			24.8	55620
		20.00	*43.67*	*2.47*	*3.00*			*20.7*	
77.00	23.00	22.70	49.58	2.75	3.34			26.7	55011
61.00	39.00	21.30	46.52	2.80	3.40			25.2	55591
68.00	32.00	22.25	48.59	2.82	3.42			26.2	55630
		20.00	*43.67*	*2.47*	*3.00*			*20.7*	
73.00	27.00	22.10	48.26	2.63	3.19			25.7	55029
		20.00	*43.67*	*2.47*	*3.00*			*20.7*	
71.00	29.00	23.00	50.24	2.71	3.29			26.6	55047
		20.00	*43.67*	*2.47*	*3.00*			*20.7*	
92.00	8.00	29.45	64.32	2.00	2.43			30.1	54919
63.00	37.00	31.50	68.79	1.71	2.08			28.9	55600
69.00	31.00	30.70	67.06	1.89	2.29			29.3	55644
		27.00	*58.96*	*1.65*	*2.00*			*22.0*	
88.00	12.00	28.20	61.58	2.81	3.41			31.7	54920
82.00	18.00	25.90	56.56	2.76	3.35			29.5	55645
		24.00	*52.42*	*2.47*	*3.00*			*23.1*	
54.00	46.00	24.40	53.28	3.92	4.76			31.0	54921
81.00	19.00	21.80	47.61	3.62	4.39			29.3	55646
		22.00	*48.06*	*3.71*	*4.50*			*26.2*	
91.00	9.00	20.70	45.21	2.12	2.57	1.86		25.5	55448
		20.00	*43.67*	*1.85*	*2.25*	*1.00*		*19.5*	
93.00	7.00	29.30	63.98	1.81	2.20			29.4	54930
81.00	19.00	27.10	59.18	1.76	2.14			26.8	55650
		27.00	*58.96*	*1.65*	*2.00*			*22.0*	
53.00	47.00	24.60	53.73	4.12	5.00			31.8	54931
		22.00	*48.06*	*3.71*	*4.50*			*26.2*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Calumet Fertilizer Co., Inc., New Albany, Ind.	
55564	Calumet Brand Raw Bone Meal	Manufacturer
	The Empire Guano Co., Nashville, Tenn.	
55557	Climax Bone Meal Mixture	Manufacturer
55558	Half and Half	*
55559	Pure Raw Bone Meal	*
	Evansville Packing Co., Evansville, Ind.	
55433	Pure Raw Bone Meal	Manufacturer
	Federal Chemical Co., Inc., Louisville, Ky.	
55067	Pure Bone	Manufacturer
55669		Birk & Price Co., Owensboro
55691		The Jenkins-Essex Co., Elizabethtown
55097	Daybreak Fine Raw Bone	Manufacturer
55098	Daybreak Raw Bone	Manufacturer
55681		St. Matthews Produce Co., St. Matthews
55124	First Prize Fine Raw Bone	Manufacturer
55125	First Prize Raw Bone	Manufacturer
	Fox Chemical Co., Br. Federal Chem. Co. Inc., Louisville, Ky.	
55154	Fox Ground Raw Bone	Manufacturer
55155	Fox Raw Bone	Manufacturer
	Globe Fertilizer Co., Br. Federal Chem. Co., Inc., Louisville, Ky.	
55185	Acorn Raw Bone	Manufacturer
55186	Globe Raw Bone	Manufacturer
	Groves Fertilizer Works, Cincinnati, Ohio.	
55225	Bone and Phosphate	Manufacturer
55733		Troutman Bros., Shepherdsville

* Manufacturer failed to send sample as required by law.

BONES, TANKAGE, &c.

PERCENTAGE OF FINENESS		Total Phosphoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia.	POTASH		Index of Relative Value.	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulfate.		
53.00	47.00	21.90	47.83	3.79	4.60			28.7	55564
		20.00	*43.67*	*3.71*	*4.50*			*25.0*	
64.00	36.00	19.30	42.16	2.20	2.67			21.8	55557
		17.00	*37.13*	*1.65*	*2.00*			*16.0*	
									55558
		17.00	*37.13*	*1.65*	*2.00*	*1.00*		*17.0*	
									55559
		21.00	*45.86*	*3.71*	*4.50*			*25.6*	
57.00	43.00	24.70	53.95	3.71	4.50			30.6	55433
		23.00	*50.24*	*3.71*	*4.50*			*26.8*	
53.00	47.00	30.00	65.52	1.72	2.09			27.2	55067
64.00	36.00	31.90	69.65	1.31	1.59			27.8	55669
81.00	19.00	30.00	65.52	1.81	2.20			29.2	55691
		30.00	*65.52*	*1.03*	*1.25*			*21.6*	
47.00	53.00	26.60	58.09	2.92	3.54			28.7	55097
		24.00	*52.42*	*2.88*	*3.50*			*24.5*	
34.00	66.00	23.60	51.55	4.27	5.18			30.7	55098
60.00	40.00	22.10	48.26	3.94	4.78			29.7	55681
		22.00	*48.06*	*3.71*	*4.50*			*26.2*	
46.00	54.00	26.00	56.77	2.90	3.52			28.1	55124
		24.00	*52.42*	*2.88*	*3.50*			*24.5*	
36.00	64.00	23.60	51.55	4.38	5.32			31.2	55125
		22.00	*48.06*	*3.71*	*4.50*			*26.2*	
51.00	49.00	25.80	56.35	2.92	3.53			28.3	55154
		24.00	*52.42*	*2.88*	*3.50*			*24.5*	
52.00	48.00	23.00	50.24	4.31	5.23			31.3	55155
		22.00	*48.06*	*3.71*	*4.50*			*26.2*	
54.00	46.00	25.40	55.48	3.12	3.79			28.9	55185
		24.00	*52.42*	*2.88*	*3.50*			*24.5*	
66.00	34.00	22.80	49.79	4.18	5.07			31.3	55186
		22.00	*48.06*	*3.71*	*4.50*			*26.2*	
97.00	3.00	22.50	49.15	0.95	1.15			21.2	55225
77.00	23.00	22.20	48.48	1.07	1.30			20.5	55733
		20.00	*43.67*	*0.82*	*1.00*			*14.9*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Groves Fertilizer Works	
55226	2-27 Bone	Manufacturer
55227	Raw Bone	Manufacturer
	Hopkins Fertilizer Co., New Albany, Ind.	
55314	Pure Raw Bone	Manufacturer
55745		Pickerill & Twyman, Hodgenville
	Ky. Fertilizer Co., Br. Federal Chem. Co., Inc., Louisville, Ky.	
55215	O. K. Fine Raw Bone	Manufacturer
55216	O. K. Raw Bone	Manufacturer
	Louisville Fertilizer Co., Inc., "Armour Owned," Louisville, Ky., and Nashville, Tenn.	
54845	Eagle Raw Bone	Manufacturer
54846	Eagle Bone Meal	Manufacturer
55775		C. L. Thomas Carriage & Implement Co., Bowling Green
54852	Eagle Ky. Bone Meal	Manufacturer
55778		Cohen Bros., Central City
54862	Bear Raw Bone	Manufacturer
54863	Bear Bone Meal	Manufacturer
55785		N. F. Hill, Bowling Green
54877	Jones' Raw Bone	Manufacturer
54878	Jones' Bone Meal	Manufacturer
55792		J. L. Shadoan & Co., Frazer
	Morris & Co., Chicago, Ill.	
55287	Big One—Ground Raw Bone	*
55288	Big Two—Pure Bone Meal	*
55794		Redman & Burba Co., Hodgenville
55292	Special Big Six—Bone Meal and Potash	*
55293	Special Big Seven—Bone Meal	*
55796		Grayson County Supply Co., Leitchfield
55799		Grayson County Supply Co., Leitchfield

* Manufacturer failed to send sample as required by law.

BONES, TANKAGE, &c.

PERCENTAGE OF FINENESS		Total Phosphoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia.	POTASH		Index of Relative Value.	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulfate.		
98.00	2.00	27.60	60.26	1.87	2.27			28.5	55226
		27.00	*58.96*	*1.65*	*2.00*			*22.0*	
89.00	11.00	24.30	53.07	3.99	4.84			32.9	55227
		22.00	*48.06*	*3.71*	*4.50*			*26.2*	
50.00	50.00	23.90	52.19	3.92	4.76			30.5	55314
47.00	53.00	22.60	49.35	4.02	4.88			29.8	55745
		21.50	*46.95*	*3.50*	*4.25*			*25.2*	
45.00	55.00	25.10	54.82	3.06	3.71			28.0	55215
		24.00	*52.42*	*2.88*	*3.50*			*24.5*	
36.00	64.00	23.20	50.67	4.44	5.39			31.1	55216
		22.00	*48.06*	*3.71*	*4.50*			*26.2*	
46.00	54.00	26.00	56.77	4.16	5.05			32.6	54845
		22.00	*48.06*	*3.71*	*4.50*			*26.2*	
100.00		29.50	64.43	2.92	3.54			33.8	54846
92.00	8.00	28.70	62.68	2.39	2.90			30.9	55775
		24.00	*52.42*	*2.47*	*3.00*			*23.1*	
100.00		29.90	65.30	1.92	2.33			30.6	54852
68.00	32.00	30.70	67.04	2.07	2.51			29.8	55778
		27.00	*58.96*	*1.65*	*2.00*			*22.0*	
35.00	65.00	25.50	55.68	3.91	4.75			30.8	54862
		22.00	*48.06*	*3.71*	*4.50*			*26.2*	
92.00	8.00	29.00	63.34	2.73	3.31			32.3	54863
90.00	10.00	26.20	57.22	3.04	3.69			31.1	55785
		24.00	*52.42*	*2.47*	*3.00*			*23.1*	
52.00	48.00	25.10	54.82	3.99	4.84			31.6	54877
		22.00	*48.06*	*3.71*	*4.50*			*26.2*	
100.00		29.00	63.34	2.65	3.22			32.5	54878
70.00	30.00	29.90	65.30	2.45	2.97			30.8	55792
		24.00	*52.42*	*2.47*	*3.00*			*23.1*	
									55287
		24.00	*52.42*	*3.29*	*4.00*			25.9	
									55288
71.00	29.00	32.10	70.10	1.69	2.05			29.7	55794
		28.00	*61.16*	*2.06*	*2.50*			*24.0*	
									55292
		16.00	*34.95*	*0.41*	*0.50*		*1.00*	*12.2*	
									55293
71.00	29.00	22.90	50.01	1.24	1.51			21.3	55796
65.00	35.00	27.20	59.40	0.87	1.06			23.0	55799
		22.00	*48.06*	*0.82*	*1.00*			*16.1*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Pero & Stoecker, Louisville, Ky.	
55416	Pure Animal Matter Corn and Wheat Grower	Manufacturer
55417	Pure Bone Meal	Manufacturer
	Read Phosphate Co., Nashville, Tenn.	
55530	Bone Meal Grain Special	*
55531	Bone Meal Mixture	Manufacturer
55532	Pure Raw Bone Meal	*
55815		Heber Young, Bowling Green
	Swift & Co., Inc., National Stock Yards, Ill.	
55253	Swift's Raw Bone Meal Fertilizer	Manufacturer
55835		I. K. Miller & Sons, Campbellsville
55847		Holloway & Co., Franklin
55254	Swift's Ground Beef Bone Fertilizer	Manufacturer
55848		J. L. Shadoan & Co., Frazer
55255	Swift's Bone Meal Fertilizer	Manufacturer
55836		Camp & Ramsey, Trenton
55256	Swift's 1½-30 Bone Meal Fertilizer	Manufacturer
55837		A. M. Napierale Co., Eminence
55257	Swift's 1½-20 Bone Meal Fertilizer	Manufacturer
55838		C. E. Pemberton, Munfordville
55849		Wilson & Co., Russellville
55386	Pioneer Raw Bone Meal	Manufacturer
55387	Pioneer Bone Meal	Manufacturer
55388	Pioneer Ground Beef Bone	Manufacturer
55389	Pioneer 1½-30 Bone Meal	Manufacturer
55390	Pioneer 1½-20 Bone Meal	Manufacturer

* Manufacturer failed to send sample as required by law.

BONES, TANKAGE, &c.

PERCENTAGE OF FINENESS		Total Phosphoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia.	POTASH		Index of Relative Value.	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulfate.		
77.00	23.00	13.60	29.70	5.81	7.05			30.6	55416
		10.00	*21.85*	*4.00*	*4.86*			*20.0*	
77.00	23.00	25.40	55.47	3.54	4.30			30.3	55417
		22.00	*48.06*	*3.50*	*4.25*			*25.5*	
									55530
		17.00	*37.13*	*1.65*	*2.00*	*1.00*		*17.0*	
63.00	37.00	19.70	43.03	2.05	2.49			21.5	55531
		17.00	*37.13*	*1.65*	*2.00*			*16.0*	
									55532
44.00	56.00	23.90	52.19	3.81	4.63			29.8	55815
		21.00	*45.86*	*3.71*	*4.50*			*25.6*	
68.00	32.00	23.50	51.33	3.97	4.82			31.2	55253
60.00	40.00	23.30	50.88	4.01	4.87			30.8	55835
77.00	23.00	25.90	56.56	4.07	4.94			33.8	55847
		23.00	*50.24*	*3.71*	*4.50*			*26.8*	
100.00		28.00	61.16	2.15	2.61			29.9	55254
85.00	15.00	30.00	65.52	2.10	2.55			30.5	55848
		27.00	*58.96*	*2.06*	*2.50*			*23.4*	
82.00	18.00	24.90	54.37	2.80	3.40			28.8	55255
83.00	17.00	24.50	53.51	3.07	3.73			29.5	55836
		24.00	*52.42*	*2.47*	*3.00*			*23.1*	
77.00	23.00	31.70	69.24	1.30	1.58			28.5	55256
75.00	25.00	31.20	68.15	1.44	1.75			28.4	55837
		30.00	*65.52*	*1.23*	*1.50*			*22.3*	
88.00	12.00	20.70	45.21	1.61	1.95			21.7	55257
80.00	20.00	20.70	45.21	2.14	2.60			23.2	55838
77.00	23.00	20.00	43.67	1.44	1.75			20.1	55849
		20.00	*43.67*	*1.23*	*1.50*			*16.3*	
68.00	32.00	23.50	51.33	3.97	4.82			31.2	55386
		23.00	*50.24*	*3.71*	*4.50*			*26.8*	
82.00	18.00	24.90	54.37	2.80	3.40			28.8	55387
		24.00	*52.42*	*2.47*	*3.00*			*23.1*	
100.00		28.00	61.16	2.15	2.61			29.9	55388
		27.00	*58.96*	*2.06*	*2.50*			*23.4*	
77.00	23.00	31.70	69.24	1.30	1.58			28.5	55389
		30.00	*65.52*	*1.23*	*1.50*			*22.3*	
88.00	12.00	20.70	45.21	1.61	1.95			21.7	55390
		20.00	*43.67*	*1.23*	*1.50*			*16.3*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Taylor & Powell Fertilizer Co., Springfield, Tenn.	
55425	Pure Raw Bone Meal	Manufacturer
55567	Half and Half	Manufacturer
	Tennessee Chem. Co., Inc., (Armour Owned) Louisville, Ky. and Nashville, Tenn.	
54890	Ox Raw Bone	Manufacturer
54891	Ox Bone Meal	Manufacturer
55854		Lebanon Carriage & Implement Co., Lebanon
55865		Wilson & Wyne, Russellville
54901	Ox Kentucky Bone Meal	Manufacturer
55869		W. F. Grainger, Franklin
55413	Ox Raw Bone with Potash	Manufacturer

BONES, TANKAGE, &c.

PERCENTAGE OF FINENESS		Total Phosphoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia.	POTASH		Index of Relative Value.	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulfate.		
52.00	48.00	24.50	53.51	3.89	4.72			30.9	55425
		22.00	*48.06*	*3.71*	*4.50*			*26.2*	
80.00	20.00	18.90	41.27	1.83	2.22			20.8	55567
		16.50	*36.04*	*1.85*	*2.25*			*16.4*	
55.00	45.00	26.10	57.00	4.07	4.94			32.8	54890
		22.00	*48.06*	*3.71*	*4.50*			*26.2*	
87.00	13.00	28.80	62.89	2.88	3.50			31.3	54891
72.00	28.00	28.75	62.78	2.52	3.06			30.2	55854
69.00	31.00	28.50	62.25	2.58	3.13			30.1	55865
		24.00	*52.42*	*2.47*	*3.00*			*23.1*	
83.00	17.00	29.10	63.56	1.80	2.19			28.6	54901
75.00	25.00	30.90	67.49	1.95	2.37			30.0	55869
		27.00	*58.96*	*1.65*	*2.00*			*22.0*	
86.00	14.00	22.20	48.48	2.23	2.71		1.05	26.2	55413
		20.00	*43.67*	*2.06*	*2.50*		*1.00*	*20.4*	

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	Index of Relative Value.	Station Number.
	The American Agricultural Chem. Co., Inc., Cincinnati Sales Dept., Cincinnati, Ohio.						
54941	Bowker's 10% Acid Phosphate	Manufacturer	11.90	3.10	15.00	11.9	54941
55610		Broadway Coal & Real Estate Co., Mayfield	10.40	2.00	12.40	10.4	55610
			10.00	*2.00*	*12.00*	*10.0*	
54942	Bowker's 12% Acid Phosphate	Manufacturer	14.50	2.00	16.50	14.5	54942
55574		V. D. Roberts, Somerset	12.40	1.00	13.40	12.4	55574
			12.00	*2.00*	*14.00*	*12.0*	
55943	Bowker's Soluble Bone	Manufacturer	16.60	1.70	18.30	16.6	54943
55611		R. A. Smith, Kuttawa	14.30	1.00	15.30	14.3	55611
			14.00	*2.00*	*16.00*	*14.0*	
54944	Bowker's 16% Acid Phosphate	Manufacturer	18.60	1.60	20.20	18.6	54944
55575		Estes & Hines, Science Hill	19.80	0.10	19.90	19.8	55575
55612		Chas. Thacker, Franklin	18.70	0.50	19.20	18.7	55612
			16.00	*2.00*	*18.00*	*16.0*	
54959	Bradley's 10% Acid Phosphate	Manufacturer	11.80	2.30	14.10	11.8	54959
			10.00	*2.00*	*12.00*	*10.0*	
54960	Bradley's 12% Acid Phosphate	Manufacturer	14.20	1.80	16.00	14.2	54960
			12.00	*2.00*	*14.00*	*12.0*	
54961	Bradley's Soluble Dissolved Bone	Manufacturer	16.40	1.90	18.30	16.4	54961
			14.00	*2.00*	*16.00*	*14.0*	
54962	Bradley's 16% Acid Phosphate	Manufacturer	18.80	1.90	20.70	18.8	54962
			16.00	*2.00*	*18.00*	*16.0*	
54977	Cleveland Dryer Wks. Horse-head Phosphate	Manufacturer	11.70	1.90	13.60	11.7	54977
55579		O. A. Lutes & Co., Shepherdsville	9.60	0.90	10.50	9.6	55579
			10.00	*2.00*	*12.00*	*10.0*	
54978	Cleveland Dryer Wks. 12% Acid Phosphate	Manufacturer	14.70	2.20	16.90	14.7	54978
			12.00	*2.00*	*14.00*	*12.0*	
54979	Cleveland Dryer Wks. XXX Super Phosphate	Manufacturer	16.50	1.30	17.80	16.5	54979
			14.00	*2.00*	*16.00*	*14.0*	

