FIFTEENTH ANNUAL REPORT

OF THE

Kentucky Agricultural Experiment Station

OF THE

State College of Kentucky

LEXINGTON, KY.

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LETTER OF TRANSMITTAL

To His Excellency,

HON. J. C. W. BECKHAM,

Governor of Kentucky.

SIR:—

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

Very respectfully,

M. A. SCOVELL, *Director.*

Agricultural and Mechanical College of Kentucky

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C. W. MATHEWS, Horticulturist.
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W. H. SCHERFFIUS, Assistant Chemist.
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J. O. LA BACH, Chemist, Food Division.
GEORGE ROBERTS, Assistant Chemist.
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MISS MARY L. DIDLAKE, Ass't Entomologist and Botanist.
S. D. AVERITT, Assistant Chemist.
D. W. MAY, Animal Husbandry.

Address of the Station,
LEXINGTON, KENTUUCKY.

The Kentucky Agricultural Experiment Station

In Account with the United States Appropriation.

To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1902, as per Act of Congress, approved March 2, 1887. $15,000.00

Expeditures:

By salaries	$11,440.00	
Labor	1,187.62	
Publications	122.80	
Postage and stationery	179.45	
Freight and express	95.41	
Heat, light and water	26.82	
Chemical supplies	341.74	
Seed, plants and sundry supplies	144.23	
Library	919.45	
Tools, implements and machinery	71.95	
Furniture and fixtures	106.25	
Scientific apparatus	199.21	
Traveling expenses	14.48	
Contingent expenses	85.84	
Building and repairs	64.75	
		$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 ending June 30, 1902; that we found the same well kept and classified as above and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000.00 and the corresponding disbursements $15,000.00, for all of which proper vouchers are on file and have been by us examined and found correct.

And we further certify that the expenditures have been solely

for the purposes set forth in the Act of Congress, approved March 2, 1887.

(Signed)

D. F. FRAZEE,
GEO. B. KINKEAD,
Auditors.

(SEAL)

Attest:
D. C. FRAZEE.

ANNUAL REPORT OF THE

Kentucky Agricultural Experiment Station

FOR THE YEAR 1902

REPORT OF THE DIRECTOR

The work of the Station is divided into three parts:

1. The work of the Station proper.
2. The Fertilizer Control work.
3. The Food Control work.

The Work of the Station Proper.

CHEMICAL DIVISION.

Prof. A. M. Peter has had charge of the work of this division, assisted by Mr. S. D. Averitt and Mr. L. O. Beatty to October 1, when he left to accept a Fellowship in Columbia University. Mr. O. M. Shedd has been appointed in his place. 494 analyses have been made under Prof. Peter's direction, including:

Grasses, forage plants, feeding stuff, etc.	136
Sorghum cane juice in selecting seed	53
Sugar beets	32
Butter in connection with dairy experiments	10
Soils to determine what fertilizer is needed	29
Potable and mineral waters	59
Rocks, minerals, clays, etc.	78
Iron steel alloys, mostly for the Department of Mechanical Engineering	13
Coal and coke, mostly for the Department of Mechanical Engineering and Inspector of Mines	37

Samples in testing methods	12
Petroleum and kerosene oils	11
Miscellaneous materials	24
Total	494

Some of these results have been published in Bulletins Nos. 98, 99 and 101.

The study of the availability of plant food in soils is giving useful and interesting results. Besides the analyses mentioned above a large number of specimens of ores, minerals, rocks, clays, and other materials have been examined and reported upon for citizens of the State. Not infrequently we receive several of such specimens in a single day.

ENTOMOLOGICAL AND BOTANICAL DIVISION.

As heretofore, under the direction of Prof. Garman, forage plants have been given a large share of attention in this division during the year. The plots on the new addition of the Experiment Farm are affording a better opportunity of testing the various species of plants adapted in one way or another to furnish food for stock. Co-operative work in forage plants has been continued with the U. S. Department of Agriculture. We have now 173 plots on the Experiment Farm used in this connection, and Prof. Garman reports that we have now on hand for this spring's planting the finest assortment of annual forage plants that has been seen in the State.

Mr. W. G. Campbell has been employed to assist Prof. Garman in this co-operative work. The U. S. Department of Agriculture appropriated $500.00 towards such experiments for the fiscal year. This is used in part payment of Mr. Campbell's salary and in labor.

Experiments with the Hessian fly have been continued, and a bulletin, No. 103, has been published giving the results obtained in these experiments. The experiments still continue.

Experiments in spraying cabbage and tobacco with arsenites were carried out in the plots on the farm during the year. The study of insects injurious to grains and seeds has been continued. Grape insects have been given attention. In the line of fungus troubles, a knot disease on young apple trees has been investigated.

Several hundred grafts of different varieties have been obtained with which to carry out the experiments in this line. Prof. Garman is also studying the weeds of the State, especially those the seeds of which are found in our clover seeds, etc., and more especially to broom-rape of hemp and tobacco. The results of the broom-rape experiments will be published in Bulletin No. 105. It is hoped by a liberal use of potash salts, or even the use of common salt on the ground that is infested, the broom-rape seed may be destroyed.

Nursery inspection, as usual, occupied about six weeks of Prof. Garman's time during the year. Prof. Garman is charged with the enforcement of the law for the destruction of the San Jose Scale and the inspection of nurseries over the State, and this must be done once a year. The number of nurseries inspected last year was forty. Prof. Garman has also attended some farmers' institutes during the year.

Prof. Garman has had to assist him in his work Miss Mary L. Didlake, Mr. W. G. Campbell and Mr. E. P. Taylor, the latter succeeding Mr. T. L. Richmond, who resigned to accept a position in the Philippine Islands.

AGRICULTURAL DIVISION.

We have continued to put the farm in shape for experimental purposes. Many fences have been completed and the farm has been surveyed into various plots, and in that portion of it which we intend to use for plot experiments, roads have been run through —leaving plots of four acres between the roads. By dividing both ways this gives each one of the four acres one side to a road, and these acre plots can easily be subdivided into 1-10, making it very convenient for accurate experiments. Some tile draining has been done and we hope this summer to finish all interior fences.

The 48-acre farm, or the one first owned by the Station, has all been seeded down to grass.

Experiments have been continued on hemp and tobacco, especially as to the effect of different ingredients of commercial fertilizers. We find that on our land, fertilizers not only benefit hemp by increasing the yield, but also by giving better fibre, and we are enabled to increase the yield of tobacco on land which is not

freshly broken from blue grass sod. Experiments have also been made as to the planting of tobacco, or rather as to the distance of planting it apart. Last year's results showed us that we got the best tobacco, as to quality, where the rows were 3½ feet apart and the plants 12 inches apart in the row, but we obtained the largest yield where the rows were 3½ feet apart and the plants 16 inches apart in the row. The tobacco planted 12 inches apart in the row yielded an exceptionally large amount of cigarette wrapper.

The most interesting experiment in this line was growing tobacco under canvas. We grew 1-20 of an acre as an experiment in this way. It yielded at the rate of 2,000 pounds per acre. We sold it at 25c a pound to the Continental Tobacco Co. This company reports the quality excellent, and after we had picked out all the cigarette wrapper, they obtained 48 per cent. more cigarette wrapper from the remainder. The company is so much pleased with the experiment that it is now undertaking to grow some 10 or 12 acres in the State in like manner, and ask that we continue the experiment. Whether this can be produced economically or not depends, in my opinion, upon whether a system of fertilization can be found whereby we can continue to raise tobacco on the same ground year in and year out, as otherwise the cost of framing and putting on canvas would be too expensive. The frame work for the purpose of canvassing the field could be so constructed that it would last for years and a cotton is now being made which will last from two to three years.

DIVISION OF ANIMAL HUSBANDRY.