			10.00	*2.00*	*12.00*	*10.0*	
54978	Cleveland Dryer Wks. 12% Acid Phosphate	Manufacturer	14.70	2.20	16.90	14.7	54978
			12.00	*2.00*	*14.00*	*12.0*	
54979	Cleveland Dryer Wks. XXX Super Phosphate	Manufacturer	16.50	1.30	17.80	16.5	54979
			14.00	*2.00*	*16.00*	*14.0*	
54980	Cleveland Dryer Wks. 16% Acid Phosphate	Manufacturer	18.50	2.30	20.80	18.5	54980
55580		A. D. Roberts, Hawesville	17.40	0.30	17.70	17.4	55580
			16.00	*2.00*	*18.00*	*16.0*	
54995	Michigan Carbon Wks. 10% Acid Phosphate	Manufacturer	11.70	1.60	13.30	11.7	54995
			10.00	*2.00*	*12.00*	*10.0*	
54996	Michigan Carbon Wks. 12% Acid Phosphate	Manufacturer	14.00	2.10	16.10	14.0	54996
55621		C. M. Langdon, Science Hill	12.60	1.50	14.10	12.6	54621
			12.00	*2.00*	*14.00*	*12.0*	
54997	Red Line Phosphate	Manufacturer	16.50	2.10	18.60	16.5	54997
55582		C. E. Owen, Madisonville	14.90	0.80	15.70	14.9	55582
55622		C. M. Langdon, Science Hill	17.30	1.85	19.15	17.3	55622
			14.00	*2.00*	*16.00*	*14.0*	
54998	Michigan Carbon Wks. 16% Acid Phosphate	Manufacturer	17.90	2.50	20.40	17.9	54998
55583		Dickinson Bros., Glasgow	21.00	0.20	21.20	21.0	55583
55623		K. C. Mason, Adairville	18.90	1.30	20.20	18.9	55623
			16.00	*2.00*	*18.00*	*16.0*	
55013	N-W Horse Shoe Brand Quick Acid Phosphate	Manufacturer	11.60	2.10	13.70	11.6	55013
55592		Jay Small & Son, Mayfield	11.30	0.60	11.90	11.3	55592
55632		Jay Small & Son, Mayfield	10.00	1.70	11.70	10.0	55632
			10.00	*2.00*	*12.00*	*10.0*	
55014	N-W Horse Shoe Brand 12% Acid Phosphate	Manufacturer	14.30	1.90	16.20	14.3	55014
			12.00	*2.00*	*14.00*	*12.0*	
55015	N-W Horse Shoe Brand Square Deal Phosphate	Manufacturer	16.60	2.10	18.70	16.6	55015
			14.00	*2.00*	*16.00*	*14.0*	
55016	N-W Horse Shoe Brand 16% Acid Phosphate	Manufacturer	18.10	2.20	20.30	18.1	55016
55593		Smith & Sowder, Brodhead	17.70	0.10	17.80	17.7	55593
			16.00	*2.00*	*18.00*	*16.0*	
55031	Packers Boars Head Brand Soluble Phosphate	Manufacturer	11.50	1.80	13.30	11.5	55031
55595		L. G. Wilcox, Greensburg	10.60	1.10	11.70	10.6	55595
			10.00	*2.00*	*12.00*	*10.0*	
55032	Packers Boars Head Brand 12% Acid Phosphate	Manufacturer	14.10	1.90	16.00	14.1	55032
			12.00	*2.00*	*14.00*	*12.0*	

TABLE III.—ACID PHOSPHATES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.	PHOSPHORIC ACID			Index of Relative Value.	Station Number.
			Available	Insoluble	Total		
	The American Agr'l Chem. Co., Inc.						
55033	Packers Boars Head Brand Gilt Edge Phosphate	Manufacturer	16.80	2.50	19.30	16.8	55033
55637		R. J. Wilcox & Son, Greensburg	14.10	1.60	15.70	14.1	55637
			14.00	*2.00*	*16.00*	*14.0*	
55034	Packers Boars Head Brand 16% Acid Phosphate	Manufacturer	18.10	2.10	20.20	18.1	55034
			16.00	*2.00*	*18.00*	*16.0*	
	Armour Fertilizer Works, Nashville, Tenn.						
54916	Armour's High Grade Phosphate	Manufacturer	18.00	2.30	20.30	18.0	54916
55642		Barren County Grocery & Hdw. Co., Glasgow	16.70	1.60	18.30	16.7	55642
			16.00	*2.00*	*18.00*	*16.0*	
54917	Armour's Star Phosphate	Manufacturer	15.10	2.10	17.20	15.1	54917
55599		Staggs Bros. Co., Vanceburg	14.50	5.20	19.70	14.5	55599
55643		Staggs Bros. Co., Vanceburg	14.20	1.90	16.10	14.2	55643
			14.00	*2.00*	*16.00*	*14.0*	
54918	Armour's Cereal Phosphate	Manufacturer	11.40	1.90	23.30	11.4	54918
			10.00	*2.00*	*12.00*	*10.0*	
55302	Ideal Super Phosphate	Manufacturer	17.30	2.40	19.70	17.3	55302
55602		T. J. Turley Hdw. & Impl. Co., Owensboro	18.00	0.50	18.50	18.0	55602
55647		T. J. Turley Hdw. & Impl. Co., Owensboro	16.45	3.55	20.00	16.5	55647
			16.00	*2.00*	*18.00*	*16.0*	
54923	Tuscarora Phosphate	Manufacturer	12.90	2.20	15.10	12.9	54923
55603		Dickinson Bros., Glasgow	12.30	4.30	16.60	12.3	55603
			12.00	*2.00*	*14.00*	*12.0*	
54932	Tuscarora High Grade Acid Phosphate	Manufacturer	17.00	1.90	18.90	17.0	54932

54923	Tuscarora Phosphate	Manufacturer	12.90	2.20	15.10	12.9	54923
55603		Dickinson Bros., Glasgow	12.30	4.30	16.60	12.3	55603
			12.00	*2.00*	*14.00*	*12.0*	
54932	Tuscarora High Grade Acid Phosphate	Manufacturer	17.00	1.90	18.90	17.0	54932
55651		Dickinson Bros., Glasgow	16.05	2.15	18.20	16.1	55651
			16.00	*2.00*	*18.00*	*16.0*	
54933	Tuscarora Acid Phosphate	Manufacturer	14.90	3.00	17.90	14.9	54933
			14.00	*2.00*	*16.00*	*14.0*	
	The Cincinnati Phosphate Co., Cincinnati, Ohio.						
55344	Wheat Grower	*					55344
			14.00	*1.00*	*15.00*	*14.0*	
55345	Acid Phosphate	*					55345
			16.00	*1.00*	*17.00*	*16.0*	
	Duncan & Brother, Lagrange, Ky.						
55415	Tiger Brand Phosphate	*					55415
55657		Manufacturer's warehouse	16.30	0.40	16.70	16.3	55657
			16.00	*2.00*	*18.00*	*16.0*	
	The Empire Guano Co., Nashville, Tenn.						
55552	Climax Phosphate	Manufacturer	12.00	10.00	22.00	12.0	55552
			10.00	*10.00*	*20.00*	*10.0*	
55554	Acid Phosphate	Manufacturer	13.60	7.40	21.00	13.6	55554
			12.00	*6.00*	*18.00*	*12.0*	
55555	High Grade Acid Phosphate	Manufacturer	15.50	5.60	21.10	15.50	55555
			14.00	*4.00*	*18.00*	*14.0*	
55556	Climax Acid Phosphate	Manufacturer	18.10	2.10	20.20	18.1	55556
			16.00	*2.00*	*18.00*	*16.0*	
	Evansville Packing Co., Evansville, Ind.						
55427	High Grade Soluble Phosphate	Manufacturer	18.10	0.50	18.60	18.1	55427
			16.00			*16.0*	
	Federal Chemical Co., Inc., Louisville, Ky.						
55057	Half and Half Phosphate	Manufacturer	12.60	12.50	25.10	12.6	55057
55441		J. A. Hines, Joyce	9.40	15.30	24.70	9.4	55441
55664		G. W. Maraman, and Sons, Shepherdsville	10.50	16.10	26.60	10.5	55664
			10.00	*14.00*	*24.00*	*10.0*	
55058	Twenty-Four Phosphate	Manufacturer	13.40	12.20	25.60	13.4	55058
			10.00	*14.00*	*24.00*	*10.0*	
55066	Extra High Grade Phosphate	Manufacturer	19.40	1.70	21.10	19.4	55066
			18.00	*2.00*	*20.00*	*18.0*	
55079	Daybreak Star Phosphate	Manufacturer	15.20	8.90	24.10	15.2	55079
			10.00	*2.00*	*12.00*	*10.0*	
55080	Daybreak Standard Phosphate	Manufacturer	16.90	5.60	22.50	16.9	55080
			12.00	*2.00*	*14.00*	*12.0*	

* Manufacturer failed to send sample as required by law.

TABLE III.—ACID PHOSPHATES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.	PHOSPHORIC ACID: Available	Insoluble	Total	Index of Relative Value.	Station Number.
	Federal Chemical Co., Inc.						
55081	Daybreak Royal Phosphate	Manufacturer	18.30	3.30	21.60	18.3	55081
			14.00	*2.00*	*16.00*	*14.0*	
55082	Daybreak High Grade Phosphate	Manufacturer	18.90	2.50	21.40	18.9	55082
55673		St. Matthews Produce Exchange, St. Mathews	18.20	3.10	21.30	18.2	55673
55695		J. A. Shaver, Greenville	19.24	1.90	21.14	19.2	55695
			16.00	*2.00*	*18.00*	*16.0*	
55083	Daybreak Double-Twelve Phosphate	Manufacturer	14.05	10.45	24.50	14.1	55083
55674		F. S. Van Hoose & Co., Paintsville	12.30	12.60	24.90	12.3	55674
			12.00	*12.00*	*24.00*	*12.0*	
55268	Daybreak Grain-Maker Phosphate	Manufacturer	11.85	12.75	24.60	11.9	55268
55682		O. L. Railey, Glasgow	10.00	17.40	27.40	10.0	55682
			10.00	*14.00*	*24.00*	*10.0*	
55478	Daybreak Special Phosphate Mixture	Manufacturer	13.40	9.00	22.40	13.4	55478
55700		A. Tartar, Columbia	9.94	14.80	24.74	9.9	55700
			10.00	*10.00*	*20.00*	*10.0*	
55481	400 Phosphate Mixture	Manufacturer	11.20	9.00	20.10	11.2	55481
55701		F. A. Joyce, Bedford	10.84	14.50	25.34	10.8	55701
			10.00	*10.00*	*20.00*	*10.0*	
55108	1st Prize AA Phosphate	Manufacturer	14.55	8.85	23.40	14.6	55108
			10.00	*2.00*	*12.00*	*10.0*	
55109	1st Prize Standard Phosphate	Manufacturer	16.65	5.65	22.30	16.7	55109
			12.00	*2.00*	*14.00*	*12.0*	
55110	1st Prize Bone Phosphate	Manufacturer	18.15	3.15	21.30	18.2	55110
			14.00	*2.00*	*16.00*	*14.0*	
55111	1st Prize High Grade Phosphate	Manufacturer	17.05	3.55	20.60	17.1	55111
			16.00	*2.00*	*18.00*	*16.0*	
55112	Clover Leaf Phosphate	Manufacturer	13.60	10.60	24.20	13.6	55112
			12.00	*12.00*	*24.00*	*12.0*	

55110	1st Prize Bone Phosphate		*14.00*	*2.00*	*16.00*	*14.0*	
55111	1st Prize High Grade Phosphate	Manufacturer	17.05	3.55	20.60	17.1	55111
			16.00	*2.00*	*18.00*	*16.0*	
55112	Clover Leaf Phosphate	Manufacturer	13.60	10.60	24.20	13.6	55112
			12.00	*12.00*	*24.00*	*12.0*	
55269	1st Prize Sweepstakes Phosphate	Manufacturer	10.25	14.15	24.40	10.3	55269
55684		Jackson Hardware & Grocery Co., Dixon	9.70	18.00	27.70	9.7	55684
			10.00	*14.00*	*24.00*	*10.0*	
55482	1st Prize Special Phosphate Mixture	Manufacturer	12.20	10.30	22.50	12.2	55482
			10.00	*10.00*	*20.00*	*10.0*	
	Fox Chemical Co. Branch Federal Chem. Co., Inc., Louisville, Ky.						
55137	Fox AA Phosphate	Manufacturer	14.50	6.30	20.80	14.5	55137
			10.00	*2.00*	*12.00*	*10.0*	
55138	Fox Standard Acid Phosphate	Manufacturer	17.00	6.00	23.00	17.0	55138
			12.00	*2.00*	*14.00*	*12.0*	
55139	Fox Acid Phosphate	Manufacturer	15.80	4.80	20.60	15.8	55139
			14.00	*2.00*	*16.00*	*14.0*	
55140	Fox High Grade Phosphate	Manufacturer	16.90	3.30	20.20	16.9	55140
55685		Harrison Austin, Beaver Dam	18.50	3.80	22.30	18.5	55685
55707		Holloway & Co., Franklin	18.60	1.60	20.20	18.6	55707
			16.00	*2.00*	*18.00*	*16.0*	
55141	Fox Soil Builder Phosphate	Manufacturer	12.10	12.30	24.40	12.1	55141
			12.00	*12.00*	*24.00*	*12.0*	
55270	Fox Better-Phosphate	Manufacturer	10.90	13.70	24.60	10.9	55270
			10.00	*14.00*	*24.00*	*10.0*	
55486	Fox Special Phosphate Mixture	Manufacturer	12.20	10.00	22.20	12.2	55486
55710		Skaggs, Franklin & Nunn, Horse Cave	10.14	14.70	24.84	10.1	55710
			10.00	*10.00*	*20.00*	*10.0*	
	Globe Fertilizer Co., Branch Federal Chem. Co., Inc., Louisville, Ky.						
55167	Globe AA Acid Phosphate	Manufacturer	14.30	9.70	24.00	14.3	55167
			10.00	*2.00*	*12.00*	*10.0*	
55168	Globe Standard Acid Phosphate	Manufacturer	17.50	5.90	23.40	17.5	55168
			12.00	*2.00*	*14.00*	*12.0*	
55169	Globe Acid Phosphate	Manufacturer	16.70	3.10	19.80	16.7	55169
			14.00	*2.00*	*16.00*	*14.0*	
55170	Globe High Grade Phosphate	Manufacturer	16.50	3.30	19.80	16.5	55170
55713		Planters Hardware Co., Hopkinsville	16.94	4.00	20.94	16.9	55713
55724		The Jenkins-Essex Co., Elizabethtown	20.70	0.20	20.90	20.7	55724
			16.00	*2.00*	*18.00*	*16.0*	

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	Index of Relative Value.	Station Number.
	Globe Fert. Co., Br. Federal Chem. Co., Inc.						
55171	Old Cap's Phosphate	Manufacturer	14.00	10.00	24.00	14.0	55171
			12.00	*12.00*	*24.00*	*12.0*	
55271	Globe Double-Value Phosphate	Manufacturer	10.40	13.60	24.00	10.4	55271
			10.00	*14.00*	*24.00*	*10.0*	
55490	Globe Special Phosphate Mixture	Manufacturer	11.20	10.10	21.30	11.2	55490
55726		Orr & Son, Allensville	9.80	14.10	23.90	9.8	55726
			10.00	*10.00*	*20.00*	*10.0*	
	Groves Fertilizer Works, Cincinnati, Ohio.						
55219	Monarch Brand	Manufacturer	14.20	0.90	15.10	14.2	55219
55729		Troutman Bros., Shepherdsville	16.20	1.00	17.20	16.2	55729
			14.00	*1.00*	*15.00*	*14.0*	
55220	16% Acid Phosphate	Manufacturer	16.80	1.20	18.00	16.8	55220
55730		Minges Hardware Co., Newport	16.40	0.30	16.70	16.4	55730
			16.00	*1.00*	*17.00*	*16.0*	
	Hopkins Fertilizer Co., New Albany, Ind.						
55312	High Grade Acid Phosphate	Manufacturer	15.50	0.20	15.70	15.5	55312
55736		Jeffries Hardware Store, Columbia	15.50	0.90	16.40	15.5	55736
			14.00	*1.00*	*15.00*	*14.0*	
55313	Climax Acid Phosphate	Manufacturer	17.90	0.30	18.20	17.9	55313
55737		Jeffries Hardware Store, Columbia	18.50	1.20	19.70	18.5	55737
55744		Jeffries Hardware Store, Columbia	17.20	3.80	21.00	17.2	55744
			16.00	*1.00*	*17.00*	*16.0*	
	International Agricultural Corporation, Florence, Ala.						
		*					55401
55401	International Acid Phosphate	Wilson & Son, Russellville	17.80	0.20	18.00	17.8	55747
55747		Pearson & Breedlove, Franklin	17.20	0.10	17.30	17.2	55748
55748			*16.00*	*1.00*	*17.00*	*16.0*	
55403	Old Hickory High Grade Acid phate	*	*16.00*	*1.00*	*17.00*	*16.0*	55403

55747		Pearson & Breedlove, Franklin					
55748			*16.00*	*1.00*	*17.00*	*16.0*	
55403	*Old Hickory High Grade Acid phate*	*					55403
	The Jarecki Chemical Co., Cincinnati, Ohio.		*16.00*	*1.00*	*17.00*	*16.0*	
55333	C. O. D. Phosphate	*					55333
			14.00	*1.00*	*15.00*	*14.0*	
55334	Acid Phosphate	*					55334
	Jefferson Fertilizer Co., Birmingham, Ala.		*16.00*	*1.00*	*17.00*	*16.0*	
55561	Jefferson Excelsior Acid Phosphate	Manufacturer	17.70	0.10	17.80	17.7	55561
	The Kaufman Fertilizer Co., Cincinnati, Ohio.		*16.00*			*16.0*	
55356	Dissolved Phosphate	*					55356
			14.00	*1.00*	*15.00*	*14.0*	
55357	Acid Phosphate	*					55357
	Kentucky Fertilizer Co., Branch Federal Chem. Co., Inc., Louisville, Ky.		*16.00*	*1.00*	*17.00*	*16.0*	
55198	O. K. Good Luck Phosphate	Manufacturer	12.00	11.30	23.30	12.0	55198
			10.00	*2.00*	*12.00*	*10.0*	
55199	O. K. Standard Phosphate	Manufacturer	17.10	5.00	22.10	17.1	55199
			12.00	*2.00*	*14.00*	*12.0*	
55200	O. K. Phosphate	Manufacturer	20.10	1.00	21.10	20.1	55200
			14.00	*2.00*	*16.00*	*14.0*	
55201	O. K. High Grade Acid Phosphate	Manufacturer	18.80	0.20	19.00	18.8	55201
55755		I. K. Miller & Sons, Campbellsville	18.90	2.20	21.10	18.9	55755
55762		D. L. D. Sandefur, Beaver Dam	19.40	1.90	21.30	19.4	55762
			16.00	*2.00*	*18.00*	*16.0*	
55202	O. K. Twin Phosphate	Manufacturer	12.50	11.00	23.50	12.5	55202
			12.00	*12.00*	*24.00*	*12.0*	
55272	O. K. Level-Best Phosphate	Manufacturer	11.60	12.60	24.20	11.6	55272
55759		D. L. D. Sandefur, Beaver Dam	9.70	16.00	25.70	9.7	55759
			10.00	*14.00*	*24.00*	*10.0*	
55493	O. K. Special Phosphate Mixture	Manufacturer	12.00	11.30	23.30	12.0	55493
55763		T. G. Moren, London	10.50	14.10	24.60	10.5	55763
			10.00	*10.00*	*20.00*	*10.0*	

* Manufacturer failed to send sample as required by law.

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	Index of Relative Value.	Station Number.
	Louisville Fert. Co., Inc., "Armour Owned," Louisville, Ky., and Nashville, Tenn.						
54847	Eagle Excelsior Acid Phosphate	Manufacturer	18.70	2.60	21.30	18.7	54847
55767		L. Stamper, Stanton	16.80	0.90	17.70	16.8	55767
55776		C. L. Thomas Carriage & Imp. Co., Bowling Green	17.70	0.30	18.00	17.7	55776
			16.00	*2.00*	*18.00*	*16.0*	
54848	Eagle High Grade Dissolved Bone	Manufacturer	15.70	2.70	18.40	15.7	54848
55768		G. C. Lewis & Co., Krypton	16.10	1.10	17.20	16.1	55768
55777		Grigsby & Co., Bardstown	14.40	0.10	14.50	14.4	55777
			14.00	*2.00*	*16.00*	*14.0*	
54853	Eagle Phosphate	Manufacturer	13.30	3.40	16.70	13.3	54853
			12.00	*2.00*	*14.00*	*12.0*	
54864	Bear Tennessee Best Acid Phosphate	Manufacturer	18.60	2.40	21.00	18.6	54864
55786		Cohen Bros., Central City	18.05	1.95	20.00	18.1	55786
55789		Cohen Bros., Central City	17.40	1.90	19.30	17.4	55789
			16.00	*2.00*	*18.00*	*16.0*	
54865	Bear High Grade Dissolved Bone	Manufacturer	15.70	2.50	18.20	15.7	54865
55787		Wm. Leaming, Hodgenville	14.40	0.10	14.50	14.4	55787
			14.00	*2.00*	*16.00*	*14.0*	
54866	Bear Phosphate	Manufacturer	12.80	3.10	15.90	12.8	54866
55790		A. B. Beale & Sons, Murray	12.40	6.10	18.50	12.4	55790
			12.00	*2.00*	*14.00*	*12.0*	
54879	Jones' Tennessee Best Acid Phosphate	Manufacturer	18.10	2.80	20.90	18.1	54879
55793		Haselden Bros., Lancaster	17.45	0.85	18.30	17.5	55793
			16.00	*2.00*	*18.00*	*16.0*	
54880	Jones' High Grade Dissolved Bone	Manufacturer	15.50	2.50	18.00	15.5	54880
			14.00	*2.00*	*16.00*	*14.0*	
	Meridian Fertilizer Factory, Me-						

55793			*16.00*	*2.00*			
54880	Jones' High Grade Dissolved Bone	Manufacturer	15.50 *14.00*	2.50 *2.00*	18.00 *16.00*	15.5 *14.0*	54880
	Meridian Fertilizer Factory, Meridian, Miss.						
55307	Union Special Acid Phosphate	Manufacturer	16.10 *16.00*	2.10 *2.00*	18.20 *18.00*	16.1 *16.0*	55307
	Nitrate Agencies Co., Columbus, Ohio.						
55499	N. A. C. 16% Acid Phosphate	*	*16.00*	*1.00*	*17.00*	*16.0*	55499
	Rasin-Monumental Co., (Subsidiary of Va.-Car. Chem. Co., Inc.), Cincinnati, Ohio.						
55371	Rasin's 14% Acid Phosphate	Manufacturer	16.35 *14.00*	1.35 *1.50*	17.70 *15.50*	16.4 *14.0*	55371
55372	Rasin's 16% Acid Phosphate	Manufacturer	17.10	0.50	17.60	17.1	55372
55803		J. M. Sloss & Son, Franklin	18.90	0.10	19.00	18.9	55803
55816		M. Sloss, Franklin	18.10 *16.00*	0.10 *1.50*	18.20 *17.50*	18.1 *16.0*	55816
55373	Rasin's 20% Acid Phosphate	Manufacturer	22.30 *20.00*	0.40 *1.50*	22.70 *21.50*	22.3 *20.0*	55373
	Read Phosphate Co., Nashville, Tenn.						
55523	Special High Grade Acid Phosphate	Manufacturer	18.60	1.90	20.50	18.6	55523
55812		Berea College, Berea	18.70	0.30	19.00	18.7	55812
55819		Baker & Glasgow, Murray	17.10 *16.00*	2.80 *2.00*	19.90 *18.00*	17.1 *16.0*	55819
55524	High Grade Acid Phosphate	Manufacturer	15.40	5.40	20.80	15.4	55524
55813		Barren Co. Groc. & Hdw. Co., Glasgow	14.20	5.10	19.30	14.2	55813
55820		J. C. Cowherd & Co., Greensburg	13.65 *14.00*	8.35 *4.00*	22.00 *18.00*	13.7 *14.0*	55820
55525	XXX Dissolved Bone	Manufacturer	15.20	6.40	21.60	15.2	55525
55821		Baker & Glasgow, Murray	15.20 *13.00*	7.10 *5.00*	22.30 *18.00*	15.2 *13.0*	55821
55526	Matchless Acid Phosphate	Manufacturer	13.80 *12.00*	7.60 *6.00*	21.40 *18.00*	13.8 *12.0*	55526
55527	50-50 Phosphate	Manufacturer	12.50	9.70	22.20	12.5	55527
55822		Baker & Glasgow, Murray	10.50 *10.00*	12.30 *10.00*	22.80 *20.00*	10.5 *10.0*	55822
	The Smith Agricultural Chem. Co., Columbus, Ohio.						
55421	Smith's 16% Acid Phosphate	Manufacturer	15.42 *16.00*	1.08	16.50	15.4 *16.0*	55421

* Manufacturer failed to send sample as required by law.

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	Index of Relative Value.	Station Number.
	Swift & Co., Inc., National Stock Yards, Ill.						
55240	Swift's High Grade Acid Phosphate	Manufacturer	19.10	0.60	19.70	19.1	55240
55845		Holloway & Co., Franklin	16.30	0.70	17.00	16.3	55845
			16.00	*1.00*	*17.00*	*16.0*	
55241	Swift's Garden City Phosphate	Manufacturer	17.20	0.70	17.90	17.2	55241
			14.00	*1.00*	*15.00*	*14.0*	
55384	Pioneer Garden City Phosphate	Manufacturer	17.20	0.70	17.90	17.2	55384
			14.00	*1.00*	*15.00*	*14.0*	
55385	Pioneer High Grade Acid Phosphate	Manufacturer	19.10	0.60	19.70	19.1	55385
			16.00	*1.00*	*17.00*	*16.0*	
	Tennessee Chemical Co., Inc. (Armour Owned), Louisville, Ky. and Nashville, Tenn.						
54892	Ox Tennessee Best Acid Phosphate	Manufacturer	18.50	2.40	20.90	18.5	54892
55855		W. F. Grainger, Franklin	19.80	1.90	21.70	19.8	55855
55866		J. S. Duke, Crab Orchard	17.45	0.35	17.80	17.5	55866
			16.00	*2.00*	*18.00*	*16.0*	
54893	Ox High Grade Dissolved Bone	Manufacturer	15.80	2.50	18.30	15.8	54893
55867		Dickey & Martin, Munfordville	15.30	0.90	16.20	15.3	55867
			14.00	*2.00*	*16.00*	*14.0*	
54898	Ox Phosphate	Manufacturer	13.00	3.00	16.00	13.0	54898
55856		Sexton Bros., Murray	13.60	3.70	17.30	13.6	55856
55868		Sexton Bros., Murray	16.40	1.20	17.60	16.4	55868
			12.00	*2.00*	*14.00*	*12.0*	
	Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.						
55051	Duplex Basic Phosphate	Manufacturer			18.60	18.6	55051
55860		E. Young, Columbia			18.10	18.1	55860
					18.00	*18.0*	

55438	Duplex Basic Phosphate	*					55438

55051	Duplex Basic Phosphate						
55860		E. Young, Columbia			18.10	18.1	
					18.00	*18.0*	
55438	Duplex Basic Phosphate	*					55438
55861		First Ky. Dist. Supply Co., Glasgow			15.10	15.1	55861
55873		Taylor Co. Supply Co., Campbellsville			16.20	16.2	55873
					13.00	*13.0*	
55498	14% Duplex Basic Phosphate	Manufacturer			16.30	16.3	55498
					14.00	*14.00*	
	Virginia-Carolina Chem. Co., Inc., Cincinnati, Ohio.						
55358	V-C Red Cross 14%	Manufacturer	15.10	1.60	16.70	15.1	55358
55874		Grayson County Supply Co., Leitchfield	16.00	0.40	16.40	16.0	55874
			14.00	*1.50*	*15.50*	*14.0*	
55359	V-C 16% Acid Phosphate	Manufacturer	18.10	0.30	18.40	18.1	55359
55875		R. H. Chrisman, Berea	18.50	0.40	18.90	18.5	55875
55886		First Ky. Dist. Supply Co., Glasgow	18.60	1.10	19.70	18.6	55886
			16.00	*1.50*	*17.50*	*16.0*	
55360	V-C 20% Acid Phosphate	Manufacturer	22.40	0.30	22.70	22.4	55360
55887		Junction City Lumber Co., Junction City	23.50	0.10	23.60	23.5	55887
			20.00	*1.50*	*21.50*	*20.0*	
	Mt. Pleasant Branch, Va.-Car. Chem. Co., Mt. Pleasant, Tenn.						
55277	Mt. Pleasant Big Winner Acid Phosphate	*					55277
55880		Dickinson Bros., Glasgow	18.20	0.20	18.40	18.2	55880
55895		Marion Milling Co., Marion	19.80	1.80	21.60	19.8	55895
			16.00	*1.00*	*17.00*	*16.0*	
55278	Black Patch Mt. Pleasant Special Acid Phosphate	*					55278
55881		Douglas & Simmons, Richmond	10.70	10.40	21.10	10.7	55881
			14.00	*1.50*	*15.50*	*14.0*	
55279	Black Patch Mt. Pleasant Soluble Bone	*					55279
55882		Dickinson Bros., Glasgow	15.40	6.70	22.10	15.4	55882
			12.00	*1.50*	*13.50*	*12.0*	
55280	Mt. Pleasant Acid Phosphate	*					55280
55896		E. S. Diuguid & Son, Murray	12.70	10.50	23.20	12.7	55896
			10.00	*2.00*	*12.00*	*10.0*	

* Manufacturer failed to send sample as required by law.

Table IV.—Acid Phosphates with Potash.

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.	Index of Relative Value.	Station Number.
	The American Agrl. Chem Co., Inc., Cin. Sales Dept., Cincinnati, Ohio.								
54958	Bowker's Acid Phosphate with Potash	Manufacturer	12.75	0.85	13.60	0.64	0.77	17.2	54958
55617		S. McKinley, Columbia	12.70	0.80	13.50	0.72	0.52	16.9	55617
			12.00	*2.00*	*14.00*	*1.00*		*16.2*	
54976	Bradley's Acid Phosphate with Potash	Manufacturer	12.90	1.00	13.90	0.58	0.55	17.1	54976
			12.00	*2.00*	*14.00*	*1.00*		*16.2*	
54994	Cleveland Dryer Wks. Acid Phosphate with Potash	Manufacturer	12.70	0.80	13.50	0.62	0.51	16.8	54994
			12.00	*2.00*	*14.00*	*1.00*		*16.2*	
55012	Michigan Carbon Wks. Acid Phosphate with Potash	Manufacturer	12.90	0.90	13.80	0.68	0.44	17.1	55012
55631		J. R. Davis & Bro., Campbellsville	12.85	1.20	14.05	0.66	0.46	17.1	55631
			12.00	*2.00*	*14.00*	*1.00*		*16.2*	
55030	N-W Horse Shoe Brand Acid Phosphate with Potash	Manufacturer	12.20	1.20	13.40	0.64	0.47	16.3	55030
			12.00	*2.00*	*14.00*	*1.00*		*16.2*	
55048	Packers Boar's Head Brand Acid Phosphate with Potash	Manufacturer	12.60	1.00	13.60	1.01		16.5	55048
			12.00	*2.00*	*14.00*	*1.00*		*16.2*	
	Armour Fertilizer Works, Nashville, Tenn.								
55446	Armour's Kentucky Wheat Special	Manufacturer	9.95	5.05	15.00	2.06		16.0	55446
			10.00	*4.00*	*14.00*	*2.00*		*15.6*	
55449	Armour's Potash Mixture	Manufacturer	11.50	4.40	15.90	1.36		16.9	55449
55648		Barren Co. Groc. & Hdw. Co., Glasgow	14.20	3.00	17.20	0.68		18.9	55648
			12.00	*4.00*	*16.00*	*1.00*		*17.0*	
55453	Tuscarora Kentucky Wheat Special	Manufacturer	11.30	4.30	15.60	0.72	1.37	17.6	55453
			10.00	*4.00*	*14.00*	*2.00*		*15.6*	

55453	Tuscarora Kentucky Wheat Special	Manufacturer	11.30 *10.00*	4.30 *4.00*	15.60 *14.00*	0.72 *2.00*	1.37	17.6 *15.6*	55453
	Calumet Fertilizer Co., Inc., New Albany, Ind.								
55565	Calumet Brand Special Dissolved Bone and Potash	Manufacturer	14.40 *13.00*	0.90 *1.50*	15.30 *14.50*	0.54 *1.00*	0.59	18.9 *17.2*	55565
	The Empire Guano Co., Nashville, Tenn.								
55551	Bone and Potash	Manufacturer	15.20 *10.00*	4.30 *6.00*	19.50 *16.00*	2.15	 *2.00*	22.1 *16.8*	55551
55553	Climax Potash Mixture	*	*11.00*	*5.00*	*16.00*		*1.00*	*16.4*	55553
	Federal Chemical Co., Inc., Louisville, Ky.								
55063	Potash Tobacco Grower	Manufacturer	10.90	11.50	22.40	0.52	2.47	21.2	55063
55667		Bedford & Tuttle, Winchester	7.90 *8.00*	9.70 *8.00*	17.60 *16.00*	1.08	1.77 *3.00*	16.6 *16.4*	55667
55094	Daybreak Double Phosphate and Potash	Manufacturer	13.65 *10.00*	9.95 *10.00*	23.60 *20.00*		1.61 *1.00*	22.3 *17.2*	55094
55095	Daybreak Champion Potash Fertilizer	Manufacturer	11.95 *8.00*	13.05 *8.00*	25.00 *16.00*		1.87 *2.00*	26.1 *15.2*	55095
55096	Imperial Tobacco Special	Manufacturer	11.65	12.95	24.60		2.75	22.5	55096
55680		Fordsville Planing Mill Co., Fordsville	8.10 *8.00*	9.30 *8.00*	17.40 *16.00*	0.54	1.03 *2.00*	15.2 *15.2*	55680
55476	Daybreak Potash Special	Manufacturer	14.60	6.80	21.40	2.83		23.1	55476
55699		McGlothlan & Son, Irvington	10.80 *10.00*	1.80 *2.00*	12.60 *12.00*	0.80	1.33 *2.00*	16.1 *15.2*	55699
55477	Daybreak Phosphate and Potash	Manufacturer	15.60 *12.00*	3.60 *2.00*	19.20 *14.00*	2.80	 *2.00*	23.0 *17.6*	55477
55479	Potash Special	Manufacturer	13.30 *10.00*	7.50 *2.00*	20.80 *12.00*	2.12	 *2.00*	21.1 *15.2*	55479
55480	Potash Compound	Manufacturer	16.05 *12.00*	3.55 *2.00*	19.60 *14.00*	2.61	 *2.00*	23.3 *17.6*	55480
55121	1st Prize Double Phosphate and Potash	Manufacturer	12.50 *10.00*	10.50 *10.00*	23.00 *20.00*	0.50	1.08 *1.00*	21.0 *17.2*	55121
55122	Mogul Potash Fertilizer	Manufacturer	11.15 *8.00*	12.80 *8.00*	24.30 *16.00*	0.52	1.40 *2.00*	20.7 *15.2*	55122
55123	Union Tobacco Special	Manufacturer	11.00 *8.00*	12.80 *8.00*	23.80 *16.00*	0.54	1.46 *2.00*	20.6 *15.2*	55123

* Manufacturer failed to send sample as required by law.