The studies in feeding and the influence of shelter and the methods of handling dairy cattle have been continued and the results of some of the experiments will be published in a bulletin soon.

A feeding test in fattening cattle has been commenced. For this purpose 32 steers were selected, averaging about 1,000 pounds each, and they were divided into eight lots of four steers each. One lot was given corn in the ear; another coarsely ground corn, including cob; a third lot was given ground corn and cotton seed meal; and a fourth lot, ground corn and gluten meal; fifth and

sixth lots were given corn and different proportions of dried distillery grain, etc.

Arrangements have been made with slaughter houses in Chicago to mark these steers as they are killed and give us data for the purpose of noting the quality of beef each makes.

Experiments have been begun in studying the immunity in Texas fever in cattle. The Station now has an immuned animal and equipments, and is now prepared to inoculate Kentucky cattle against Texas fever in order to facilitate southern trade in improved live stock.

A herd of Berkshire swine is being improved. Several experiments have been carried out with swine in studying the influence of certain mineral matters, especially lime, upon metabolism: namely, assimilation of nutrients by the animal body, rate of growth per pound of food consumption, composition of the bone, etc.

Studies in feeding, the influence of shelter and methods of handling dairy cattle have been continued. The new dairy barn has been completed with all modern equipment.

Fertilizer Control Work.

During the year some 673 analyses of fertilizers were made and 872,736 tags were printed, proof-read, counted, put up in packages from day to day and sent to various firms in such manner that no complaint has been made to us as to delay or mistake.

Our work in inspection increases yearly. We find especially in the remote parts of the State that tags are sometimes left off of the goods, and we find goods in some places that have not been properly registered. Good fertilizers are sought by farmers and when they find one that goes below the guarantee, such brand usually becomes unpopular. One firm has left the State since we suggested that none of its goods be purchased without first sending samples to us, as they generally fell below their guarantee. The farmers have the privilege of sending in samples of fertilizers and have them analyzed here free of charge. They are becoming acquainted with this provision of the law and we are receiving more samples for free analysis each year.

Mr. H. E. Curtis has charge of this work, assisted by Mr. W. H. Scherffius and Mr. Geo. Roberts.

Food Control Work.

Last year in order to more perfectly organize the work under this head, it was made a division of the Station and Mr. R. M. Allen was appointed Secretary and Executive in charge under my direction and Mr. J. O. LaBach chemist. Under this organization, Mr. Allen has charge of the office and of the inspection of samples and prepares cases for court. Mr. LaBach makes the chemical examinations and Prof. Garman, Entomologist and Botanist, makes most of the microscopical examinations. As all records in this department must be kept accurately and systematically, a file case card system has been adopted for keeping them. All important data concerning a sample, its label, chemical analysis, whether it is found adulterated or not, when reported to the County Attorney if adulterated, and court decision, are printed on the card.

During the year 453 samples have been taken and examined for adulteration. Of this number 256 have been found adulterated. The results with reference to each food product examined are as follows:

Sample.	Adulterated.	Not Adulterated.	Total.
Bread	0	1	1
Baking powder	30	2	32
Breakfast food	0	26	26
Butter	4	1	5
Canned fruits and vegetables	20	32	52
Canned meats and sausages	9	12	21
Cocoa	0	2	2
Coffee substitutes	0	2	2
Coloring	0	1	1
Flavoring extracts	17	0	17
Fountain drinks	6	0	6
Jellies and jams	24	2	26
Milk	0	9	9
Mince meats	9	7	16
Miscellaneous cereals	0	3	3
Lards	4	21	25
Pancake flour	0	3	3
Pepper mustard and pickles	9	6	15
Preservatives	1	0	1
Sugar, syrups and honey	14	25	39
Oleomargarine	7	0	7
Oysters	0	8	8

Tomato catsup	77	3	80
Vinegar	19	19	38
Feeds	6	12	18
Total	256	197	453

During the year 210 violations have been reported to the County Attorneys over the State, 108 of these have been settled, 2 verdicts of "not guilty" have been returned and 100 are yet to be dealt with. It has been our policy not to prosecute if we can avoid it, but to notify the manufacturers as soon as we ascertain that their goods are adulterated. This method has been very successful, for in most every instance the manufacturers have sent a representative here and requested us, after talking the matter over, to indicate how the label should be printed, or in some instances they have agreed to withdraw objectionable food from the State. In this line some of the largest meat packers have withdrawn objectionable sausage and have labeled lards "adulterated" or mixed with cotton seed oils and beef stearine whenever these products have been put into such lard.

We have given much attention to preserved fruits and we have found in many instances samples in which the percentage of fruit in can-goods was very small and a large percentage of sugar present. As sugars are much cheaper than fruits, this we hold is a method of adulteration. Preserves should contain at least 60 per cent of fruit, whereas we have found numerous cases in which less than 20 per cent. was present.

The coloring of tomato catsups and flavoring extracts and vinegars, etc., has been dealt with. This artificially coloring enables the manufacturers to adulterate, and yet cover up such adulterations. Manufacturers have been notified that artificial coloring must be stopped unless the words "artificially colored" are plainly made a part of the label. The flavoring extract question is being investigated at present. We had some difficulty in interesting the manufacturers in this matter until we brought several suits in the courts. This seemed to be all that was required, as the manufacturers promptly paid the fines and are now anxious to know just how to label. We have ruled that all flavoring extracts that are not made from genuine flavor shall be called "artificial," as "arti-

ficial vanilla," or "artificial lemon extract." This gives the buyer an opportunity to know whether he is buying genuine articles or otherwise. We have found lemon extracts containing only a trace of the true lemon oil.

In Louisville we have been ably assisted by Dr. M. K. Allen of the Health Department of Louisville, who has been taking up the work under a city ordinance, and Mr. Aaron Kohn, our attorney, has given him advice whenever asked for. Dr. Allen's work in Louisville has enabled us to more promptly inspect other towns in the State. We have taken up also in this division the inspection and analysis of feeding stuffs. We have found bran adulterated very extensively with corn cob meal and the matter is now in Mr. Kohn's hands for investigation.

It is my opinion that the enforcement of the Food Law has been of great material value to the State in the past year. From a conservative estimate from the information we have before us, I believe that the enforcement of the law has saved the State many hundred thousand dollars in the purchase of food products, besides almost shutting out entirely from the State articles which are known to be injurious to health which have heretofore been sold in the State. It is true that many adulterated articles of food are being sold and it may appear that they are on the market now more than ever before, but this is because they were sold as pure but now are labeled to show that they are adulterated. Such goods have to be sold cheaper now than before they were so branded. Manufacturers inform me that better grades of foods are coming into Kentucky than ever before, but that the prices remain the same.

While we are very much crowded in our present quarters, we are anticipating very commodious quarters in our new building which was ordered at the last meeting of the Board of Trustees. Plans and specifications are now being made for this building.

We have published during the year the following bulletins:

Bulletin No. 98—

Kentucky Forage Plants—

1. The Clovers and their Allies.
2. Notes on the True Grasses in the Plots in 1900-1901.

3. **Analyses of Forage Plants from the Plots.**

Bulletin No. 99.

Oats—

1. Test of Varieties.
2. Treatment for Smut.
3. Test of Fertilizers.
4. Relative Value of the Varieties for Feeding.

Bulletin No. 100.

Inspection and Analyses of Foods.

Bulletin No. 101.

A Comparison of Feeds for Pigs.

Bulletin No. 102.

Commercial Fertilizers.

Bulletin No. 103.

Hessian Fly Experiments.

Bulletin No. 104.

Commercial Fertilizers.

The bulletins published during the year are appended herewith and then follow the analyses pertaining to the general work of the Station which are thought desirable for publication (See page 283 et seq.). The analyses of forage plants from Bulletin No. 98 are here included with others made since the publication of that bulletin and with the addition of determinations of albuminoids. They have been recalculated to water-free and fresh condition, for better comparison. Particular attention is called to the analyses of fresh distillery slop, of which very few analyses are to be found in Station publications.