Table IV.—Acid Phosphates with Potash.

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.	Index of Relative Value.	Station Number.
	Fox Chemical Co. Branch Federal Chem. Co., Inc., Louisville, Ky.								
55151	Fox Double Phosphate and Potash	Manufacturer	13.00	9.20	22.20		1.83	21.5	55151
			10.00	*10.00*	*20.00*		*1.00*	*17.2*	
55152	Fox Ideal Potash Fertilizer	Manufacturer	10.80	13.00	23.80	0.70	1.29	20.4	55152
			8.00	*8.00*	*16.00*		*2.00*	*15.2*	
55153	Sterling Tobacco Special	Manufacturer	11.20	12.00	23.20	0.66	1.14	20.3	55153
			8.00	*8.00*	*16.00*		*2.00*	*15.2*	
55484	Fox Potash Special	Manufacturer	13.30	7.50	20.80	2.15		21.1	55484
			10.00	*2.00*	*12.00*		*2.00*	*15.2*	
55485	Fox Bone Phosphate	Manufacturer	15.80	3.80	19.60	2.70		23.2	55485
			12.00	*2.00*	*14.00*		*2.00*	*17.6*	
	Globe Fertilizer Co., Branch Federal Chem. Co., Inc., Louisville, Ky.								
55182	Globe Double Phosphate and Potash	Manufacturer	13.90	10.70	24.60	0.58	0.75	22.4	55182
			10.00	*10.00*	*20.00*		*1.00*	*17.2*	
55183	Globe Tip Top Potash Fertilizer	Manufacturer	8.80	13.00	21.80	0.60	1.26	17.9	55183
			8.00	*8.00*	*16.00*		*2.00*	*15.2*	
55184	Globe Top Notch Tobacco Special	Manufacturer	8.30	12.70	21.00	0.54	1.26	17.1	55184
			8.00	*8.00*	*16.00*		*2.00*	*15.2*	
55488	Globe Potash Special	Manufacturer	13.70	6.70	20.40	1.84	0.76	21.9	55488
			10.00	*2.00*	*12.00*		*2.00*	*15.2*	
55489	Globe Potash Compound	Manufacturer	13.00	5.60	18.60	2.68		20.5	55489
			12.00	*2.00*	*14.00*		*2.00*	*17.6*	
	Kentucky Fert. Co., Branch Federal Chem. Co., Inc., Louisville, Ky.								
55212	O. K. Double Phosphate and Potash	Manufacturer	11.60	10.00	21.60		1.11	19.3	55212
			10.00	*10.00*	*20.00*		*1.00*	*17.2*	
55213	O. K. Gold Medal Potash Fertilizer	Manufacturer	9.70	13.50	23.20	0.52	1.08	18.9	55213
			8.00	*8.00*	*16.00*		*2.00*	*15.2*	

55213	Potash O. K. Gold Medal Potash Fertilizer	Manufacturer	9.70 *8.00*	13.50 *8.00*	23.20 *16.00*	0.52	1.08 *2.00*	18.9 *15.2*	55213
55214	Gold Medal Tobacco Special	Manufacturer	10.50	13.30	23.80		1.62	18.9	55214
55758		I. K. Miller & Sons, Campbellsville	7.90 *8.00*	14.50 *8.00*	22.40 *16.00*	0.60	1.03 *2.00*	17.0 *15.2*	55758
55492	O. K. Potash Special **Louisville Fertilizer Co. Inc., "Armour Owned," Louisville, Ky. and Nashville, Tenn.**	Manufacturer	13.10 *10.00*	7.30 *2.00*	20.40 *12.00*	2.45	 *2.00*	21.1 *15.2*	55492
55461	Eagle Ky. Wheat Special	Manufacturer	11.60 *10.00*	4.40 *2.00*	16.00 *12.00*		2.01 *2.00*	18.1 *15.2*	55461
55502	Eagle Ky. Wheat Special	Manufacturer	12.70 *10.00*	0.40 *4.00*	13.10 *14.00*		2.54 *2.00*	18.5 *16.0*	55502
55468	Bear Ky. Wheat Special **Read Phosphate Co., Nashville, Tenn.**	Manufacturer	10.60 *10.00*	4.60 *4.00*	15.20 *14.00*	0.52	1.24 *2.00*	16.6 *16.0*	55468
55521	Standard Potash Acid	*							55521
55810		U. L. Antle, Columbia	10.85 *11.00*	7.05 *5.00*	17.90 *16.00*	1.55 *1.00*		17.4 *16.2*	55810
55522	Alkaline Bone	Manufacturer	15.70	4.00	19.70	0.74	1.21	22.6	55522
55811	**Tennessee Chem. Co., Inc., "Armour Owned," Louisville, Ky. and Nashville, Tenn.**	J. C. Dunavent, Eminence	12.40 *10.00*	7.60 *6.00*	20.00 *16.00*	1.91 *2.00*		19.8 *16.4*	55811
55473	Ox McChesney's Special	Manufacturer	12.60	4.00	16.60		1.28	18.3	55473
55872		N. Wood, Trenton	13.55 *12.00*	4.05 *4.00*	17.60 *16.00*	0.61	 *1.00*	18.5 *17.2*	55872
55474	Ox Kentucky Wheat Special **Wood Stubbs & Co., Inc., Louisville, Ky.**	Manufacturer	11.45 *10.00*	4.15 *4.00*	15.60 *14.00*	0.52	1.45 *2.00*	17.7 *16.0*	55474
55258	Acme Potash Fertilizer	Manufacturer	10.80 *8.00*	13.20 *8.00*	24.00 *16.00*		1.75 *2.00*	20.3 *15.2*	55258

* Manufacturer failed to send sample as **required by law.**

TABLE V.

Station Number	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The American Agri. Chem. Co., Inc., Cin. Sales Dept., Cincinnati, Ohio.	
54938	A. A. C. Special Tobacco Grower	Manufacturer
55571		T. J. Hook, Hardinsburg
55607		J. B. Hatcher, Glasgow Junction
54939	A. A. C. Potato and Tobacco Special	Manufacturer
55572		St. Matthews Produce Exchange, St. Matthews
55608		S. E. Bridwell, Shepherdsville
54940	A. A. C. Little Wonder	Manufacturer
55573		V. D. Roberts, Somerset
55609		Skaggs, Franklin & Nunn, Horse Cave
54945	Bowker's 1-10 Ammoniated Acid Phosphate	Manufacturer
55576		Chas. Thacker, Franklin
55613		Chas. Thacker, Franklin
54946	Bowker's 2-10 Ammoniated Acid Phosphate	Manufacturer
54947	Bowker's 3-10 Ammoniated Acid Phosphate	Manufacturer
54948	Bowker's 2-12 Ammoniated Acid Phosphate	Manufacturer
55614		S. E. Bridwell & Son, Shepherdsville
54963	Bradley's 1-10 Ammoniated Acid Phosphate	Manufacturer
54964	Bradley's 2-10 Ammoniated Acid Phosphate	Manufacturer
54965	Bradley's 3-10 Ammoniated Acid Phosphate	Manufacturer
54966	Bradley's 2-12 Ammoniated Acid Phosphate	Manufacturer
54981	Cleveland Dryer Wks. 1-10 Ammoniated Acid Phosphate	Manufacturer
54982	Cleveland Dryer Wks. 2-10 Ammoniated Acid Phosphate	Manufacturer
54983	Cleveland Dryer Wks. 3-10 Ammoniated Acid Phosphate	Manufacturer

Acid Phosphates with Nitrogen.

PHOSPHORIC ACID			NITROGEN				Equivalent to Ammonia.	Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.			
11.60	5.20	16.80		0.87	0.86	1.73	2.10	22.1	54938
10.25	2.65	12.90		0.22	1.41	1.63	1.98	19.1	55571
12.10	0.40	12.50		0.81	0.93	1.74	2.11	20.8	55607
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
12.60	5.00	17.60		0.70	1.77	2.47	3.00	25.8	54939
11.40	4.80	16.20		1.01	1.55	2.56	3.11	24.6	55572
11.50	1.40	12.90		1.01	1.56	2.57	3.12	23.4	55608
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*22.3*	
12.30	4.40	16.70				0.58	0.70	18.6	54940
10.50	1.10	11.60				0.59	0.72	15.1	55573
11.20	0.60	11.80			0.58	0.58	0.70	15.7	55609
10.00	*4.00*	*14.00*				*0.41*	*0.50*	*15.0*	
12.40	4.00	16.40				0.92	1.12	19.7	54945
10.70	0.20	10.90	0.24	0.48	0.41	1.13	1.37	16.9	55576
10.60	0.30	10.90		0.31	0.72	1.03	1.25	16.5	55613
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*16.5*	
11.10	4.60	15.70		0.80	1.04	1.84	2.23	21.6	54946
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
12.50	4.20	16.70		1.02	1.68	2.70	3.28	26.1	54947
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*22.3*	
14.30	5.00	19.30		0.63	1.07	1.80	2.19	25.5	54948
13.70	1.30	15.00		0.90	0.97	1.87	2.27	23.5	55614
12.00	*4.00*	*16.00*				*1.65*	*2.00*	*21.8*	
12.25	4.25	16.50				0.88	1.07	19.5	54963
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*16.5*	
11.55	5.00	16.55		0.84	0.83	1.67	2.03	21.7	54964
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
12.45	3.80	16.25		0.88	1.59	2.47	3.00	25.1	54965
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*22.3*	
14.90	5.50	20.40		0.65	1.23	1.88	2.28	26.7	54966
12.00	*4.00*	*16.00*				*1.65*	*2.00*	*21.8*	
12.70	3.30	16.00				0.75	0.91	19.2	54981
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*16.5*	
11.30	4.80	16.10		0.74	1.14	1.83	2.28	22.1	54982
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
12.10	4.60	16.70		0.93	1.78	2.71	3.29	25.9	54983
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*22.3*	

TABLE V.

Station Number	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The American Agr'l Chem. Co., Inc.	
54984	Cleveland Dryer Wks. 2-12 Ammoniated Acid Phosphate	Manufacturer
55618		Taylor County Supply Co., Campbellsville
54999	Michigan Carbon Wks. 1-10 Ammoniated Acid Phosphate	Manufacturer
55584		W. M. Wilson, Campbellsburg
55624		K. C. Mason, Adairville
55000	Michigan Carbon Wks. 2-10 Ammoniated Acid Phosphate	Manufacturer
55625		G. W. Miller, Elkton
55001	Michigan Carbon Wks. 3-10 Ammoniated Acid Phosphate	Manufacturer
55585		E. P. Barnes & Bro., Beaver Dam
55002	Michigan Carbon Wks. 2-12 Ammoniated Acid Phosphate	Manufacturer
55017	N. W. Horse Shoe Brand 1-10 Ammoniated Acid Phosphate	Manufacturer
55594		V. D. Roberts, Somerset
55633		V. D. Roberts, Somerset
55018	N. W. Horse Shoe Brand 2-10 Ammoniated Acid Phosphate	Manufacturer
55019	N. W. Horse Shoe Brand 3-10 Ammoniated Acid Phosphate	Manufacturer
55020	N. W. Horse Shoe Brand 2-12 Ammoniated Acid Phosphate	Manufacturer
55035	Packers Boar's Head Brand 1-10 Ammoniated Acid Phosphate	Manufacturer
55036	Packers Boar's Head Brand 2-10 Ammoniated Acid Phosphate	Manufacturer
55037	Packers Boar's Head Brand 3-10 Ammoniated Acid Phosphate	Manufacturer
55038	Packers Boar's Head Brand 2-12 Ammoniated Acid Phosphate.	Manufacturer
	Armour Fertilizer Works, Nashville, Tenn.	
54907	Armour's Ammoniated Mixture	Manufacturer
55638		G. P. Heath, Bedford

ACID PHOSPHATES WITH NITROGEN.

PHOSPHORIC ACID			NITROGEN				Equivalent to Ammonia.	Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.			
14.70	5.40	20.10		0.58	1.36	1.94	2.36	26.6	54984
12.70	1.10	13.80		0.69	0.95	1.64	1.99	21.4	55618
12.00	*4.00*	*16.00*				*1.65*	*2.00*	*21.8*	
12.30	3.80	16.10				1.23	1.49	20.6	54999
10.90	1.90	12.80		0.27	0.75	1.02	1.24	17.4	55584
12.55	0.60	13.15		0.44	0.63	1.07	1.30	19.1	55624
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*16.5*	
11.60	4.90	16.50		0.84	1.05	1.89	2.29	22.5	55000
13.00	0.70	13.70		1.12	0.74	1.86	2.26	22.4	55625
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
12.30	4.50	16.80		0.74	1.98	2.72	3.30	26.1	55001
11.70	5.10	16.80		1.08	1.44	2.52	3.06	24.9	55585
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*22.3*	
14.50	5.20	19.70		0.70	1.17	1.87	2.27	26.0	55002
12.00	*4.00*	*16.00*				*1.65*	*2.00*	*21.8*	
12.50	3.80	16.30				1.00	1.21	20.0	55017
10.30	2.00	12.30		0.34	0.61	0.95	1.15	16.5	55594
12.30	0.70	13.00		0.42	0.69	1.11	1.35	18.9	55633
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*16.5*	
11.40	4.70	16.10		0.70	1.10	1.80	2.19	21.9	55018
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
11.60	4.60	16.20		0.84	1.67	2.51	3.05	24.6	55019
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*22.3*	
14.40	5.10	19.50		0.74	1.10	1.84	2.23	25.8	55020
12.00	*4.00*	*16.00*				*1.65*	*2.00*	*21.8*	
12.30	3.70	16.00				0.96	1.17	19.6	55035
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*16.5*	
11.40	5.00	16.40		0.83	0.93	1.76	2.14	21.8	55036
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
12.20	5.10	17.30		0.76	1.79	2.55	3.10	25.6	55037
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*22.3*	
14.60	5.20	19.80		0.70	1.05	1.75	2.12	25.7	55038
12.00	*4.00*	*16.00*				*1.65*	*2.00*	*21.8*	
14.90	3.80	18.70				0.51	0.62	21.2	54907
13.70	2.80	16.50				0.42	0.51	19.0	55638
14.00	*4.00*	*18.00*				*0.41*	*0.50*	*19.8*	

TABLE V.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Armour Fertilizer Works.	
54910	Miller's Wheat and Tobacco Special	Manufacturer
54911	Armour's Potato Grower	Manufacturer
54912	Armour's Phosphate and Tankage	Manufacturer
55597		Simpson County Hardware Co., Franklin
55640		J. B. Hatcher, Glasgow Junction
55301	Ideal Corn Grower	Manufacturer
55304	Miller's High Grade Tobacco Grower	Manufacturer
54925	Tuscarora Ammoniated Acid	Manufacturer
54929	Tuscarora Acid and Ammonia	Manufacturer
55605		Dickinson Bros., Glasgow
	The Cincinnati Phosphate Co., Cincinnati, Ohio.	
55341	Bone and Phosphate Mixture Wheat Special	*
55342	Ammoniated Super Phosphate	*
55343	Favorite Grain Grower	*
55347	Bonus A Humus Phosphate	*
	Duncan & Bro., LaGrange, Ky.	
55407	Tiger Brand Corn and Wheat Grower	*
55652		Manufacturer's warehouse
55655		Manufacturer's warehouse
55408	Tiger Brand Phosphate and Tankage	*
55653		Manufacturer's warehouse
55656		L. D. Harrison, Crestwood
	The Empire Guano Co., Nashville, Tenn.	
55546	Red Banner Favorite	Manufacturer
55547	Premium Formula	Manufacturer
55549	Ammoniated Phosphate	*

* Manufacturer failed to send sample as required by law.

Acid Phosphates with Nitrogen.

PHOSPHORIC ACID			NITROGEN				Equivalent to Ammonia.	Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.			
13.10	4.20	17.30				0.48	0.58	19.1	54910
12.00	*4.00*	*16.00*				*0.41*	*0.50*	*17.4*	
11.20	3.90	15.10				2.56	3.11	24.0	54911
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*22.3*	
10.90	4.05	14.95				1.85	2.25	21.2	54912
10.30	1.80	**12.10**				1.51	1.83	18.4	55597
11.60	2.40	14.00				1.43	1.74	19.9	55640
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
10.80	3.70	14.50				1.77	2.15	20.6	55301
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
13.10	3.60	16.70				0.53	0.64	19.0	55304
12.00	*4.00*	*16.00*				*0.41*	*0.50*	*17.4*	
11.20	4.10	15.30				1.69	2.05	21.0	54925
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
14.20	4.10	18.30				0.56	0.68	20.6	54929
14.10	1.50	**15.60**				0.39	0.47	18.9	55605
14.00	*4.00*	*18.00*				*0.41*	*0.50*	*19.8*	
									55341
8.00	*8.00*	*16.00*				*1.65*	*2.00*	*18.6*	
									55342
12.00	*1.00*	*13.00*				*1.65*	*2.00*	*20.6*	
									55343
10.00	*1.00*	*11.00*				*0.82*	*1.00*	*15.3*	
									55347
12.00	*1.00*	*13.00*				*0.41*	*0.50*	*16.2*	
									55407
9.60	1.70	**11.30**				0.50	0.61	14.0	55652
10.60	2.60	13.20				0.41	0.50	15.2	55655
10.00	*4.00*	*14.00*				*0.41*	*0.50*	*15.0*	
									55408
12.55	1.25	13.80	0.32		0.64	0.96	1.17	18.9	55653
12.00	3.50	15.50				0.82	1.00	18.7	55656
12.00	*3.00*	*15.00*				*0.82*	*1.00*	*18.5*	
13.50	4.30	17.80		0.76	1.63	2.39	2.90	26.3	55546
12.00	*5.00*	*17.00*				*1.65*	*2.00*	*22.2*	
16.20	4.40	20.60		0.34	0.67	1.01	1.23	24.7	55547
13.00	*7.00*	*20.00*				*0.41*	*0.50*	*19.8*	
									55549
10.00	*7.00*	*17.00*				*1.65*	*2.00*	*20.6*	

TABLE V.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Empire Guano Co.	
55550	High Grade Grain Grower	Manufacturer
55560	Corn Grower	*
	Evansville Packing Co., Evansville, Ind.	
55435	Wonder Growth	Manufacturer
55660		Dallas Rector, Dunmor
	Federal Chemical Co., Inc., Louisville, Ky.	
55055	A-1 Corn and Wheat Fertilizer	Manufacturer
55663		J. L. Shadoan & Co., Frazer
55687		T. G. Moren, London
55056	High Grade Fertilizer	Manufacturer
55688		M. G. Parman, London
55059	High Grade Ammoniated Mixture	Manufacturer
55665		Hiner & Stricklett, Vanceburg
55060	Clay Land Corn and Wheat Grower	Manufacturer
55666		D. B. Shackelford & Co., Richmond
55061	Standard Meal Mixture	Manufacturer
55689		D. L. D. Sandefur, Beaver Dam
55064	A-1 Potato Grower	Manufacturer
55668		St. Matthews Produce Exchange, St. Matthews
55690		St. Matthews Produce Exchange, St. Matthews
55065	A-1 Extra Tobacco Special	Manufacturer
55077	Daybreak Nitro-Phosphate	Manufacturer
55672		Birk & Price Co., Owensboro
55694		J. A. Shaver, Greenville
55078	Vegetable Grower	Manufacturer
55084	Staff-O-Life Fertilizer	Manufacturer
55675		I. K. Miller & Sons, Campbellsville
55085	Daybreak King Crop Grower	Manufacturer
55676		G. W. Maraman & Sons, Shepherdsville

* Manufacturer failed to send sample as required by law.