M. A. Scovell, *Director.*

KENTUCKY

AGRICULTURAL EXPERIMENT STATION

OF THE

State College of Kentucky.

BULLETIN No. 98.

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1. *Kentucky Forage Plants—The Clovers and their Allies.*
2. *Notes on True Grasses in the Plots in 1900-1901.*
3. *Analyses of Forage Plants from the Plots.*

LEXINGTON, KENTUCKY,

February 25, 1902.

KENTUCKY
Agricultural Experiment Station.

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M. A. SCOVELL, Director and Chemist.
A. M. PETER, H. E. CURTIS, } Chemists.
H. GARMAN, Entomologist and Botanist.
C. W. MATHEWS, Horticulturist.
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S. D. AVERITT, Ass't Chemist.
D. W. MAY, Animal Husbandman.

Address of the Station—LEXINGTON, KY.

NOTICE.

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

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

ADDRESS:
KENTUCKY AGRICULTURAL EXPERIMENT STATION,
LEXINGTON, KY.

BULLETIN No. 98.

I. Kentucky Forage Plants—The Clovers and their Allies.

By H. GARMAN, Entomologist and Botanist.

Bulletin 87, published by this Station in 1900, relates to the true grasses. Another group of forage plants, including clovers, next to the grasses in importance, and not second to them in some respects, is known under the family name Leguminosæ. These plants have a special importance because of their properties as green fertilizers and as nitrogen gatherers. This bulletin relates to such members of the family as are cultivated in Kentucky, to others that have been grown in plots on the Experiment Farm at Lexington, and to those found growing wild in the State. The number of these latter will doubtless be increased somewhat as we become better acquainted with our native flora. The list presented is considered only as a foundation for a more thoroughgoing account of our species, which we have in preparation.

The same plan of arranging the species is adopted as in Bulletin 87, the technical names being presented in alphabetical order, while an index including only common names is appended.

So much space is occupied in agricultural journals with discussions on the effect of clovers and their allies on soils, that it may seem like thrashing over very old straw to give the matter attention here. Farmers, it may be said, understand very well that these plants improve their land, and are ready to make use of them without caring very much how the improvement is brought about. It may be questioned if this attitude is one that is likely to contribute to an improved

agriculture. The explanations brought out by a study of plant physiology and of bacteriology may not be all they should be, but are the best we have, and will at least serve as a foundation for further investigation and thinking. Future work may lead to their complete overthrow or to their being more firmly established. Earnest students of these subjects are not likely to raise any serious objection to either result.

Yet in view of the care with which experiments have been made, showing that clovers and allied plants appropriate the free nitrogen of the air and thus put it within the reach of other plants, such as wheat and corn, that cannot draw upon this source of nitrogen, it may be considered very improbable that future investigations will greatly alter our conceptions of the part played by these plants in restoring to soils this important element.

Good reasons can be given for the belief that these plants do not take free nitrogen from the air by means of their leaves, and evidence has been recorded showing that they do not gain free nitrogen in any way unless certain knots or tubercles appear on their roots; that minute bacteria in the tubercles and not the plant itself, are the agents by which nitrogen of the air is fixed in the plant. A very brief review of investigations that have led to the accepted views on these points will help to a clearer understanding of the purpose of some observations and experiments on soy beans reported in what follows.

Leguminous Plants as Nitrogen Gatherers.

The peculiar renovating properties of the clovers have been known in practical agriculture for many years. A French chemist appears to have been first in the field with the purpose of finding an explanation. In 1837 Boussingault began numerous experiments with plants grown in sterilized soil, the plants themselves enclosed and sometimes surrounded with air that had been "washed." At one time, we are told, he held the opinion that nitrogen of the air was fixed in the soil by certain microscopic plants, but later abandoned this view, and finally as the result of many years' investigation con-

cluded that the higher plants cannot assimilate the free nitrogen of the air.

Messrs. Lawes and Gilbert, who became of recent years the leading British authorities on the subject, began work on the problem about the time Boussingault gave it up, in 1857. They also grew plants in sterilized soil under glass covers, and like him reached the conclusion that plants do not appropriate the free nitrogen of the air.

But this conclusion did not satisfy workers. Facts were being observed that could not be explained, assuming that plants do not get nitrogen from some other source than the soil, and the dissatisfaction led at length to renewed experiment. The American chemist, W. O. Atwater, was one of the first, possibly the first, to publish the conclusion based upon experimental evidence that after all some plants do take up the free nitrogen from the atmosphere. In the American Chemical Journal, Vol. 6. pages 365-388 (1884-5), he gives his data in detail, but makes no serious effort to explain just how the nitrogen is taken up.*

The best known work tending to demonstrate that free nitrogen is appropriated by leguminous plants was furnished by the Germans, Hellriegel and Willfarth. The former of these in 1883 grew various plants in washed quartz sand, adding nutrient solutions but no nitrogen. Then to a part of them he gave various known quantities of combined nitrogen. He found that ordinary grasses grew in proportion to the quantity of combined nitrogen supplied them, but that the Leguminosæ did not in all cases agree. Certain plants growing better than any of the others were found to have small nodules, or tubercles, on the roots. In conjunction with his colleague, he began to make use of soil extracts, simply shaking up rich garden soil in a vessel with water, then removing the soil and applying the water to certain plants under experiment. It was found that this treatment led to a good growth of the plants, with a development of nodules on the roots, and as a result of many such experiments they an-

* Atwater appears to have published his results before the American Association for the Advancement of Science in 1881.

nounced in 1886 that Leguminosæ thrive in soils with no nitrogen in them, if only the tubercles are developed, but that without tubercles the growth is poor and no free nitrogen is taken from the air.

Lawes and Gilbert took up the study again in 1888, and during this year and several following, obtained results completely confirming those obtained by the German writers mentioned. In summing up the results of their later work they write (Journal of the Royal Society of Agriculture of England, 3d Series, Vol. 2, 1891, p. 689), "Reviewing the whole of the results which have been brought forward, there can be no doubt that the fact of fixation of free nitrogen in the growth of Leguminosæ under the influence of suitable microbe infection of the soil, and of the resulting nodule-formation on the roots, may be considered as fully established."

The importance of the conclusion reached by these men is not yet fully appreciated by farmers. Nitrogen in some form is essential to the proper growth of plants. It is one of the most costly fertilizing materials when supplied artificially. Yet here is a supply ready to every farmer's hand. He cannot draw on it with wheat or corn or oats; but clover, soy beans, and alfalfa, capture it and place it at his disposal. In the light of this explanation, we may read with a better understanding the words of Monsieur Georges Ville (Artificial Manures, 1882, p. 37), "It cannot be too often repeated that it is one of the secrets of profitable farming, to draw from the air as much nitrogen as possible by the alternation of crops."

The Tubercles.

The root nodules, or tubercles, of clovers and cowpeas are familiar to most farmers. They vary much in shape and average size with the plant on which they grow. On the hairy vetch (*Vicia villosa*) they are variously lobed, young galls frequently consisting of three or four rather slender processes loosely attached to a rootlet, and older galls having numerous lobes, making the general surface very uneven. The diameter of some of those observed in our plots was 5-16 inch. The tubercles formed on the roots of soy beans are

very different, looking like minute potatoes. They are frequently quite spherical, the surface rather smooth, sometimes with a few obscure impressed lines, occasionally with the surface decidedly impressed in places, producing coarse folds. When cut open early in the season the cut surfaces are of a peculiar reddish brown or brick-red color. Late in the fall the cut surfaces are greenish, and as the plants dry out, the tubercles blacken and shrivel, becoming at length coated with a whitish mould-like fungus. They are juicy and rather soft at first, often with an appearance of a small central cavity. The diameter varies from about 1-16 to 5-16 inch. Large numbers are produced on a single plant, some on the central root, others far out on the lateral fibrous branches. On clover, the galls are oval in shape and only about 1-16 inch long.

Tubercles similar to those occurring on the roots of leguminous plants are found on the roots of some plants of other families, and are probably in some cases due to similar organisms. Some others are the result of the invasion of the roots by microscopic plants recognized as fungi proper. Still others are due to attacks by microscopic worms, one of the best known of which is *Heterodera radicola*, of cucumbers, lettuce and other plants.

The Bacteria Causing the Tubercles.

The organisms living in the nodules were recognized as bacteria as early as 1866. Later, and quite recently, the exact nature of the organisms was in dispute, some naturalists considering them fungi, under the genus name Rhizobia, others regarding them as true, though in some features of structure and development, exceptional bacteria. At present the latter view is quite generally held by bacteriologists. The name *Bacillus radicicola* was applied to them in 1888 and is now in common use. Each genus of Leguminosæ appears to harbor an organism in some ways different from those living on others, but yet so much alike that they cannot in all cases be distinguished. Most of them are coming to be regarded as varieties of one species, and in conformity with this view it is held that bacteria producing nodules on clover, for example,

will in time also produce them on other closely related plants that may be planted in soil previously occupied by clover.

How the Bacteria Get Into the Roots.

The life history of the organisms has recently been studied with some care. They have been found to invade the roots by way of the root hairs, making for themselves a slender passage down the centers of the hairs until the root proper is reached in which they occupy larger passages bearing at first some resemblance to the growing threads of a fungus. It was the thread-like appearance of these larger passages that led early investigators to consider them an essential part of the organism, the bacteria being looked upon as reproductive bodies.

The Effect of the Absence of Nodule Bacteria from Soil.

Since it is by the aid of the bacteria that clovers and other leguminous plants can live and thrive in soils containing no combined nitrogen, it has been suspected that in some cases when clovers fail to do well it is because the nodule-producing bacteria are absent, and that by introducing them the plants will be enabled to grow. This matter has now been pretty thoroughly investigated in European countries, and to some extent also in this country. It has been found that land is often greatly improved for clover simply by sowing it with soil taken from good clover land, and thus introducing the nodule-producing bacteria. The method is somewhat inconvenient in practice and has other defects, such as introducing fungus or other pests with the *Bacillus radicicola*.

The Bacteria May be Sown by Means of Cultures.

Any way the use of pure cultures was bound to be considered, and has for some years been tried. Beyerinck, who first described the organisms as true bacteria, appears to have made such cultures previous to 1888. In this country Prof. Atkinson, of Cornell University, made cultures about 1889 from tubercles on the roots of vetches. Dr. Nobbe, of Thar-

and, Saxony, about 1896, began the preparation of cultures of the organisms of leguminous crops on a commercial scale, and they were at one time obtainable in this country, and were to some slight extent employed here in an experimental way. Recent inquiry with reference to obtaining cultures for experiment at this Station, however, disclosed the fact that they could no longer be secured through the representatives of the German manufacturer, and it was only through the kindness of Dr. L. Hiltner, of Berlin, that fresh cultures were finally obtained. These were tested last summer on the Experiment Farm, in the case of soy beans with a success that was quite surprising, considering all the difficulties in the way of sending the living bacteria such a long distance. Further reference to these cultures will be found under the heads of red clover, alfalfa, and soy beans.

The Dissemination of the Bacteria by Natural Means.

The nodule bacteria of our most commonly cultivated leguminous plants, such as garden peas, beans and clover, seem to be quite generally distributed in the soils of the State. This is what would be expected from the fact that these plants have for a long period been cultivated here. In the case of plants which are not generally grown, soy beans for example, tubercles can not be expected to appear on the roots the first year of planting on ground new to the plant, unless bacteria are introduced. This has been the experience in our forage plant plots at Lexington, at any rate. The second year of planting on the same ground the tubercles are always abundant, though nothing is done to encourage them. The bacteria are perhaps carried about to some extent in the air. Atwater and Woods report* that they found tubercles on some plants grown in sterilized soil and kept moist with sterilized water, and suppose the organisms to have been conveyed in the air from a neighboring garden. It has been observed in our plots, however, that the special bacteria of new forage plants remain very closely restricted to soil in

*Bulletin 5, Storrs School of Agriculture Experiment Station, 1889.

which such plants are grown, not even crossing a three-foot path to plants of the same sort. For a whole season two plots from the same lot of seed have stood thus side by side, the one with roots loaded with tubercles, the other with none. One would expect that particles of earth carried on tools used in working the plots and on the shoes of workmen would inevitably inoculate the new plots, but no evidence of this has been witnessed. It may be that the destructive effect of sunlight and drought on the bacteria in the surface layer of soil accounts for these facts, in which case we can hardly suppose the bacteria would, in their growing state at any rate, survive dissemination in the atmosphere. It has seemed to me from observations of this sort that the bacteria must be scattered chiefly, if not entirely, during cool, moist weather, in fall and spring, by the washing of soils, otherwise they would surely appear before the end of a summer in new plots standing beside old ones. But this does not explain the sudden appearance of the special bacteria adapted to soy beans in an isolated plot of ground, while land all about remains free from them. It must be assumed in such cases that the organisms of some commonly grown plant become adapted to the soy bean, that by virtue of some change either in the soy bean or in the bacteria, the association of the two becomes possible after the first season.

Other Nitrogen-Fixing Plants.

It has been shown by Dr. Hiltner that some other plants (alders among them) besides the Leguminosæ fix nitrogen of the air with the aid of the bacteria residing in tubercles on their roots. Certain of the lower green plants (Algæ and mosses) which grow on the surfaces of moist soils have been thought to appropriate free nitrogen without aid from bacteria; but results obtained in experiments with these plants have been criticised because the growths under experiment were not freed from bacteria, these latter being assumed by critics to have secured the nitrogen while getting the carbon from the Algæ, the association of the two being thus similar in charac-

ter to that of tubercle bacteria and clovers. At any rate the tendency for some time past has been to consider the evidence of fixation by Algæ and mosses as not completely satisfactory.

Nitrifying Bacteria.

The bacteria producing tubercles on the roots of clovers and cowpeas are very different from those described by the naturalist Winogradsky, and which he obtained in 1891 from soil, and succeeded in growing in pure cultures on a medium containing soluble silicates. These nitrobacteria are of three sorts, one of which (Nitrosomonas) attacks organic matter at a certain stage of decay, producing nitrites, after which, acting on the nitrites, a second form (Nitrobacter) produces the nitrates which are assimilated by growing crops. It thus appears that the plants employed for crops are completely dependent on lowly soil-inhabiting bacteria; upon the nodule-forming species for the free nitrogen obtained from the air; and upon the nitrobacteria of Winogradsky for rendering nitrogenous material already in the soil available as plant food.

Bacterial Cultures for Wheat and Corn.

Of late a preparation known as "alinit" has been distributed to stations in this country by a European manufacturer*, which is claimed to encourage the growth of wheat and allied plants by its action on nitrogenous materials in the soil, its effect being like that produced by the Nitrosomonas and Nitrobacter of Winogradsky. Samples received at this Station last summer were put up in small vials of brown glass, each vial containing enough for an acre of ground. The brown powdery contents include with other material compact masses of an organism that may easily be the Nitrosomonas. The enterprise appears to be an effort to utilize Winogradsky's discoveries. The preparation has not been tested by us in a practical way. A French worker, Malpeaux, has recently announced that he has obtained results from pot experiments indicating that alinit has a beneficial effect in soil very rich in

*Friedr. Bayer & Co., Elberfeld, Germany.

organic matter, but that it has no such effect on cultivated land*. I have called attention to it here merely to point out that it is not like tubercle bacteria, calculated to increase the nitrogenous matter in the soil, but only to render available to growing crops certain fertilizing materials already present.