Acid Phosphates with Nitrogen.

Phosphoric Acid			Nitrogen				Equivalent to Ammonia.	Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.			
14.20	5.20	19.40		0.45	1.05	1.50	1.82	24.4	55550
13.00	*5.00*	*18.00*				*0.82*	*1.00*	*20.5*	
									55560
9.00	*8.00*	*17.00*				*0.41*	*0.50*	*15.4*	
16.90	0.40	17.30				1.85	2.25	26.9	55435
10.10	2.50	12.60				2.16	2.62	20.7	55660
10.00						*1.65*	*2.00*	*17.8*	
17.55	1.55	19.10				1.75	2.12	27.8	55055
13.60	0.20	13.80		0.41	0.54	0.95	1.15	19.7	55663
15.60	1.00	16.60				0.85	1.03	22.1	55687
14.00	*4.00*	*18.00*				*0.82*	*1.00*	*21.3*	
18.10	1.20	19.30				2.68	3.25	31.6	55056
13.40	2.50	15.90		0.93	0.69	1.62	1.97	22.8	55688
12.00	*4.00*	*16.00*				*1.65*	*2.00*	*21.8*	
12.20	11.80	24.00				1.18	1.43	23.5	55059
9.90	12.60	22.50			0.57	0.57	0.69	18.9	55665
10.00	*12.00*	*22.00*				*0.41*	*0.50*	*18.2*	
11.25	11.65	22.90				1.80	2.19	24.5	55060
7.20	16.20	23.40				0.78	0.95	17.9	55666
8.00	*12.00*	*20.00*				*0.82*	*1.00*	*17.3*	
13.65	9.65	23.30				1.44	1.75	25.3	55061
9.50	13.50	23.00		0.21	0.99	1.20	1.46	21.0	55689
10.00	*10.00*	*20.00*				*0.82*	*1.00*	*18.9*	
14.20	4.80	19.00				3.84	4.66	32.4	55064
10.90	3.30	14.20	1.84	1.43	0.23	3.50	4.25	26.7	55668
11.00	0.90	11.90			3.35	3.35	4.07	25.3	55690
10.00						*3.29*	*4.00*	*23.5*	
11.60	7.80	19.40				3.81	4.63	30.4	55065
10.00	*4.00*	*14.00*				*3.29*	*4.00*	*25.1*	
15.20	4.00	19.20		1.21		1.21	1.47	24.1	55077
16.40	3.60	20.00				0.70	0.85	23.6	55672
18.57	1.60	20.17		0.25	0.35	0.60	0.73	25.0	55694
15.00	*4.00*	*19.00*				*0.41*	*0.50*	*21.0*	
12.80	6.20	19.00				2.51	3.05	26.6	55078
12.50	*4.00*	*16.50*				*2.06*	*2.50*	*23.8*	
11.30	13.00	24.30				1.09	1.32	22.6	55084
9.50	17.70	27.20				0.57	0.69	20.5	55675
10.00	*12.00*	*22.00*				*0.41*	*0.50*	*18.2*	
10.80	13.00	23.80				1.35	1.64	22.9	55085
7.40	13.70	21.10				0.95	1.15	17.7	55676
8.00	*12.00*	*20.00*				*0.82*	*1.00*	*17.3*	

TABLE V.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Federal Chemical Co., Inc.	
55086	Royal Meal Mixture	Manufacturer
55087	Standard Truck and Tobacco Grower	Manufacturer
55677		G. W. Maraman & Sons, Shepherdsville
55088	Daybreak Double-Duty Corn and Wheat Grower	Manufacturer
55696		McGlothlan & Son, Irvington
55089	Daybreak Half and Half Meal Mixture	Manufacturer
55697		C. C. Hale, London
55273	Standard Beef, Blood and Bone	Manufacturer
55698		Grayson County Supply Co., Leitchfield
55494	Liberty Grain Grower	Manufacturer
55702		J. B. Benjamin, Providence
55106	1st Prize Ammoniated Bone Phosphate	Manufacturer
55703		C. L. Jewell, Horse Cave
55107	1st Prize Truck Grower	Manufacturer
55113	1st Prize Fertilizer King	Manufacturer
55114	Blue Ribbon Truck and Tobacco Grower	Manufacturer
55683		Marson, Wooten & Pelston, Columbia
55115	Sweepstakes Corn and Wheat Grower	Manufacturer
55116	Blue Ribbon Meal Mixture	Manufacturer
	Fox Chem. Co., Branch Federal Chem. Co. Inc., Louisville, Ky.	
55135	Fox Ammoniated Phosphate	Manufacturer
55706		Skaggs, Franklin & Nunn, Horse Cave
55136	Fox Vegetable Grower	Manufacturer

ACID PHOSPHATES WITH NITROGEN.

PHOSPHORIC ACID			NITROGEN				Equivalent to Ammonia.	Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.			
12.30	9.90	22.20				1.47	1.78	23.9	55086
10.00	*10.00*	*20.00*				*0.82*	*1.00*	*18.9*	
12.80	9.80	22.60				1.48	1.80	24.5	55087
9.50	13.60	23.10				0.97	1.18	20.2	55677
10.00	*10.00*	*20.00*				*0.82*	*1.00*	*18.9*	
13.80	8.60	22.40				1.45	1.76	25.1	55088
11.34	11.20	22.54			0.97	0.97	1.18	21.5	55696
10.00	*10.00*	*20.00*				*0.82*	*1.00*	*18.9*	
13.10	8.50	21.60				1.83	2.22	25.5	55089
11.80	9.80	21.60		0.69	0.74	1.43	1.74	23.1	55697
10.00	*10.00*	*20.00*				*1.65*	*2.00*	*21.8*	
12.85	10.65	23.50		1.42		1.42	1.72	24.7	55273
10.00	12.20	22.20				1.28	1.55	21.4	55698
10.00	*10.00*	*20.00*				*0.82*	*1.00*	*18.9*	
11.40	10.40	21.80		1.64		1.64	1.99	23.6	55494
11.60	13.00	24.60				0.67	0.81	21.5	55702
10.00	*10.00*	*20.00*				*0.41*	*0.50*	*17.4*	
15.20	5.00	20.20				1.25	1.52	24.6	55106
17.47	0.20	17.67		0.21	0.38	0.59	0.72	23.1	55703
15.00	*4.00*	*19.00*				*0.41*	*0.50*	*21.0*	
15.00	4.30	19.30		2.32	0.30	2.62	3.18	28.9	55107
12.50	*4.00*	*16.50*				*2.06*	*2.50*	*23.8*	
12.40	12.10	24.50		1.11	0.37	1.48	1.80	24.9	55113
8.00	*12.00*	*20.00*				*0.82*	*1.00*	*17.3*	
12.40	10.10	22.50		1.17	0.23	1.40	1.70	23.8	55114
9.40	12.40	21.80				0.92	1.12	19.5	55683
10.00	*10.00*	*20.00*				*0.82*	*1.00*	*18.9*	
12.80	10.80	23.60		1.12	0.35	1.47	1.78	24.8	55115
10.00	*10.00*	*20.00*				*0.82*	*1.00*	*18.9*	
11.95	9.45	21.40		2.00		2.00	2.43	25.1	55116
10.00	*10.00*	*20.00*				*1.65*	*2.00*	*21.8*	
15.30	4.70	20.00		1.24		1.24	1.51	24.6	55135
15.64	0.20	15.84				0.52	0.63	20.7	55706
15.00	*4.00*	*19.00*				*0.41*	*0.50*	*21.0*	
13.50	4.90	18.40		2.50		2.50	3.04	26.9	55136
12.50	*4.00*	*16.50*				*2.06*	*2.50*	*23.8*	

TABLE V.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Fox Chemical Co.	
55142	World Feeder Fertilizer	Manufacturer
55143	Fox King Mixture	Manufacturer
55144	Early Harvest Truck and Tobacco Grower	Manufacturer
55145	Fox Double-Quick Corn and Wheat Grower	Manufacturer
55708		Harrison Austin, Beaver Dam
55146	Fox Half and Half Meal Mixture	Manufacturer
	Globe Fertilizer Co., Branch Federal Chem. Co., Inc., Louisville, Ky.	
55165	Globe Grain-O-Phosphate	Manufacturer
55712		Pearson & Breedlove, Franklin
55166	Globe Soluble Vegetable Manure	Manufacturer
55172	Front Rank Fertilizer	Manufacturer
55173	Globe King Fertilizer	Manufacturer
55714		M. J. Yopp Seed Co., Paducah
55174	Globe Good Luck Meal Mixture	Manufacturer
55175	Big 4 Truck and Tobacco Grower	Manufacturer
55715		Planters Hardware Co., Hopkinsville
55176	Globe Double-Value Corn and Wheat Grower	Manufacturer
55725		C. L. and F. F. Dudley, Flemingsburg
55177	Globe Half and Half Meal Mixture	Manufacturer
	Groves Fertilizer Works Cincinnati, Ohio.	
55218	Perfect Driller	Manufacturer
55728		Troutman Bros., Shepherdsville
55223	Ammoniated Phosphate	Manufacturer
55224	Grain Grower	Manufacturer
55721		I. K. Miller & Sons, Campbellsville

Acid Phosphates with Nitrogen.

PHOSPHORIC ACID			NITROGEN				Equivalent to Ammonia.	Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.			
11.70	12.40	24.10				1.14	1.38	23.0	55142
10.00	*12.00*	*22.00*				*0.41*	*0.50*	*18.2*	
11.40	12.00	23.40				1.43	1.74	23.5	55143
8.00	*12.00*	*20.00*				*0.82*	*1.00*	*17.3*	
11.55	10.85	22.40		1.33	0.28	1.61	1.95	23.8	55144
10.00	*10.00*	*20.00*				*0.82*	*1.00*	*18.9*	
12.20	10.60	22.80		1.18	0.25	1.43	1.74	23.9	55145
8.70	14.30	23.00		0.20	0.88	1.08	1.31	19.9	55708
10.00	*10.00*	*20.00*				*0.82*	*1.00*	*18.9*	
11.40	10.20	21.60				1.92	2.33	24.5	55146
10.00	*10.00*	*20.00*				*1.65*	*2.00*	*21.8*	
15.40	4.00	19.40		1.00	0.25	1.25	1.52	24.5	55165
15.54	2.20	17.74				0.47	0.57	21.2	55712
15.00	*4.00*	*19.00*				*0.41*	*0.50*	*21.0*	
13.10	5.30	18.40		2.47	0.20	2.67	3.24	27.2	55166
12.50	*4.00*	*16.50*				*2.06*	*2.50*	*23.8*	
11.20	12.40	23.60				1.15	1.40	22.4	55172
10.00	*12.00*	*22.00*				*0.41*	*0.50*	*18.2*	
10.00	13.80	23.80				1.32	1.60	22.1	55173
7.90	14.00	21.90	0.21		0.96	1.17	1.42	19.2	55714
8.00	*12.00*	*20.00*				*0.82*	*1.00*	*17.3*	
12.80	9.60	22.40		1.01	0.38	1.39	1.69	24.1	55174
10.00	*10.00*	*20.00*				*0.82*	*1.00*	*18.9*	
12.50	9.10	21.60		1.01	0.38	1.39	1.69	23.5	55175
9.50	14.20	23.70				1.27	1.54	21.5	55715
10.00	*10.00*	*20.00*				*0.82*	*1.00*	*18.9*	
12.40	9.80	22.20		1.11	0.34	1.45	1.76	23.9	55176
11.00	11.10	22.10				1.50	1.82	22.9	55725
10.00	*10.00*	*20.00*				*0.82*	*1.00*	*18.9*	
10.90	10.30	21.20		1.01	1.01	2.02	2.45	24.3	55177
10.00	*10.00*	*20.00*				*1.65*	*2.00*	*21.8*	
10.90	6.20	17.10				0.52	0.63	17.4	55218
8.60	8.00	16.60				0.56	0.68	15.5	55728
		16.00				*0.41*	*0.50*	*11.0*	
12.20	1.20	13.40				1.77	2.15	21.3	55223
12.00	*1.00*	*13.00*				*1.65*	*2.00*	*20.6*	
12.90	1.10	14.00				0.95	1.15	19.3	55224
12.10	1.50	13.60				0.82	1.00	18.0	55721
12.00	*1.00*	*13.00*				*0.82*	*1.00*	*17.7*	

TABLE V.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Hopkins Fertilizer Co., New Albany. Ind.	
55310	Favorite	Manufacturer
55734		Pickerill & Twyman, Hodgenville
55742		Pickerill & Twyman, Hodgenville
55311	Tankage and Phosphate Special	Manufacturer
55735		A. F. Vertrees, Vine Grove
55743		Taylor County Supply Co., Campbellsville
	The Jarecki Chemical Co., Cincinnati, Ohio.	
55330	Raw Bone and Phosphate Mixture	*
55752		Fremd's Grocery Co., Eminence
55331	Cereala	*
55332	Ammoniated Phosphate	*
55751		J. C. Everett & Co., Maysville
	The Kaufman Fertilizer Co., Cincinnati, Ohio.	
55353	Half and Half	*
55354	Jewell Plant Food	*
55355	Phosphate and Ammonia	*
	Kentucky Fertilizer Co., Branch Federal Chem. Co., Inc., Louisville, Ky.	
55196	O. K. Ammoniated Phosphate	Manufacturer
55754		R. M. Hart, Corbin
55761		D. L. D. Sandefur, Beaver Dam
55197	O. K. Vegetable Grower	Manufacturer
55203	O. K. Life-Saver Fertilizer	Manufacturer
55204	Golden King Fertilizer	Manufacturer
55205	Golden Leaf Truck and Tobacco Grower	Manufacturer
55756		D. B. Shackelford & Co., Richmond
55206	O. K. Double-Header Corn and Wheat Grower	Manufacturer
55207	O. K. Half and Half Meal Mixture	Manufacturer

* Manufacturer failed to send sample as required by law.

ACID PHOSPHATES WITH NITROGEN.

PHOSPHORIC ACID			NITROGEN				Equivalent to Ammonia.	Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.			
13.60	0.30	13.90		0.86	0.75	1.61	1.95	22.1	55310
13.90	1.40	15.30	0.96		0.55	1.51	1.83	22.5	55734
12.30	1.40	13.70	1.06		0.87	1.93	2.34	22.1	55742
12.00	*1.00*	*13.00*				*1.65*	*2.00*	*20.6*	
13.60	0.30	13.90		0.37	0.66	1.03	1.25	20.1	55311
14.50	1.00	15.50	0.34		0.56	0.90	1.09	21.0	55735
13.80	1.30	15.10	0.49		0.35	0.84	1.02	20.0	55743
12.00	*1.00*	*13.00*				*0.82*	*1.00*	*17.7*	
									55330
9.50	9.00	18.50		0.70	1.20	1.90	2.31	21.7	55752
8.00	*8.00*	*16.00*				*1.65*	*2.00*	*18.6*	
									55331
12.00	*1.00*	*13.00*				*1.65*	*2.06*	*20.6*	
									55332
10.70	2.30	13.00				1.03	1.25	17.4	55751
10.00	*1.00*	*11.00*				*0.82*	*1.00*	*15.3*	
									55353
8.00	*8.00*	*16.00*				*1.65*	*2.00*	*18.6*	
									55354
12.00	*1.00*	*13.00*				*1.65*	*2.00*	*20.6*	
									55355
10.00	*1.00*	*11.00*				*0.82*	*1.00*	*15.3*	
16.80	2.90	19.70		0.87	0.43	1.30	1.58	25.9	55196
17.00	1.10	18.10				0.42	0.51	22.3	55754
15.70	3.00	18.70				0.67	0.81	22.4	55761
15.00	*4.00*	*19.00*				*0.41*	*0.50*	*21.0*	
16.10	2.40	18.50		2.13	0.43	2.56	3.11	29.2	55197
12.50	*4.00*	*16.50*				*2.06*	*2.50*	*23.8*	
10.20	11.70	21.90		0.58	0.56	1.14	1.38	20.9	55203
10.00	*12.00*	*22.00*				*0.41*	*0.50*	*18.2*	
9.10	14.90	24.00		0.77	0.53	1.30	1.58	21.4	55204
8.00	*12.00*	*20.00*				*0.82*	*1.00*	*17.3*	
13.40	9.90	23.30		1.00	0.49	1.49	1.81	25.3	55205
10.90	13.60	24.50				0.76	0.92	20.1	55756
10.00	*10.00*	*20.00*				*0.82*	*1.00*	*18.9*	
13.20	9.90	23.10		1.01	0.52	1.53	1.86	25.2	55206
10.00	*10.00*	*20.00*				*0.82*	*1.00*	*18.9*	
13.90	7.90	21.80		1.52	0.62	2.14	2.60	27.3	55207
10.00	*10.00*	*20.00*				*1.65*	*2.00*	*21.8*	

TABLE V.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Louisville Fert. Co., Inc., "Armour Owned," Louisville, Ky. and Nashville, Tenn.	
54842	Eagle Ammoniated Phosphate	Manufacturer
55764		G. C. Lewis & Co., Krypton
54843	Eagle Special Corn and Tobacco Maker	Manufacturer
55765		L. A. Collins, Lebanon
54844	Eagle Winner	Manufacturer
55766		Thomas Jameson & Son, Beattyville
55774		C. L. Thomas Carriage & Implement Co., Bowling Green
55228	Hall's Potato Grower	Manufacturer
55275	Kentucky Corn and Wheat Maker	Manufacturer
55772		G. O. Denwiddie, Moreland
55779		Taylor & Son, Greensburg
55443	Grain Maker	Manufacturer
55782		Grigsby & Co., Bardstown
55454	Eagle Kentucky Wheat Maker	Manufacturer
55455	Eagle Ammoniated Mixture	Manufacturer
55456	Eagle Wheat and Oats Special	Manufacturer
55500	Eagle Wheat and Oats Special	Manufacturer
54859	Bear Ammoniated Phosphate	Manufacturer
54860	Bear Special Corn and Tobacco Maker	Manufacturer
54861	Bear Winner	Manufacturer
55788		Irvington Hdw. & Imp. Co., Irvington
55462	Bear Wheat and Oats Special	Manufacturer
54874	Jones Ammoniated Phosphate	Manufacturer
54875	Jones Special Corn and Tobacco Maker	Manufacturer

Acid Phosphates with Nitrogen.

Phosphoric Acid			Nitrogen				Equivalent to Ammonia.	Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.			
11.30	3.50	14.80				1.82	2.21	21.3	54842
11.00	1.40	12.40		0.52	1.15	1.67	2.03	19.6	55764
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
13.30	2.80	16.10				0.90	1.09	20.2	54843
14.20	0.30	14.50		0.28	0.62	0.90	1.09	20.3	55765
12.00	*4.00*	*16.00*				*0.82*	*1.00*	*18.9*	
13.70	2.90	16.60				0.70	0.85	20.1	55844
12.20	0.20	12.40				0.37	0.45	16.0	55766
12.90	1.20	14.10				0.49	0.59	17.7	55774
12.00	*4.00*	*16.00*				*0.41*	*0.50*	*17.4*	
10.50	3.60	14.10				1.67	2.03	19.9	55228
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
11.20	2.00	13.20				1.08	1.31	18.0	55275
10.00	0.30	10.30			0.72	0.72	0.87	14.6	55772
10.20	1.50	11.70				0.85	1.03	15.8	55779
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*16.5*	
13.80	1.20	15.00		1.11	0.38	1.49	1.81	22.3	55443
11.60	0.60	12.20				0.93	1.13	17.4	55782
12.00	*4.00*	*16.00*				*0.82*	*1.00*	*18.9*	
10.30	6.00	16.30				0.91	1.10	18.0	55454
10.00	*4.00*	*14.00*				*0.82*	*1.00*	*16.5*	
14.20	5.70	19.90				0.76	0.92	22.0	55455
14.00	*4.00*	*18.00*				*0.41*	*0.50*	*19.8*	
12.30	3.80	16.10				1.02	1.24	19.9	55456
12.00	*2.00*	*14.00*				*0.82*	*1.00*	*18.1*	
15.50	0.50	16.00		0.48	0.78	1.26	1.53	23.2	55500
12.00	*4.00*	*16.00*				*0.82*	*1.00*	*18.9*	
10.30	3.70	14.00				1.75	2.12	20.0	54859
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
13.30	3.00	16.30				0.97	1.18	20.6	54860
12.00	*4.00*	*16.00*				*0.82*	*1.00*	*18.9*	
13.20	3.00	16.20				0.72	0.87	19.6	54861
13.30	1.10	14.40				0.52	0.63	18.2	55788
12.00	*4.00*	*16.00*				*0.41*	*0.50*	*17.4*	
13.50	3.80	17.30				1.02	1.24	21.3	55462
12.00	*4.00*	*16.00*				*0.82*	*1.00*	*18.9*	
11.10	3.20	14.30				1.71	2.08	20.2	54874
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
13.00	3.00	16.00				0.98	1.19	20.2	54875
12.00	*4.00*	*16.00*				*0.82*	*1.00*	*18.9*	

TABLE V.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Louisville Fertilizer Co., Inc.	
54876	Jones Winner	Manufacturer
55791		Barnett Bros., London
	Meridian Fertilizer Factory., Meridian, Miss.	
55308	Meridian Home Mixture	Manufacturer
	Morris & Co., Chicago, Ill.	
55290	Special Big Four	*
55795		Redman & Burba Co., Hodgenville
55297	Special Big Eleven Phosphated Manure	*
55798		Redman & Burba Co., Hodgenville
55801		The Cayce-Yost Co., Hopkinsville
55298	Special Big Twelve Phosphated Manure	*
	Rasin-Monumental Co. (Subsidiary of Va.-Car. Chem. Co., Inc.), Cincinnati, Ohio.	
55374	Rasin's Fenhumus Fertilizer	Manufacturer
55375	Rasin's Grain Fertilizer	Manufacturer
55376	Rasin's Special Plant Food	Manufacturer
55381	Rasin's Phosphate and Bone Meal	Manufacturer
55382	Rasin's Truck and Tobacco Fertilizer	Manufacturer
55805		Martin-Hodgkin Supply Co., Winchester
	Read Phosphate Co., Nashville, ville, Tenn.	
55513	Ammoniated Super Phosphate	*
55517	Challenge Formula	Manufacturer
55518	Read's Special Formula	Manufacturer
55519	Grain Special	Manufacturer
55809		T. J. Alexander, Monticello
55818		T. J. Alexander, Monticello

* Manufacturer failed to send sample as required by law.

Acid Phosphates with Nitrogen.

Phosphoric Acid			Nitrogen				Equivalent to Ammonia.	Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.			
13.10	3.00	16.10				0.63	0.76	19.1	54876
12.20	0.10	12.30				0.65	0.79	17.0	55791
12.00	*4.00*	*16.00*				*0.41*	*0.50*	*17.4*	
10.95	4.35	15.30				1.77	2.15	21.1	55308
12.00	*1.00*	*13.00*				*1.65*	*2.00*	*20.6*	
									55290
12.70	6.80	19.50				0.65	0.79	20.2	55795
13.00	*5.00*	*18.00*				*0.41*	*0.50*	*19.0*	
									55297
12.30	1.00	13.30				1.26	1.53	19.6	55798
12.00	1.20	13.20				0.90	1.09	18.0	55801
10.00	*1.00*	*11.00*				*0.82*	*1.00*	*15.3*	
									55298
12.00	*2.00*	*14.00*				*1.65*	*2.00*	*21.0*	
12.90	1.10	14.00				0.62	0.75	18.1	55374
12.00	*1.50*	*13.50*				*0.41*	*0.50*	*16.4*	
13.70	1.80	15.50				1.27	1.54	21.6	55375
13.00	*1.50*	*14.50*				*0.82*	*1.00*	*19.1*	
12.20	2.20	14.40		0.55	1.36	1.91	2.32	22.2	55376
11.00	*1.50*	*12.50*				*1.65*	*2.00*	*19.6*	
11.80	12.00	23.80				1.39	1.69	23.8	55381
10.00	*12.00*	*22.00*				*0.82*	*1.00*	*19.7*	
11.10	1.10	12.20				2.78	3.37	23.5	55382
11.20	3.30	14.50			2.49	2.49	3.02	23.5	55805
9.00	*1.50*	*10.50*				*2.47*	*3.00*	*20.1*	
									55513
10.00	*7.00*	*17.00*				*1.65*	*2.00*	*20.6*	
15.60	4.70	20.30		0.27	0.99	1.26	1.53	25.0	55517
13.00	*7.00*	*20.00*				*0.41*	*0.50*	*19.8*	
13.70	4.20	17.90		0.55	1.76	2.31	2.80	26.2	55518
12.00	*5.00*	*17.00*				*1.65*	*2.00*	*22.2*	
14.60	5.00	19.60		0.41	1.17	1.58	1.92	25.1	55519
13.80	3.80	17.60				1.21	1.47	22.3	55809
14.40	3.00	17.40			0.88	0.88	1.07	21.6	55818
13.00	*5.00*	*18.00*				*0.82*	*1.00*	*20.5*	

TABLE V.

Station Number	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Read Phosphate Co.	
55529	Magic Plant Food	*
55533	Corn Grower	*
	The Smith Agricultural Chemical Co., Columbus, Ohio.	
55419	Smith's Wheat Maker and Seeding Down	Manufacturer
	Swift & Co., Inc., National Stock Yards, Ill.	
55233	Swift's Blood and Phosphate	Manufacturer
55826		J. L. Shadoan & Co., Frazer
55841		W. E. Burress, Greensburg
55235	Swift's Diamond "L" Grain Grower	Manufacturer
55843		W. E. Burress, Greensburg
55236	Swift's Tankage and Bone Phosphate	Manufacturer
55237	Swift's Ammoniated Bone Phosphate	Manufacturer
55828		Dickinson Bros., Glasgow
55844		Holloway & Co., Franklin
55238	Swift's Corn and Oats Special	Manufacturer
55829		W. E. Burress, Greensburg
55239	Swift's Early Vegetable and Fruit Grower	Manufacturer
55398	Pioneer 1-12-0 Brand	Manufacturer
55399	Pioneer 1-10-0 Brand	Manufacturer
55400	Pioneer 2-12-0 Brand	Manufacturer
	Taylor & Powell Fertilizer Co., Springfield, Tenn.	
55404	No. 4 Tobacco Grower	Manufacturer
55405	Corn Fertilizer No. 1	Manufacturer
55424	No. 2 Tobacco Grower Without Potash	Manufacturer
55566	Wheat Fertilizer No. 1 with Tankage Base	Manufacturer

* Manufacturer failed to send sample as required by law.

Acid Phosphates with Nitrogen.

Phosphoric Acid			Nitrogen				Equivalent to Ammonia.	Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.			
									55529
16.00	*3.00*	*19.00*				*0.82*	*1.00*	*23.3*	
									55533
9.00	*8.00*	*17.00*				*0.41*	*0.50*	*15.4*	
10.13	1.42	11.55				0.48	0.58	14.4	55419
12.00						*0.41*	*0.50*	*15.8*	
11.82	3.28	15.10				1.74	2.11	21.6	55233
12.20	2.40	14.60				1.41	1.71	20.5	55826
13.10	2.50	15.60				1.46	1.77	21.8	55841
12.00	*3.00*	*15.00*				*1.65*	*2.00*	*21.4*	
9.45	3.00	12.45				1.76	2.14	18.7	55235
9.40	2.60	12.00				1.47	1.78	17.5	55843
9.00	*3.00*	*12.00*				*1.65*	*2.00*	*17.8*	
12.17	3.08	15.25				0.80	0.96	18.6	55236
12.00	*3.00*	*15.00*				*0.82*	*1.00*	*18.5*	
10.02	2.88	12.90				0.79	0.96	15.9	55237
12.00	0.20	12.20				0.77	0.93	17.2	55828
11.60	0.60	12.20				0.86	1.04	17.2	55844
10.00	*3.00*	*13.00*				*0.82*	*1.00*	*16.1*	
11.55	3.25	14.80				1.71	2.08	21.2	55238
10.30	1.50	11.80				1.38	1.68	17.8	55829
10.00	*3.00*	*13.00*				*1.65*	*2.00*	*19.0*	
11.70	3.10	14.80				3.20	3.88	26.5	55239
10.00	*3.00*	*13.00*				*3.29*	*4.00*	*24.7*	
12.17	3.08	15.25				0.80	0.96	18.6	55398
12.00	*3.00*	*15.00*				*0.82*	*1.00*	*18.5*	
10.02	2.88	12.90				0.79	0.96	15.9	55399
10.00	*3.00*	*13.00*				*0.82*	*1.00*	*16.1*	
11.82	3.28	15.10				1.74	2.11	21.6	55400
12.00	*3.00*	*15.00*				*1.65*	*2.00*	*21.4*	
10.30	8.70	19.00				2.61	3.17	25.0	55404
10.00						*2.47*	*3.00*	*20.7*	
12.05	8.90	20.95				1.50	1.82	23.3	55405
11.00						*1.23*	*1.50*	*17.5*	
10.60	1.50	12.10				1.72	2.09	19.3	55424
10.35						*1.65*	*2.00*	*18.2*	
12.10	8.30	20.40		1.08	0.59	1.67	2.03	23.7	55566
11.00						*1.23*	*1.50*	*17.5*	

TABLE V.

Station Number	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Tennessee Chemical Co., Inc., (Armour Owned), Louisville, Ky., and Nashville, Tenn.	
54887	Ox Ammoniated Phosphate	Manufacturer
55864		W. F. Grainger, Franklin
54888	Ox Special Corn and Tobacco Maker	Manufacturer
54889	Ox Winner	Manufacturer
55853		J. C. Cowherd, Greensburg
54902	Ox Animal Tankage and Phosphate	Manufacturer
55857		W. F. Grainger, Franklin
55870		W. F. Grainger, Franklin
55049	Miller's Special Tobacco Grower	Manufacturer
55050	Miller's Tobacco and Corn Grower	Manufacturer
55305	Ox Dark Tobacco Special	Manufacturer
55445	Ox Grain Maker	Manufacturer
55871		Geo. Richardson, Somerset
55469	Ox Wheat and Oat Special	Manufacturer
55496	Miller's Wheat Grower	Manufacturer
55497	Miller's Special Wheat Grower	Manufacturer
	Virginia-Carolina Chemical Co., Inc., Cincinnati, Ohio.	
55361	V.-C. Richumus Fertilizer	Manufacturer
55876		R. H. Chrisman, Berea
55888		Patrick Dillon, Hardinsburg
55362	V.-C. Sure Grain Producer	Manufacturer
55889		Junction City Lumber Co., Junction City
55363	V.-C. Rescue Fertilizer	Manufacturer
55890		Junction City Lumber Co., Junction City

Acid Phosphates with Nitrogen.

PHOSPHORIC ACID			NITROGEN				Equivalent to Ammonia.	Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.			
10.90	4.10	15.00				1.60	1.94	20.3	54887
9.85	1.55	11.40				1.51	1.83	17.7	55864
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
12.90	3.10	16.00				0.87	1.06	19.8	54888
12.00	*4.00*	*16.00*				*0.82*	*1.00*	*18.9*	
13.40	2.80	16.20				0.68	0.83	19.6	54889
12.80	0.40	13.20				0.44	0.53	17.1	55853
12.00	*4.00*	*16.00*				*0.41*	*0.50*	*17.4*	
14.50	6.00	20.50				0.67	0.81	22.2	54902
14.60	2.20	16.80				0.69	0.84	20.8	55857
14.40	4.40	18.80				0.61	0.74	21.2	55870
14.00	*5.00*	*19.00*				*0.41*	*0.50*	*20.2*	
12.80	3.10	15.90				0.90	1.09	19.8	55049
12.00	*4.00*	*16.00*				*0.82*	*1.00*	*18.9*	
13.20	3.00	16.20				0.98	1.19	20.5	55050
12.00	*4.00*	*16.00*				*0.82*	*1.00*	*18.9*	
10.40	4.00	14.40				1.78	2.16	20.3	55305
10.00	*4.00*	*14.00*				*1.65*	*2.00*	*19.4*	
13.80	1.10	14.90		1.11	0.33	1.44	1.75	22.0	55445
12.10	2.10	14.20				0.96	1.17	18.7	55871
12.00	*4.00*	*16.00*				*0.82*	*1.00*	*18.9*	
13.20	3.70	16.90				1.01	1.23	20.9	55469
12.00	*4.00*	*16.00*				*0.82*	*1.00*	*18.9*	
13.70	1.70	15.40				1.17	1.42	21.2	55496
12.00	*4.00*	*16.00*				*0.82*	*1.00*	*18.9*	
14.30	1.40	15.70				0.57	0.69	19.7	55497
12.00	*4.00*	*16.00*				*0.41*	*0.50*	*17.4*	
13.40	1.10	14.50				0.65	0.79	18.8	55361
14.80	1.50	16.30				0.53	0.64	20.0	55876
14.00	2.00	16.00				0.73	0.89	20.2	55888
12.00	*1.50*	*13.50*				*0.41*	*0.50*	*16.4*	
17.00	1.40	18.40				1.30	1.58	25.5	55362
15.90	0.50	16.40				0.97	1.18	22.7	55889
13.00	*1.50*	*14.50*				*0.82*	*1.00*	*19.1*	
12.30	1.80	14.10		0.58	1.43	2.01	2.44	22.5	55363
14.50	1.30	15.80				1.53	1.86	23.3	55890
11.00	*1.50*	*12.50*				*1.65*	*2.00*	*19.6*	

TABLE V.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Virginia-Carolina Chemical Co.	
55368	V.-C. Bone Meal and Phosphate	Manufacturer
55894		Taylor Co. Supply Co., Campbellsville
55369	V.-C. Tobacco Plant Food	Manufacturer
55878		Charlie Butts, Franklin
	Mt. Pleasant Branch Va.-Car. Chem. Co., Mt. Pleasant, Tenn.	
55281	Mt. Pleasant Grain Grower	*
55282	Mt. Pleasant Corn Special	*
55883		L. A. Collins, Lebanon
55286	Black Patch Universal	*
55885		J. B. Mitchell, Clay
	Wood, Stubbs & Co., Inc., Louisville, Ky.	
55262	Acme High Grade Fertilizer	Manufacturer

* Manufacturer failed to send sample as required by law.

ACID PHOSPHATES WITH NITROGEN.

PHOSPHORIC ACID			NITROGEN				Equivalent to Ammonia.	Index of Relative Value.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.			
8.90	13.60	22.50		0.69	0.68	1.37	1.66	20.9	55368
13.00	13.00	26.00				0.99	1.20	24.3	55894
10.00	*12.00*	*22.00*				*0.82*	*1.00*	*19.7*	
12.00	1.60	13.60		1.12	1.70	2.82	3.42	24.9	55369
12.60	4.60	17.20				2.13	2.59	24.4	55878
9.00	*1.50*	*10.50*				*2.47*	*3.00*	*20.1*	
									55281
8.00	*1.50*	*9.50*				*1.23*	*1.50*	*14.5*	
									55282
15.90	4.40	20.30				0.81	0.98	23.7	55883
12.00	*1.50*	*13.50*				*0.82*	*1.00*	*17.9*	
									55286
10.80	8.70	19.50		0.65	1.18	1.83	2.22	22.9	55885
10.00	*1.50*	*11.50*				*1.65*	*2.00*	*18.4*	
18.10	1.00	19.10		2.15	0.43	2.58	3.13	31.2	55262
12.00	*4.00*	*16.00*				*1.65*	*2.00*	*21.8*	

Kentucky
Agricultural Experiment Station

University of Kentucky, Lexington, Ky.