Useful Literature Relating to Nitrogen-Fixing and Nitrifying Bacteria.

Following are the titles of a few of the most commonly accessible articles on the action of bacteria in providing and preparing food for the higher plants. For the farmer, numbers 2, 3, 8 and 9 give information of special value. The agricultural student will find numbers 1, 4, 5 and 6 highly interesting.

1. W. O. Atwater, The Acquisition of Atmospheric Nitrogen by Plants: American Chemical Journal, Vol. 6, pp. 365-388 (1884-5).

2. J. B. Lawes, and J. H. Gilbert, The Sources of the Nitrogen of our Leguminous Crops: Journal of the Royal Agricultural Society, Vol. 2, 3d Series, p. 657 (1891).

3. R. Warington, Lectures delivered before the Association of Agricultural Colleges and Experiment Stations: Bulletin 8, Office of Experiment Stations, U. S. Dep. Agr. (1892).

4. Albert Schneider, Observations on some American Rhizobia: Bulletin Torrey Botanical Club, Vol. 19, p. 205 (1892).

5. Albert Schneider, A New Factor in Economic Agriculture: Bulletin 29, University of Illinois Agricultural Experiment Station, p. 301 (1893).

6. G. F. Atkinson, Contribution to the Biology of the Organism Causing Leguminous Tubercles: Botanical Gazette, Vol. 18, pp. 157, 226, 257 (1893).

7. R. Warington, Contribution to Recent Investigations upon Nitrification: Agricultural Science, Vol. 7, p. 34 (1893).

8. J. Augustus Voelcker, "Nitragin" or the Use of "Pure Cultivation" Bacteria for Leguminous Crops: Journal Royal Agricultural Society, Vol. 7, 3rd Series, p. 253 (1896).

9. P. P. Deherain, Origin and Formation of Organic Matter

*Journal Royal Microscopical Society, 1901, p. 577 (abstract).

in Plants: Experiment Station Record, Vol. 9, p. 903 (1898).

10. E. F. Smith, Notice of a paper by O. Zinsser on the root-tubercles of Leguminosæ: American Naturalist, Vol. 32, p. 365 (1898).

11. H. von Schrenck, Notice of a paper by L. Hiltner on root-tubercles of alders and Eleagnaceæ: American Naturalist, Vol. 33, p. 450 (1899).

The Characters of the Clovers and Allied Plants.

While these Plants are often used for hay and pasturage in the same manner as grasses, they are very different in their botanical characters from true grasses. Plants belonging here generally have leaves composed of divisions known as leaflets, irregular, perfect flowers, often very showy and attractive to insects, the seeds generally enclosed in a single-celled pod or legume.*

Many valuable plants besides those used for forage belong to the group: Indigo comes from one; gum-arabic from a second; rosewood from another; and the dye, logwood, from still another. It includes also some species, such as the Darling pea of Australia, that are accused of poisoning stock.

List of Kentucky Leguminosae, with Notes.

Acuan illinoensis (Illinois Mimosa).—An erect herb with finely divided leaves and clustered pods. Credited to Kentucky by several authors. Observed in cultivation at Lexington. Said to be eaten by stock turned out on bottom lands.

Amorpha fruticosa (False Indigo).—A shrub often seen about lawns. Probably of no great value as forage. Perhaps native also, since it was credited to Kentucky by Short and Peter.

Anthyllis vulneraria (Kidney Vetch).—European. Thrives on dry and rather poor soils, where it furnishes good pasture for sheep. It has the general habit of the clovers, being inclined to grow in tufts, the upper stem leaves with slender divisions, the yellow flower-clusters about the size of red clover

*The word legume is sometimes applied to *plants* of the family; thus, clover, alfalfa and cowpeas are by this usage, legumes.

heads, but broader in proportion to the length. It has been grown twice in plots on the Experiment Farm, and presented a very pretty appearance the second season in both cases, but did not last. It was planted April 25, in one case, and May 19, in another. The first season the leaves were rather short, and no blossoms were developed. The second season in both cases it bloomed freely, being in one planting at its best June 13, and in the other, May 23, the difference being the result of different weather conditions. But one yearly cutting can be secured from it on our soil. From our experience with it, I would commend the plant as worthy of trial in a small way by farmers living in hilly sections where there is some sand in the soil.

Apios apios (GROUND-NUT).—A perennial vine, observed along the Kentucky River.

Apios priceana.—A species collected in the State by Miss Sadie F. Price, of Bowling Green.

Astragalus carolinianus (CAROLINA MILK VETCH).—A native plant credited to Kentucky by Drs. Short and Peter.

Baptisia alba (WHITE WILD INDIGO).—Kentucky (Short and Peter).

Baptisia leucantha (LARGE WHITE WILD INDIGO).—Kentucky (Britton and Brown).

Baptisia tinctoria (WILD INDIGO).—Kentucky (Britton and Brown).

Cassia chamæcrista (PARTRIDGE PEA).—An annual, with numerous very small leaflets and bright yellow flowers. Common locally in Western Kentucky.

Cassia marylandica (WILD SENNA).—Coarser and taller than the preceding species, and perennial. Frequent. Occurs through the State.

Cassia nictitans (SENSITIVE PEA).—Eastern Kentucky. A specimen in the Station collection was collected by Prof. A. R. Crandall; another from Jackson County was collected by Mr. G. M. Sullivan.

Cassia tora (LOW SENNA).—Kentucky (Short and Peter).

Cercis canadensis (RED-BUD).—This well known tree is

very common in Kentucky, being especially abundant along the Kentucky River.

Cladrastis lutea (YELLOW-WOOD).—The yellow-wood is becoming scarce in Kentucky, though young trees from 10 to 15 feet in height, and 1½ to 2 inches in diameter of trunk can still be found in some numbers on the cliffs of Kentucky River in Jessamine County. The tree is well worthy of cultivation. Flowers white, like those of black locust, but the cluster more straggling, and often 15 inches long. Leaflets of young growth often 5 to 6 inches in length.

Clitoria mariana (BUTTERFLY PEA).—A specimen in the collection was collected at Cumberland Falls by Prof. C. W. Mathews.

Cracca spicata (GOAT'S RUE).—Collected at Cumberland Falls by Prof. Mathews.

Cracca virginiana (CAT-GUT, GOAT'S RUE).—Frequent on hill tops throughout much of Kentucky. The seeds sometimes badly infested with a small snout-beetle. Aden Springs; King's Mountain; Cloverport.

Cytisus scoparius (SCOTCH BROOM, HAGWEED).—This has been grown in the Vivarium of this Division, but does not seem calculated to be of value for forage. It is a coarse, straggling plant, with scant foliage and woody stems, such that they could only be browsed while young. It has been recommended as a soil renovator for rather arid regions.

Falcata comosa (HOG PEANUT).—A perennial vine credited to the State by Kearney.

Falcata pitcheri (HOG PEANUT).—A perennial vine. Clay's Ferry, August 22, 1892.

Galactia volubilis (DOWNY MILK PEA).—Kentucky (Miss Sadie F. Price, also Britton and Brown).

Gleditschia aquatica (WATER LOCUST).—Collected by me only along the Mississippi River in Western Kentucky.

Gleditschia triacanthos (HONEY LOCUST).—A very common tree throughout Kentucky.

Gymnocladus dioicus (KENTUCKY COFFEE-TREE, COFFEE BEAN).—One of the most characteristic trees of Blue-grass

Kentucky in woodland pastures, where the large pods become conspicuous during the fall and early winter months.