THOMAS P. COOPER, Director

CIRCULAR NO. 20

An Experiment Comparing Velvet Bean Meal, Tankage and Soy Bean Meal as Supplements to Corn Meal in Feeding Hogs

BY

E. S. GOOD and L. B. MANN



January, 1918

CIRCULAR NO. 20

AN EXPERIMENT COMPARING VELVET BEAN MEAL, TANKAGE AND SOY BEAN MEAL AS SUPPLEMENTS TO CORN MEAL IN FEEDING HOGS.

BY

E. S. GOOD AND L. B. MANN.

Numerous inquiries have been received by this Station relative to the value of velvet bean meal (hull and kernel ground together), as a supplement to corn in feeding hogs. To secure some data as to its value in this connection it was thought best to compare it with well known supplements to corn, such as digester tankage and soy bean meal; accordingly, the following experiment was conducted.

On June 24, 1917, shoats, of the Duroc and Berkshire breeds, averaging about 125 pounds, were divided into three lots of eight each, as equally as possible with regard to breed, quality and conformation. Lot 1 was fed a mixture of corn meal 5 parts and velvet bean meal 1 part, by weight. Lot 2 was given a mixture of corn meal 9 parts and tankage 1 part, and lot 3 was fed a mixture of corn meal 7 parts and soy bean meal 1 part, by weight. The pigs were fed in dry lots and received, twice a day, all the feed they would eat without waste.

About thirty days after the beginning of the experiment it was noticed that the pigs in the lot receiving corn meal and velvet bean meal would not eat as much as the two lots receiving the other mixtures. The pigs did not relish the feed containing velvet bean meal, and this became more noticeable as the experiment progressed.

The mixture containing the velvet bean meal lacked considerably in the amount of digestible crude protein and fat for each 100 pounds of feed eaten, as compared with the other two mixtures, as can be seen from Table 1. It would have done no good, however, to increase the proportion of velvet bean meal to corn, so as to increase the content of crude protein the pigs would receive, for they would have eaten a proportionately smaller amount of feed, on account of its lack of palatability, and hence would have received no more protein.

TABLE 1

Digestible Nutrients in 100 Pounds of Each Ration.

Ration	Crude Protein.	Carbo-hydrate.	Fat.	Nutritive ratio.
Corn meal 5 parts, velvet bean meal 1 part	8.75	64.11	3.46	1:8.3
Corn meal 9 parts, tankage 1 part	11.92	61.02	5.40	1:6.3
Corn meal 7 parts, soy bean meal 1 part	10.40	61.17	5.81	1:7.2

Table 2 gives a synopsis of the feeds fed and results obtained in this experiment. The experiment began June 14, 1917, and closed September 11, 1917.

TABLE 2

	Lot No. 1; corn meal 5 parts, velvet bean meal 1 part	Lot No. 2; corn meal 9 parts, tankage* 1 part	Lot No. 3; corn meal 7 parts, soy bean meal 1 part
Number of pigs on experiment	8	8	8
Days on experiment	89	89	89
Average first weight, pounds	125.6	126.2	121.8
Average final weight, pounds	196.8	261.8	248.1
Average gain per pig, pounds	71.2	135.6	126.3
Average daily gain per pig, pounds	.80	1.52	1.42
Total pounds of grain eaten	3679.0	4549.0	4549.0
Average grain eaten, per pig, daily, pounds	5.17	6.39	6.39
Pounds grain per 100 pounds gain	645.9	419.4	450.2
Cost of 100 pounds gain**	$21.71	$15.53	$15.93
Pounds gain per bu. (56 lbs.) grain fed	8.66	13.32	12.43
Cost of 56 pounds of feed**	$1.88	$2.07	$1.98
Amount realized per bu. (56 lbs.) feed, pork @ $18.00	$1.55	$2.40	$2.23

* The tankage used in this test is listed under the name "Armour's Meat Meal."

** Based on the following prices of feed:
Corn, $2.00 per bushel plus $2.00 per ton for grinding, =$73.42 per ton.
Tankage, $80.00 per ton.
Soy beans, $50.00 per ton plus $2.00 per ton for grinding, = $52.00 per ton.
Velvet bean meal, $36.00 per ton.

As shown by Table 2, the pigs receiving corn and velvet bean meal did not make as large daily gains as those receiving the other rations and, while they did not eat as much feed per day as the other two lots, they required 196 pounds more of grain to produce 100 pounds of gain than was the case with the lot receiving corn and soy beans, and 226 pounds more of grain for this purpose than the lot receiving corn and tankage. The cost of 100 pounds of gain for Lot 1 was about $6.00 more than for either of the other lots. The amount realized for a bushel (56 lbs.) of the corn and velvet bean mixture was $1.55 while the cost was $1.88. The amount realized for a bushel of feed for the other two lots was $2.40 for the lot receiving corn

meal and tankage, and $2.23 for the lot receiving corn meal and soy bean meal, and the cost per bushel was $2.07 and $1.98 respectively. It is seen that a loss was sustained in the feeding of Lot 1, while a good profit was made in the feeding of Lots 2 and 3.

In this experiment the velvet bean meal used was bean and pod ground together, this being the usual form in which this meal is found on the market. Velvet bean meal in this form contains too much crude fiber to be palatable to the hog. Then, too, the hog has a small stomach and cannot digest crude fiber as can cows and sheep which have four stomachs and rechew their feed in the form of a cud.

The following table gives the percentage of crude nutrients in the feeds used:

TABLE 3

	Crude protein.	Crude fat.	Crude fiber.	Ash.	Water.	Nitrogen free extract.
Velvet bean meal*	18.75	3.74	14.18	3.87	9.55	49.91
Tankage*	61.50	8.31	2.42	14.27	7.59	6.91
Soy bean meal**	35.85	19.25	4.73	5.75	6.90	26.50
Corn meal***	10.23	5.00	2.04	1.38	7.32	74.04

* Analysis made by Prof. H. D. Spears, Chemist, Department of Feed Stuffs.

** Average of three analyses made by the Chemistry Department of soy beans grown on the Station farm in 1900. Bulletin No. 98, page 56.

*** Average of 13 analyses made by the Chemistry Department of different varieties of corn grown on the Station farm, in 1904. Bulletin No. 122, page 177.

No doubt velvet bean meal from the kernel only would be much superior to the kind used in this experiment, as it would contain more protein and less crude fiber. In the course of time the meal from the kernel will undoubtedly be found more abundantly on our markets.

This experiment again emphasizes the value of soy beans as a supplement to corn in the growing and fattening of hogs, for the results of the lot receiving soy beans in its ration compared very favorably with those of the lot receiving tankage. Soy beans can, to a large extent, take the place of tankage in swine feeding operations and, as the best grades of tankage are now retailing at about $100.00 per ton, one can well understand the great economic importance of the soy bean.

Acknowledgment: The soy beans fed in this test were grown on the Station farm by the Department of Entomology and Botany and we are indebted to Dr. H. Garman, head of the Department, for the same.

Kentucky
Agricultural Experiment Station
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CIRCULAR NO. 21

LIVE STOCK AND OTHER FACTORS FOR PROFITABLE FARMING IN NORTHERN KENTUCKY

By

J. B. HUTSON

June, 1918
(5)

CIRCULAR NO. 21

LIVE STOCK AND OTHER FACTORS FOR PROFITABLE FARMING IN NORTHERN KENTUCKY

By J. B. HUTSON

In the Summer of 1917 a Farm Management Study was made in Kenton County, Kentucky, for the purpose of determining the main factors that were affecting profits in farming and the most desirable and profitable type of farming for Northern Kentucky. The area selected for the study is typical of the more rolling section of Northern Kentucky. The farms included in the study are slightly smaller than the average Northern Kentucky farms. A complete statement of a year's business was secured from 80 representative farms and their profits calculated.

The term used to compare the profits on the different farms is "Farmer's Earnings." The "Farmer's Earnings" is the sum of the receipts and increase in inventories, minus the sum of the expenses, the decrease in inventories and 5 per cent. interest on the total investment. It is the farmer's salary or the amount left for his labor or managerial ability after all expenses and the interest on the investment have been deducted. The things that the farm furnishes the family, such as fair rental charge for residence, stock and garden products, etc., are included in receipts. In this way the farms are all put upon an equal basis and their profits are more accurately determined.

Of course, there was a wide variation in the profits made on these farms. The profits were many times larger on some farms than on others. Why this great difference? There

are some who say that large profits in farming are due to the seasons and "good luck." The seasons and the "breaks of the game" do have their influence, but when farms operated under the same conditions and affected by the same weather differ widely in profits the difference is usually due to the organization or method of managing the farms. Wherein, then, does the organization of the more profitable farms differ from that of the other farms? At what particular points do the more profitable farms excel the other farms? By carefully examining the organization of these farms we have been able to find some of these more important factors for profits.

The profits in farming in Northern Kentucky seem to depend chiefly upon the amount of live stock kept, the quality of the live stock, the crop yields and the size of the business. Of course, there are other important factors that influence the profits but these seem to be the most important, as shown by a study of the data obtained by this survey.

Amount of Live Stock and Profits.

Northern Kentucky is especially suited to live-stock farming. As a rule, the most heavily stocked farms are the most profitable. Tables 1 and 2 show the relation of the amount of live stock kept to profits.

In studying Table 1 and other tables in which the averages of the most profitable ten farms are compared with the averages of all farms in the survey it should be kept in mind that the difference in the Farmer's Earnings is not due entirely to the single factor shown by the one table. Such tables are intended merely to show the practis of the farmers who are making largest profits. In the other tables where the farms are divided into groups on the basis of some practis, the difference in the Farmer's Earnings is due largely to the particular factor under consideration.

Table 1.—The Most Profitable Ten Farms Compared With The Average of 80 Farms, In The Amount of Live Stock Kept.

	Averages for 80 farms.	Averages for most profitable 10 farms.
Animal units* per 10 acres in pasture....	2.7	3.3
Animal units per 10 acres in crops.....	4.3	6.0
FARMER'S EARNINGS	$871.	$1866.

In Table 1 the most profitable ten farms are compared with the average of the 80 farms included in the Kenton County survey. The average farm has only 2.7 animal units per ten acres in pasture, while the most profitable ten farms have 3.3 animal units per ten acres in pasture. Stating this in another way, the average farm has only one animal unit for each 3.7 acres in pasture, while the most profitable farms have one animal unit for each 3.0 acres in pasture. From this it seems that there is a tendency among the farmers of Northern Kentucky to understock rather than overstock their pastures. In looking into the crop area it is found that the average farm has only 4.3 animal units per ten acres in crops while the most profitable farms have 6.0 animal units per ten acres in crops.

Table 2.—Relation of Amount of Live Stock Kept to Farmer's Earnings.

(Farms divided into three groups, on the basis of the number of animal units per 10 acres in crops.)

	Number of farms.	Farmer's Earnings.
3.4 animal units per 10 acres in crops....	36	$729.
5.3 animal units per 10 acres in crops....	23	926.
7.7 animal units per 10 acres in crops....	21	1054.

*An animal unit is a mature horse or cow, or an equivalent in other live stock. It has been found that 2 yearlings, 4 calves, 5 hogs, 10 shoats, 7 sheep, 14 lambs, or 100 head of poultry are equivalent, respectively, to one mature horse or cow; these are reckoned as animal units.

Table 2 shows the farms divided into three groups, on the basis of amount of live stock kept per given crop area. The first group contains 36 farms, having an average of 3.4 animal units to 10 acres in crops. The average Farmer's Earnings on these farms is only $729. They have considerably less live stock than the average and their profits, also, are below the average. Of the farms more heavily stocked than the average there is one group of 23 farms with 5.3 animal units per 10 acres in crops. The average Farmer's Earnings on these farms is $926. There is another group of 21 farms still more heavily stocked, having 7.7 animal units per 10 acres in crops. The average Farmer's Earnings on these most heavily stocked farms is $1,054. From these figures it seems fair to conclude that an increase in live stock on most farms in Northern Kentucky would mean an increase in profits.

Live stock that utilize large quantities of hay and pasturage are especially profitable in Northern Kentucky. Altho much of the land is too rolling for intensive cropping, it is well suited for hay production and affords good pasturage. Figures on cost of producing farm crops show that the market crops, such as tobacco and potatoes, are produced with a very small margin of profit. Our data also seem to indicate that the feed-crops, such as corn and hay, net much more profit when fed than when sold. The systems of farming built around the live-stock enterprises are undoubtedly the most profitable. Enough live stock should be kept to utilize the pasture and consume the feed crops, and market crops should be grown when they will aid in solving the labor problem.

Quality of Live Stock and Profits.

In the foregoing discussion we have directed attention to figures showing the desirability of increasing the amount of live stock upon the average farm in Northern Kentucky. The data from this study show that BETTER live stock is just as important as MORE live stock. Tables 4 and 5 show the relation of the quality of live stock to profits.

Only figures from the cattle enterprise are used to illustrate this point but there is no reason to believe that better hogs, better sheep and better poultry would affect the profits less, considering the size of the enterprise.

Table 3.—The Most Profitable Ten Farms Compared with the Average of 80 Farms, in the Production Per Cow.

	Averages for 80 farms.	Averages for most profitable 10 farms.
Production per cow (pounds of milk)	4300.	4800.
Receipts per cattle unit	$74.	$79.
FARMER'S EARNINGS	$871.	$1866.

In Table 3 the averages for the most profitable 10 farms are again compared with the averages for the 80 farms. The average production of the cows on the farms in the survey was about 4,300 pounds of milk during the year. The average production of the cows on the most profitable 10 farms was about 4,800 pounds of milk during the same period. The receipts per animal unit in cattle were greater by about $5 per head on the most profitable than on the average farms. From this it appears that the better grade of cattle are kept on the more profitable farms.

Table 4.—Relation of Production Per Cow to Farmer's Earnings.

(Farms divided into three groups, on the basis of pounds of milk produced per cow.)

	Number of farms.	Average Farmer's Earnings
Group averaging about 3300 pounds of milk per cow	29	$761.
Group averaging about 4200 pounds of milk per cow	27	876.
Group averaging about 5800 pounds of milk per cow	21	1004.

In Table 4 the farms are divided into three groups, on the basis of pounds of milk produced per cow. In the first group there are 29 farms on which the cows average only about 3,300 pounds of milk during the year. The average Farmer's Earnings on these farms is $761. In the second group there are 27 farms on which the average production per cow is about 4,300 pounds of milk. The average Farmer's Earnings on these farms is $876. Then there is another group of 21 farms on which the average production per cow is about 5,800 pounds of milk. The average Farmer's Earnings on these farms is $1,004. These figures show clearly that, of the dairy farms, those with the best cows are making the largest profits. After studying the other live-stock enterprises we feel safe in making a wider application and saying that, as a rule, the farmers in Northern Kentucky who are keeping the best grade of live stock are making the most money.

It is a great waste, at any time, to put good feed into poor live stock, and, with the present prices of feed and stock products, it is more important than ever before that the live stock be of good quality. No one doubts that some animals are more efficient users of feed than others. Many cows in Kentucky, when judiciously fed $75 worth of feed, will produce $150 worth of milk; others, when fed the same amount of feed, will not produce products that will sell for more than $100. There are ewes in Kentucky which will produce two lambs and from 6 to 8 pounds of wool each year. On the other hand, there are ewes that, with practically the same feed and care, will produce only one lamb and from 3 to 4 pounds of wool. There are sows in Kentucky that produce two large litters of pigs each year and there are sows that produce less. It is not easy to determine correctly the real value of poor and good live stock. A poor animal may be a liability, while the value of a good animal is likely to be underestimated. A few dollars often influence farmers too much in selecting and securing breeding stock. It should

be remembered that a FEW dollars in BLOOD may SAVE MANY dollars in FEED.

Crop Yields and Profits.

Wherever studies of this kind have been made the crop yields have been found to be one of the most fundamental factors affecting profits. So it is not surprising to find the profits so strongly influenced by crop yields in Northern Kentucky. Broadly speaking, the farmers who are making the most money are getting the best yields of crops. Tables 5 and 6 show the relation of crop yields to profits.

Table 5.—The Most Profitable Ten Farms Compared with the Average of 80 Farms, in Crop Yields.

Crops.	Average yields of 80 farms.	Average yields of best 10 farms.
Corn grain, bu. per acre	36	39
Corn silage, tons per acre	8.	9
Alfalfa, tons per acre	2.4	3.1
Mixed hay, tons per acre	1.2	1.6
Oats, bu. per acre	18.	19.
Tobacco, pounds per acre	1233.	1326.
Wheat, bu. per acre	8.	11.2
Crop yields for entire farm, exprest on the percentage basis	100.	116.
FARMER'S EARNINGS	$871.	$1866.

In Table 5 the crop yields on the most profitable ten farms are compared with the average crop yields for all the farms in the survey. It will be observed that in the case of every crop the yield is larger on the most profitable farms than the average for all the farms. Putting all these figures

together and expressing the result on the percentage basis, it is seen that on the most profitable ten farms the crop yields for the same number of acres of the same crops is 16 per cent. greater than the average for all the farms. To state this in another way, only 100 acres are required on the most profitable farms to produce as much as 116 acres in the same crops on the average farms.

Table 6.—Relation of Crop Yields to Farmer's Earnings.
(Farms divided into four groups, on the basis of crop yields.)

Crop Yields.	Number of farms.	Average Farmer's Earnings.
24 per cent. below average	23	$592.
5 per cent. below average	19	852.
7 per cent. above average	20	908.
29 per cent. above average	18	1206.

Table 6 shows the farms divided into four groups, on the basis of crop yields. In the first group there are 23 farms on which the crop yields average 24 per cent. below the average for the 80 farms. The average Farmer's Earnings on these farms is only $592, or 32 per cent. below the average Farmer's Earnings for the 80 farms. There are 19 farms on which the crop yields are 5 per cent. below the average for the 80 farms. The average Farmer's Earnings on these farms is only $852, or 2 per cent. below the average Farmer's Earnings for the 80 farms. Then there is a group of 20 farms on which the crop yields average 7 per cent. above the average for the 80 farms. The average Farmer's Earnings on these farms is $908 or about 4 per cent. above the average Farmer's Earnings for the 80 farms. There is another group of 18 farms on which the crop yields average 29 per cent. above the average for the 80 farms. The average Farmer's Earn-

ings on these farms is $1,206 or about 38 per cent. above the average Farmer's Earnings for the 80 farms.

These facts indicate that profits increase as crop yields increase, and that the most profitable farms have the better crop yields. Of course, there is a point at which it will not pay to further increase the crop yields. More detailed studies in other sections have shown that the crop yields may be safely increased to one-fifth or one-fourth above the average for the section. Possibly now, with the increased prices, it would be profitable to increase the crop yields to as much as one-third above the previous average for the section.

When crop yields have as much influence on profits as the above figures indicate, it is certainly very important that each farmer give some attention to improving his yields. As land values and labor and crop prices increase, the importance of larger crop yields becomes more evident. As indicated above, the data show that the more heavily stocked farms produce the larger yields of crops; thus, increasing the amount of live stock will help toward increasing the crop yields. More live stock should mean larger crop yields and larger crops, in turn, should mean MORE LIVE STOCK.

Size of Farm Business and Profits.

In farming, as in other kinds of business, the size of the business has an important bearing upon the profits. The size of the farm business is determined largely by the amount of capital invested, the number of acres farmed and the amount of live stock kept. Much has been written about large profits on small farms. Tables 7 and 8 show that chances for profit are better, in Northern Kentucky, with a farm business of at least medium size than with a small business. Similar conclusions have been reached wherever detailed Farm Management Studies have been made.

Table 7.—Most Profitable Ten Farms Compared with the Average of 80 Farms, in Size of Business.

	Averages for 80 farms.	Averages for most profitable 10 farms.
Capital	$10642.	$14711.
Total no. of acres	123.	156.
Acres in crops	42.	56.
Acres in pasture	67.	98.
Animal units	18.	33.
FARMER'S EARNINGS	$871.	$1866.

In Table 7 the averages for the most profitable 10 farms are again compared with the averages for the 80 farms. It will be observed that the most profitable 10 farms are considerably larger than the average farms. The farmers on the most profitable 10 farms have a larger investment by over $4,000 than the average farmers; they have 33 acres more land than the average; they are using their land to better advantage than the average, as is shown by the fact that, with farms only 33 acres larger, they have 14 acres more in crops and 31 acres more in pasture than the average; they have nearly TWICE as much LIVE STOCK as the average and are making more than TWICE as much MONEY as the average.

Table 8.—Relation of Size of Farm to Farmer's Earnings.

(Farms divided into four groups, on the basis of total number of acres.)

	Number of farms.	Average Farmer's Earnings
Group of farms averaging 53 acres	20	$676.
Group of farms averaging 87 acres	21	705.
Group of farms averaging 127 acres	16	862.
Group of farms averaging 210 acres	23	1124.

In Table 8 the farms are divided into four groups, on the basis of size, in acres. In the first group there are 20 farms with an average of 53 acres per farm. The Farmer's Earnings on these farms average $676. In the second group there are 21 farms with an average of 87 acres per farm. The Farmer's Earnings on these farms average $705. In the third group there are 16 farms, with an average of 127 acres per farm. The Farmer's Earnings on these farms average $862. In the fourth group there are 23 farms, with an average of 210 acres per farm. The Farmer's Earnings on these farms average $1,124. These figures indicate that the chances for large profits are better on large farms and also, as a rule, that the farmers with the larger incomes are found upon the larger farms.

There are many reasons why a large farm business nets more profits than a small one. Man labor can be utilized to better advantage on a large than on a small farm. There is much farm work that requires two men; so no matter how small the farm may be, one man cannot do all the work to good advantage. For best results a farm should at least be large enough to employ two men for the entire year. Horse labor cannot be used to the best advantage on a small farm. Horses are required for certain kinds of work during the rush season and then are idle for the remainder of the year. This period of idleness is not as long on large as on small farms. Then, on farms with only one man, the team must remain idle when the farmer uses the hoe and does the chores. On a larger farm the teams may be combined while such work is done. With the present prices of feed any change in the farm organization that permits the better utilization of horse labor will have a marked effect on profits. The machinery cost is greater per given amount of work on a small than on a large farm. A mower, a harrow and a cultivator, while essential on even a small farm, cannot be used as many days as on a larger farm. The machinery cost per acre is, then, necessarily greater on a small than on a large farm. The farm products can be marketed more economically and, in

many cases, better prices can be secured with a large than with a small business. These are only a few of the reasons why the men with the larger farms are making more money than the men with the smaller farms.

In some sections men with small farms are partially overcoming some of these natural disadvantages by "swapping work" with their teams, labor and machinery. This is an excellent thing to do. In these times of stress farmers must co-operate more and they may be compelled to call upon their city friends for help. Yet even with such co-operation it appears that the farmers with the larger business continue to have the advantage.

If the chances for profit are greater with a business of large or medium size than with a small business the question naturally arises, how may the small farmer increase the size of his business? Many farmers can increase the size of their business by making better use of waste land. There is a considerable amount of land in Northern Kentucky that is not producing anything. This land should be got into shape and used for pasture and crops as soon as possible. The most profitable farms have practically no waste land. A few farmers can increase the size of their business by buying or renting land. Where there is adjacent land available, a man with a small farm will, in many cases, increase his chances for profits by buying or renting it.

Possibly the best way to increase the size of the business on most farms in Northern Kentucky is to increase the amount of live stock. Previous statements have indicated the desirability of increasing the amount of live stock on the average farm. The data indicate that most farms are too lightly stocked for the largest profits. More live stock will mean a larger business. The farmer who does not have more live stock than the average will, in most cases, INCREASE HIS PROFITS BY ADDING MORE LIVE STOCK.

A Well-Balanced Farm Business.

In the foregoing discussion we have indicated the desirability of having more live stock, better live stock, larger crop yields and a larger farm business. We have briefly discust these factors because we believe them to be the most fundamental. They are the factors that distinguish the most profitable farms in Northern Kentucky from the other farms. There are other important factors which influence the profits. Mistakes can be made in many other ways. But, as a rule, the farms that excel in these four factors are netting large profits. THEY ARE WELL BALANCED.

Table 9 shows that the farmers with the largest earnings have their farms 45 per cent. more heavily stocked than the average, live stock that produce 12 per cent. better than the average, crop yields 16 per cent. above the average and a business 49 per cent. larger than the average. It will be observed that their farm organizations are considerably above the average in the four principal points; i. e., amount of live stock, quality of live stock, crop yields, and size of business. For the largest profits farms must rank well up in all these points. To speak figuratively, we may say that such farm organizations are built for speed and endurance. Their crop yields and quality of live stock give them speed and their size of business and amount of live stock give them endurance. Every farmer should take some time for study, find the weak place in his business and look for a remedy. The county agricultural agent can be of much assistance in locating the weak place and in suggesting a remedy. It should be remembered that a remedy for the weak place will BALANCE THE BUSINESS and INCREASE THE PROFITS.

Table 9.—The Most Profitable Ten Farms Compared with the Average of 80 Farms and the Result Exprest on a Percentage Basis.

	80 Kenton County farms.	Most profitable 10 farms.
Amount of Live Stock (Live Stock in proportion to total acres).....	Average	45% above average
Quality of Live Stock (Production per cow).....	Average	12% above average
Crop Yields.....	Average	16% above average
Size of Business (Number of animal units, number of acres and capital).....	Average	49% above average

In looking for remedies let us see what more high-class live stock would do for the average farm in Northern Kentucky. Would not more good live stock mean better live stock? Would not more good live stock mean larger crop yields? Would not more good live stock mean a larger business? Would not more high-class live stock increase the chances for profits? Every farmer who is not satisfied with his farm organization and profits should look well before he passes the MORE-GOOD-LIVE-STOCK remedy by.

Nothing has been said in this discussion concerning the extent to which it will pay to specialize in any particular enterprise. The fact that very few farmers in the region studied are making mistakes along this line is the reason for this omission. Most of the farms have three or four important enterprises as sources of receipts. As a rule, the farms that have only one or two enterprises have more difficulties with their labor problems and their cropping systems than do those that have several enterprises. There are special conditions, however, that enable the farmer to overcome these natural disadvantages. For example, the increased prices

received for pure-bred live stock may make it highly desirable that some men specialize in breeding and developing a particular kind of live stock. Kentucky has some men who are doing their part and doing it well and with profit, in developing some of the breeds. The opportunities are great in the pure-bred live stock industry and the field is not yet crowded. There are other breeds that could be developed with profit by the right kind of men and possibly the reader is one of the men; yet the vast majority of the farmers in Northern Kentucky must depend upon general live-stock farming for their profits.

All the data indicate that for the largest profits the systems of farming in Northern Kentucky must be built around the live-stock enterprises. The soil demands that the crops be fed, and the profits justify the demand. The South is looking to Kentucky for breeding stock. The Government is asking for more stock products for our allies and "the boys in the trenches." To meet these demands the farms of Kentucky must be stocked more heavily. The data indicate that it is the profitable thing to do, we know it is the patriotic thing to do, and surely Kentucky will respond with, more, More and MORE GOOD LIVE STOCK.

Kentucky
Agricultural Experiment Station
University of Kentucky, Lexington, Ky.
THOMAS P. COOPER, Director

CIRCULAR NO. 22

Treatment of Seed Wheat With Formalin

BY

H. GARMAN and CARRIE LEE HATHAWAY

JULY, 1918
(21)

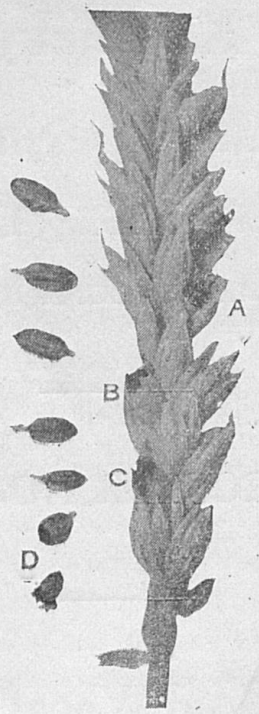

Fig. 1. A head of wheat infected with bunt, A, B, C, D, seeds broken to show the black, soot-like contents composed largely of spores. Natural size.

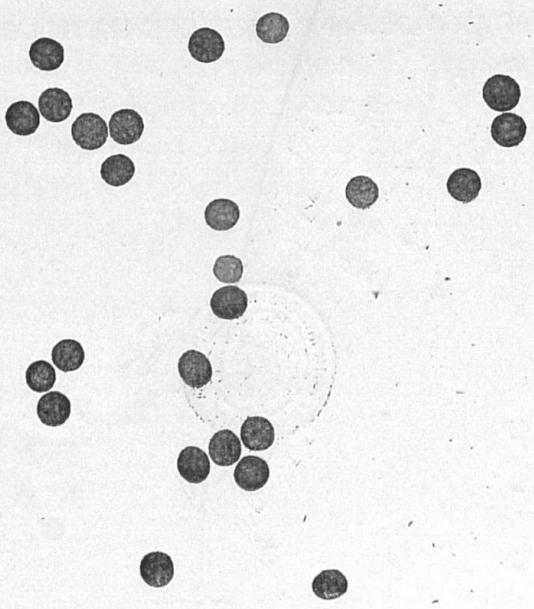

Fig. 2. Spores of bunt, photographed from the microscope. Magnified to 194 diameters. These are the bodies left on the seed wheat, which are destroyed by formalin.

CIRCULAR NO. 22

TREATMENT OF SEED WHEAT WITH FORMALIN

By H. Garman and Carrie Lee Hathaway.

Complaints that the customary treatment for seed wheat with formalin for the purpose of preventing stinking smut, or bunt,* results in a diminished stand because of an injurious effect of formalin on the germination, suggested in the fall of 1917 some preliminary tests of different solutions of this fungicide with a view to getting more definite knowledge of the matter and to learn, if possible, the proportions and exposures calculated to give the most satisfactory results. If treatment results in diminishing the yield by checking the germination of a large part of the seeds it is not always evident to the grower that good has been done, even tho all the smut has been prevented, if, at the same time, wheat from untreated seed contains a large per cent. of smut yet a greater weight of sound wheat. The results of these tests indicate that this condition sometimes results. Of course, a larger yield of seeds badly infected with smut may be less valuable than a smaller one entirely free, but it is not evident by ordinary inspection that this is so, and so a profit in money may be obtained from a crop that, because of the presence in it of smut spores in large quantities, ought not to be put on the market either for seed or for food.

In the tests the seed wheat was in all cases thoroly dusted, just before treatment and sowing, with pulverized grain which had been ruined by smut. The seeds were thus more completely

*The fungus used in these tests was the smooth-spored Tilletia foetens, causing what is sometimes called "concealed smut." Formalin cannot be regarded as a remedy for "loose smut." Some of the latter was observed among the growing wheat, but no attempt was made to get percentages.

infected than any ordinary seed wheat, and one of the results of the tests is a very complete confirmation of the claims generally made for the effectiveness of formalin as a remedy for bunt. The same weight of seed wheat was used in both treated and untreated lots, and all were sown October 11, 1917, and harvested June 22, 1918. After treatment, enough seed was reserved, in each case, for a germination test in the seed germinator, the rest being planted out-of-doors in drilled rows, with a check row of untreated seeds for each test, the checks being placed by themselves and at a little distance from the others.

Discussion and Conclusions.

Some damage to the treated lots by sparrows renders the relative yields uncertain as the result of treatment, yet results of the germination tests point in the same direction as the yields, showing, as they do, a reduction in the viability of the treated seed, which could very well be the cause, in part, of the smaller number of heads secured from some treated seeds as compared with their checks. A repetition of the tests, however, will show more certainly whether or not the treatments reduced the final yield of wheat, as some of these tests imply.

The average germination of all the checks is 95 per cent., which, considering the number of these tests, certainly gives the germination value of the untreated seeds.

The germination is generally lower than this in the treated seeds; in some of the tests so low that there can be little question that it resulted from the injurious effect of the formalin. The average of all treated lots is 88.6 per cent., and in only one case (No. 15) was a treated lot higher in germination than the average of the checks.

It will be noted at once that the number of heads of wheat harvested was generally less in treated than in untreated lots, while the number of bunt-infested heads was in every case much greater in the untreated wheat. In fact, treatment prevented almost entirely the development of bunt, so that the only question remaining, so far as the tests are concerned, as to the practical value of treatment with formalin results from differences

in yields of sound wheat, these yields being often in favor of check lots.

Thus, the yield of sound wheat from different lots of treated seeds ranges from 135 to 433 heads, the variation being greater than that of untreated seeds, which ranged from 205 to 390 heads. The average yield of sound heads from treated seeds was lower, being only 257 heads as against 274 heads for the untreated seeds.

A comparison of results from dipt seeds with those from sprinkled seeds shows that both methods are effective, but that sprinkled seeds give somewhat better results.

The average yield of heads from dipt seeds was only 223 heads to 335 heads from sprinkled seeds. In three out of four tests of sprinkled seeds the yields were greater than the average of the check lots. In the matter of the prevention of smut, again, there is a slight advantage in favor of the sprinkled seeds, the latter averaging only 0.75 head to a lot, while the dipt seeds averaged 1 head.

A repetition of the tests will be required before one will be justified in considering the result conclusive as to the superior value of this particular treatment, but attention may properly be directed to No. 25, where sprinkling with one pint of formalin in 40 gallons of water gave a germination of 90 per cent., which is 5 per cent. lower than the average of the checks, yet the grain produced decidedly more sound wheat than any other lot, treated or untreated, together with a complete absence of bunt in the crop.

The weak solutions of formalin (½ pint in 20 and 30 gallons) gave as good results as the stronger solutions and, since they are less likely to reduce the germination of the seed, are to be preferred.

Using the tests here reported as a basis, it may be concluded that sprinkling seed wheat with ½ pint of formalin in 30 gal-

TREATMENT	Test Number.	Germination Per Cent.	Heads Without Bunt.	Heads With Bunt.	Per Cent. With Bunt.
Dipt 10 min. in formalin, 1 pt. to 30 gals. water. Kept. moist 1 hr.	1	82	135	1	0.7
None	2 check	94	316	80	20.
Dipt 5 min. in formalin, 1 pt. to 30 gals. water. Kept moist 1 hr.	3	86	155	none	none
None	4 check	96	227	28	11.
Dipt 2 min. in formalin, 1 pt. to 30 gals. water. Kept moist 1 hr.	5	92	188	1	0.5
None	6 check	94	261	54	17.
Dipt 10 min. in formalin, 1 pt. to 30 gals. water. Kept. moist ½ hr.	7	92	156	5	3.1
None	8 check	94	302	48	14.
Dipt 5 min. in formalin, 1 pt. to 30 gals. water. Kept. moist ½ hr.	9	92	228	1	0.4
None	10 check	96	223	31	12.
Dipt 2 min. in formalin, 1 pt. to 30 gals. water. Kept. moist ½ hr.	11	86	238	none	none
None	12 check	94	390	94	19.
Dipt 10 min. in formalin, ½ pt. to 30 gals. water. Kept. moist 1 hr.	13	92	255	none	none
None	14 check	98	332	88	21.
Dipt 5 min. in formalin, ½ pt. to 30 gals. water. Kept. moist 1 hr.	15	96	305	1	0.3
None	16 check	98	305	108	26.
Dipt 2 min. in formalin, ½ pt. to 30 gals. water. Kept moist 1 hr.	17	92	344	none	none
None	18 check	90	330	109	25.
Sprinkled with formalin, 1 pt. to 30 gals. water. Kept moist 1 hr.	19	86	255	1	0.39
None	20 check	98	200	88	30.
Sprinkled with formalin, ½ pt. to 30 gals. water. Kept moist 1 hr.	21	84	345	1	0.2
None	22 check	98	262	81	24.
Sprinkled with formalin, 1 pt. to 40 gals. water. Kept moist 1 hr.	23	82	308	1	0.3
None	24 check	92	215	114	35.
Sprinkled with formalin, 1 pt. to 40 gals. water. Kept moist 2 hrs.	25	90	433	none	none
None	26 check	92	205	59	22.

lons of water, leaving the seed in a heap to retain the moisture, for 2 hours, then spreading out to dry before planting, will give satisfactory results in checking bunt and will not injure the seeds so as to reduce the yield of wheat, but that very strong solutions are to be avoided as calculated to reduce the yield by lowering the germination.

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