Glycine hispida (SOY BEAN, SOJA BEAN).—This forage plant caught the attention of Kentucky farmers recently, and has risen rapidly in favor; promising in the end to displace the cowpea. Its upright growth gives it the advantage of cowpeas in cutting and curing. It makes good hay and silage, is a convenient soiling crop, and the seeds make good feed for most stock. They make a very acceptable dish for the table also, either picked green or when thoroughly ripe. The plant is a soil renovator, and endures severe drought well. In short, it has more good qualities than any other forage plant that has recently engaged the attention of our farmers.

The soy bean is an annual, with a strong central root, broad leaves, somewhat like those of ordinary beans, small purplish flowers, and short, downy, few-seeded pods, clustered in large numbers along the main branches; the seeds small, roundish generally, though in some varieties flattened like navy beans, resembling in a general way the seeds of the common garden pea, but with a long scar and the surface never indented. In color the seeds vary from white through shades of yellow and green to black.

The plants may be dwarf and early-maturing, or medium, 3 to 3½ feet high, or late and tall, reaching a height of 3½ to 4 feet or more, and maturing their seeds so late that at this latitude they are likely to be caught by frosts. A moderately early yellow, or green pea is best adapted to the State.

Soy beans should never be sown until the soil is thoroughly warm. Plots planted on the Experiment Farm with the idea of giving them an early start have not done as well as those planted two weeks or a month later. They are hot weather plants. Immediately after planting corn is generally a good time to put the seeds in the ground. If planted for seed, sow with a grain drill, stopping up the holes so as to make rows about 32 inches apart. When grown for hay, or soiling, they may be drilled like wheat, using about 5 pecks of seeds to the acre; but they are vigorous plants, and even for hay

better results will generally be obtained by giving them more room. They may be cultivated with a weeder, or one-horse cultivator, at the outset; later they cover the ground and take care of themselves until ready to cut. The cutting can be done with a special bean harvester, if the soil is soft enough to permit, or with an ordinary mower, though it should be remembered that the stems become tough and hard to cut as the plant ripens, and on this account it is well not to delay the harvest longer than is necessary. For hay, the plants may be cut soon after they begin to blossom; for silage, as soon as the pods are developed and before they are ripe. If grown for seed it is well to harvest as soon as the seeds are ripe and before the pods dry out and begin to split, otherwise much of the crop may be scattered in the field, or lost in handling.

Yield. The yield of seeds and hay varies much with variety, season, soil, and culture. Our best yield was obtained from seed imported from Japan by the United States Department of Agriculture, and sent us numbered 4913. In 1900 this variety yielded at the rate of 26⅔ bushels per acre, the plants without tubercles. In 1901 some of the seed of this variety, sown in the same plot as in 1900, yielded at the rate of 36 bushels per acre, the plants bearing many root tubercles. Some of this same home-grown seed was planted also in new ground in 1901, and yielded 34⅔ bushels per acre, the plants being without tubercles. Some of the original imported seed left over from 1900 was planted in ground new to soy beans in 1901 and yielded, without developing tubercles, at the rate of 40 bushels to the acre. It must be added that plants were at various times during the summer taken from these plots, sometimes to examine the roots, sometimes for chemical analysis, occasionally for photography and herbarium specimens, and the yield was therefore somewhat reduced, and perhaps not to the same extent in all of the plots. The final yield of seed obtained in October is thus rather below what this variety can do in a good soil during a trying season.

A second variety of yellow soy bean (No. 4912 of the U. S. Dep. Agr.) does not average as well as 4913, though one of

the plots yielded in 1901 at the rate of 40 bushels per acre. In 1900 this variety yielded at the rate of 35⅓ bushels per acre.

Two other varieties grown in the plots are too late for the production of seed, but in 1900 were favored by a prolonged open fall, and mature seeds were secured from both. One of these (No. 4914, U. S. Dep. Agr.) produced seeds at the rate of 34⅔ bushels per acre, while the other (Seed bought of J. M. Thorburn & Co.) yielded only 20½ bushels per acre. Both of these late varieties would make good hay or silage.

Two plots of 4914 were cut in 1901, and yielded green fodder at the rate, respectively, of 14.08 and 11.84 tons per acre, and dry fodder at the rates of 6.16 and 5.44 tons per acre. They were cut (Sep. 18) when pretty well matured, hence the yield is greater than can be expected in field work, where the plants are commonly cut when in bloom.

Its value as forage. The readiness with which stock of all kinds eats the soy bean, fed as green fodder, as silage, or as hay, is good evidence concerning its food value. Barring cases of perverted appetite, animals prefer for food that which affords them most nourishment. Chemical analysis, while admitted not to be the final test, strongly confirms evidence of other sorts. It shows that the plant contains a somewhat higher percentage of the materials that produce muscle and fat than does the cowpea. Actual feeding tests made so as to exclude as far as possible chances of error, show that soy beans are a nourishing food. Professors Voorhees and Lane, of the New Jersey Station, give the following as the result of tests of soy beans and cowpeas:

DIGESTIBLE FOOD PER TON.

	Fat, lbs.	Protein, lbs.	Carbohydrates, lbs.
Soy beans	6.6	34.2	174.0
Cowpeas	6.0	28.8	119.0

Its value as a fertilizer. Without any very exact data at hand as a basis for comparison, it may still be said without danger of going far wrong that soy beans have the same effect as a green fertilizer as cowpeas.

If the number of tubercles produced on the roots shows its value for this purpose, from my own experience I should consider it the better plant of the two. But farmers are liable to make the mistake of assuming from a first year's experience that the soy bean will not develop tubercles on their land. In 1900 four varieties were grown in our forage plots, and all made a fine growth. But none of the plants developed nodules. They were dug up with special care to avoid the chance of breaking the nodules off and leaving them in the soil. None were found. In the spring of 1901 three of these plots were planted with seed gathered from them in the fall of 1900. The fourth plot was some distance away in 1900, and it was decided to plant seeds obtained from it next the other three. The plot chosen for this seed bore in 1900 an imperfect stand of blue lupines. To my surprise the plants in the three plots that had borne soy beans in 1900 produced tubercles in 1901 in large numbers, while on those of the third plot, which, so far as known, had never before borne soy beans, not a single tubercle was to be found.

Other plots planted from the same lots of seed, but in another section of the forage plant garden, where soy beans had not before been grown, bore no tubercles in 1901. Several plantings of considerable extent on another part of the farm and from seeds obtained from various sources, also produced no nodules. The soils in which all these plants grew contained more or less nitrogenous material, and those with no tubercles appeared to thrive as well as the others. If combined nitrogen had been wanting in the soils it is probable that the beans planted on new land would have failed.

Just why the tubercles should not appear the first year and should appear in large numbers the second, is not at present easy to explain. But the fact is important as offering an explanation of the disappointment which some farmers experience with the plant. *Planting a second season on the same land appears to be necessary to get the soy bean at work as a nitrogen fixer.* In soils deficient in combined nitrogen, the crop is at first likely to languish because of failure to develop root nodules.

The nodules can be grown artificially the first season. It

was demonstrated in our plots in 1901 that the tubercles can be grown in great numbers on the roots of soy beans by the use of pure cultures of the tubercle bacteria. Through the kindness of Dr. L. Hiltner, of Berlin, Germany, I received in June, 1901, test tubes containing cultures of bacteria for soy beans, red clover, and alfalfa. It was too late when they arrived to get fair tests of the cultures on red clover and alfalfa, and the attempts failed. On the soy bean the time appeared to be most opportune. The growth in one of the tubes was turned into a small beaker containing enough distilled water to moisten thoroughly seeds sufficient to plant 1-80 acre. The gelatine bearing the growth was broken up so as to mix the bacteria with the water. After sprinkling the soy beans with this, they were mixed with sand and set away in a dark cupboard until ready to plant. The sand and seeds together were then sown in drills, and beside the plot another 1-80 acre was sown with untreated seed. Both lots grew off well, with no apparent difference above ground in the plants of the two plots. But when about eight inches high, tubercles began to appear on the roots of the treated lot and a little later they became thickly covered. Probably not a plant was entirely free from them. The plants in the adjacent check lot produced no tubercles during the season.

The experiment was a complete success, and if I may judge by these results, the cultures for clover and alfalfa would also have succeeded if tried at the proper season for sowing these plants. I wish to acknowledge here the kindness of Dr. Hiltner, and to thank him for this opportunity to test the cultures.

Insect and other enemies. At present the plants are attacked by but few insects, and appear to be equally free from fungus enemies. Grasshoppers (mostly the red-legged grasshopper) gnawed the leaves during a dry period last summer, and a reddish brown hairy caterpillar (*Spilosoma virginica*) at one time ate numerous holes in the leaves of both soy beans and cowpeas, but was destroyed later by a parasitic fungus (Empusa) that left the dried bodies in large numbers sticking to the leaves. A few leaf-mines were ob-

served at one time, occupied by the grubs of a small beetle (Odontota sp.). The character of the grubs as well as the egg-mass at the edge of each mine, showed this to be a near relative of our locust leaf-miner (*Odontota dorsalis*), but it was impossible to rear the grubs to maturity and thus identify the species, because of the quickness with which the leaves dry out. My record with reference to them, made July 19, reads: Occasional brown blotches on upper sides of leaflets, reaching a diameter of ¾ inch and occupied by 3-5 flat larvæ, which can be seen by holding the leaf up to the light, busily gnawing away the green substance between the upper and under cuticles. On the under side of each mine is a blackish mass of eggs, covered with gum so as to conceal its true nature.

In a single case the leaflets of a plant were drawn together by an active worm, the young of some leaf-folding moth.

A few plants of one plot were found to have the bean root-louse (*Tychea phaseoli*) on the underground parts of the stems.

Kraunhia frutescens (American Wisteria).—A woody vine, frequently seen in cultivation about verandas.

Kuhnistera candida (White Prairie-clover).—Kentucky (Short and Peter).

Kuhnistera foliosa (Leafy Prairie-clover).—Kentucky (Britton and Brown).

Kuhnistera purpurea (Violet Prairie-clover).—Kentucky (Short and Peter).

Lathyrus palustris (Marsh Vetchling). — Kentucky (Short and Peter).

Lathyrus sylvestris (Flat Pea).—A trailing perennial, introduced from Europe. Grown in our plots it has not done well, producing only a small amount of forage, and appearing to suffer from heat. The roots are very thick and strong, however, and would be thought to render it a good drought resister. We have never secured enough forage to give it a fair test with stock, but others report it as not relished, though chemical analysis shows it to stand well as regards nutrient constituents. It did not develop flowers at any time in the plot.

Lespedeza angustifolia (NARROW-LEAVED BUSH-CLOVER).—Kentucky (Short and Peter).

Lespedeza frutescens (WAND-LIKE BUSH-CLOVER).—Junction City, June 19, 1892.

Lespedeza hirta (HAIRY BUSH-CLOVER).—Frequent in the mountainous sections of the eastern part of the State. Reported by Col. Jay H. Northup, of Louisa, as relished by stock.

Lespedeza nuttallii (NUTTALL'S BUSH-CLOVER).—Collected in Lawrence County, in 1894, by Professor A. R. Crandall.

Lespedeza striata (JAPAN CLOVER).—As seen growing along roadsides in southern and western Kentucky this is a low straggling plant, with light green foliage, generally grazed close to the ground by roaming stock. It is an introduced annual and furnishes a very good forage in sections where the soil does not furnish much forage of other sorts. In the northern counties it does not persist, being killed by frost and apparently generally failing to mature its seed. It has been tried several times in our plots. Sometimes the seed failed to germinate. Only once was a good stand secured, and no trace of plants was to be seen the next season, though the land was left undisturbed in the hope that some dropped seeds were left in the soil. It is a nitrogen fixer and soil improver and hence proves a boon where it grows spontaneously. It has been noted as especially common at Nortonville, Adairsville and Clinton.

Lespedeza stuvei (STUVE'S BUSH-CLOVER).—Kentucky (Miss Price.

Lespedeza violacea (BUSH-CLOVER).—Kentucky (Short and Peter).

Lespedeza virginica (SLENDER BUSH-CLOVER).—(Kentucky) Kearney.

Lupinus albus (WHITE LUPINE).—This is an annual European forage plant grown for the purpose of enriching soils. It was planted in one of our plots in 1900 and made a fine stand of thrifty plants averaging, June 29, about 31 inches in height. The pods are about 3½ inches long and ¾ inch wide. The seeds large (7-16 inch in diameter), flat, and of a

pinkish white color. It is a nitrogen fixer, and from our experience with it would seem calculated to serve well in poor soils as a green manure. The seeds are not edible, being bitter, but the young plants may be fed to stock.

Lupinus hirsutus (BLUE LUPINE).—This is grown for the same purpose as the white lupine, but in our plots proved a much slighter and less vigorous plant, with very slender (linear) leaflets. Height about two feet. Pods in a terminal cluster, 1¾ inch long. Seeds much smaller and rounder than those of the white lupine, of a gray blue color, mottled with white. The seed did not germinate well, and only a few plants were secured.

Lupinus luteus (YELLOW LUPINE).—This plant is somewhat like the preceding. Leaflets nine, linear-oblanceolate. Flowers yellow. Whole plant gray, and about 11 inches high in plot, with a very long tap-root measuring 13 inches in a plant pulled up by hand. The seeds did not germinate well, and the few plants secured did not thrive. Seeds about the same size as those of the blue lupine (¼ inch in greater diameter), but flatter. Yellow, speckled with black. Both plant and seeds make good feed for stock. The lime in our soil may explain its failure in the plots, since it is said to be partial to sandy soils.

Medicago lupulina (BLACK MEDICK).—A rather slight, introduced annual clover, in our plots not producing as much forage as white clover, and otherwise not very promising. Flower clusters rather less than ¼ inch in diameter and bright yellow, appearing about May 23, when the average height of plants is about 8 inches. Some plants came up the second season, but it is practically an annual here. The plant is frequently found along roads and in fields, growing spontaneously, the seeds having been scattered with other clover or grass seeds.

The seeds, contained in black pods (coiled at tips), are ripe June 20. The seeds themselves resemble very closely those of red clover, but can be distinguished by the presence of a small prominence or tubercle next the scar. They are said to be

used extensively for the adulteration of red clover seed, which may account for the frequent appearance of plants in cultivated ground. Insects do not attack it as much as they do red clover, which is to be regarded as an indication that it is not as palatable for stock, since insects in the plots generally eat most freely of the most valuable forage. This clover is highly valued in some parts of England for sheep pasture, and is there known according to Sowerby as shamrock and black nonesuch. An analysis published by Professors Jenkins and Winton is as follows:

Water, 78.52; ash, 1.37; protein, 3.40; fiber, 6.31; nitrogen free extract, 9.29; fat, 1.11.

Medicago sativa (ALFALFA, LUCERNE).—While this well-known forage plant has not on the Experiment Farm given us reason to feel enthusiastic about it as forage for Blue-grass Kentucky, it has yet given evidence of possessing some very exceptional qualities that may render it even here useful on occasion. In some sections of the State farther west it has been found of great value as forage for beef cattle. Mr. J. J. Botto, of Boston, Nelson County, has had special proof of its value for this purpose, and is disposed to rate it very high. His soil, he tells me, is second bottom land. But it is well to keep in mind the fact that alfalfa requires *good deep soil*, not too wet, and that yields which some have secured from such land can not be obtained from heavy, shallow, imperfectly drained, clayey soils. I have concluded from my experience with it that our subsoil is too hard, and contains too little available food to suit its very long and deeply penetrating roots. It appears not to develop root-nodules in any numbers.

But it lasts well, better than red clover, and after the first year stands drought pretty well, although we can always see in it the effect of protracted dry weather. Farmers who may try it are likely to be disappointed with it the first season. The plants are at first rather slight, and late in the season may lose much of their leafage. The second season, when their roots have pushed deeper into the soil and are stronger, they present a much better appearance and will yield several cuttings of hay. The mistake made in our plots at first was in

not cutting often enough. The plants appear to do better when cut frequently, and even when from drought the yield may be scant, it is often best to remove the growth present, since once it has ceased growing it appears not to recommence readily unless the old growth is removed.

Root nodules are not common in our plots, and an attempt to introduce them last summer gave no results.

It is about as nearly perennial as any of the leguminous forage plants. A plot of ordinary alfalfa from seed, bought of an eastern seedsman, was started in the spring of 1892, and was still growing in the spring of 1901, when it was made part of a paddock for stock. Hogs turned into the enclosure at once attacked this alfalfa, and had soon not only removed what was above ground, but had stirred up the surface soil to get as much of the plant as possible. Alfalfa plainly cannot stand such "grazing" as these animals do.

Some notes giving the record of this plot may be worth presenting here as showing what may be expected of alfalfa from year to year in this part of Kentucky.

May 13, 1893.—A dense and uniform growth. 10 inches high. No flowers.

June 13, 1893.—A splendid growth. Very uniform and thick. With purple flowers. Average height 1 ft., 10 inches. Occasional stalks reaching a height of 2 ft., 9 inches. Flower clusters 0.58 inch in length and the same in diameter. Leaflets 0.72-0.92 inch long. Stems smooth and round, 0.12 inch in diameter. Should make fine hay.

July 19, 1893.—This was cut some time ago and has since grown up again, looking fresh and green. Averages about 1 foot in height. A few flowers.

Aug. 8, 1893.—A good, uniform growth 10 inches high. Has suffered some from drought.

Aug. 26, 1893.—Has suffered from drought. Dropped most of its leaves. Injured by young red-legged grasshoppers (*Pezotettix femur-rubrum*), which are very abundant about it.

Sept. 16, 1893.—This is now 8 to 10 inches high, the stems green, with a very few leaves, the rest having been gnawed

off by grasshoppers. The injuries have been especially severe because of drought and the consequent drying up of other vegetation.

Jan. 20, 1894.—Good. Green at base of last year's stubble.

June 18, 1894.—A uniform growth averaging 14 inches high. With numerous purple flowers, and some fruit. Flower clusters ½ inch in diameter and of the same length. Old clusters bearing seeds, ⅞ inch in length in some cases. Leaves in health dull dark green, but most plants show a yellowing of the leaflets. Occasional plants are 2 feet in height. A close growth over whole plot. Especially subject to insects, partly because of the shelter which the peculiar growth affords, but probably to a considerable extent because of its nutritiousness. An ash-gray blister beetle (*Macrobasis unicolor*) is common. The spotted cucumber-bug (*Diabrotica 12-punctata*) is also common about the plants. A small leaf-hopper (*Empoa albopicta*) is very common, as is also the tarnished plant-bug (*Lygus pratensis*). The flowers are visited by common butterflies (*Colias philodice*, *Pieris protodice*, several Hesperidæ) and by numerous small bees.

July 10, 1894.—Had this cut yesterday. Weight of fresh fodder, 32½ pounds, or at the rate of 1.28 ton per acre.

July 26, 1894.—Since cutting, this has grown well, and is now uniformly green, and averages 10 inches high. Little trace of the yellows, so apparent in first crop. No flowers yet. Insects abundant.

Aug. 23, 1894.—A good second growth 12 inches high, now in blossom. Some yellow leaves. Grasshoppers and blister beetles of several species abundant.

Sep. 22, 1894.—Averages 18 inches high. Somewhat injured by grasshoppers. Not very heavy. Some flowers.

Nov. 6, 1894.—Good. Still green and averaging 15 inches high.

Dec. 4, 1894.—Frosted.

March 6, 1895.—Green leaflets show at bases of old brown stalks. Has wintered well.

March 30, 1895.—A bright green growth coming up rapidly.

April 29, 1895.—A fine growth 14 inches high.

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May 24, 1895.—Good. Averaging 18 inches high. A very few flowers.

June 27, 1895.—Cut the alfalfa of this plot. Weight, fresh, 37½ pounds, which is at the rate of 1.50 ton per acre.

July 25, 1895.—A good growth about 10 inches high. Some flowers.

Sept. 17, 1895.—This has not been cut a second time. Not very rank. Leaves badly eaten by grasshoppers. About 15 inches high.

March 26, 1896.—Good. A fresh growth beginning to appear.

April 17, 1896.—Growing finely. 6 inches high.

April 27, 1896.—A good growth a foot high.

July 6, 1896.—Now about 25 inches high; still flowering. Not as heavy as it has sometimes been.

July 28, 1896.—Some flowers yet; violet in color. Pods ripe, brown, with 2½ to 3 whorls, and terminating in a filament; somewhat like the spiral of a post-hole auger. Leaflets pale bluish green, gray (glaucus) beneath. Stems green, but tough when old.

July 28, 1896.—2½ feet high. Some flowers yet. Weeds among it, but holds its own fairly well.

May 23, 1899.—Average height 24 inches. Still occupies much of the plot, and is in good condition. Some flowers.

Aug. 23, 1899.—2½ feet high. Some flowers.

Turkestan or Samarcand alfalfa. It has been claimed that this variety of the plant is rather better than that commonly grown. In the plots I have been unable to perceive any great difference. The plants from seed imported by the United States Department of Agriculture do not differ from those obtained from ordinary bought seed sufficiently to constitute them separate varieties. A plot was started May 21, 1898, using seed at the rate of 30 pounds to the acre. It was not cut the first season. The following notes relate to it:

Aug. 2, 1898.—A fair stand 6 inches high. Some flowers. Not a thrifty growth.

May 23, 1899.—This plot started last year from seed furnished by the United States Department of Agriculture is now

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in excellent condition, averaging about 16 inches high, and densely covering the ground with a fine green growth, among which some purple flowers can be seen. Can see no difference between it and other alfalfa.

Aug. 23, 1899.—This plot now in excellent condition, some in blossom. All fresh and green and about 18 inches high.

This plot was made a part of the paddock referred to above as including the common alfalfa, and was treated by the hogs the same way, the whole surface of the plot being stirred up.

A second plot of Turkestan alfalfa was planted in the spring of 1900 on better land than that on which the old plots were situated, and in 1901 it was cut as many times as possible. As is usual with alfalfa, it did not grow thriftily during 1900, and in late summer looked exceedingly unpromising. In 1901 it had obtained a good hold on the soil and looked very much better. The yield is given below. Single cuttings are much better than could have been secured from either common or Turkestan alfalfa in the old plots, which goes to show that to do well alfalfa must have good soil.

1st Cutting, June 8, 1901: Weight, fresh, 184 lbs.; weight, dry, 48 lbs., being at the rate per acre of 7.36 tons, fresh, and 1.92 ton, dry.

2d Cutting, July 11: Weight, fresh, 56 lbs.; weight, dry, 29 lbs., being at the rate of 2.24 tons, fresh, and 1.16 ton, dry, per acre.

3d Cutting, Aug. 24: Weight, fresh, 113 lbs.; weight, dry, 41 lbs., being at the rate of 4.52 tons, fresh, and 1.64 ton, dry, per acre.

4th Cutting, Oct. 17: Weight, fresh, 45 lbs.; weight, dry, 22 lbs., being at the rate of 1.8 ton, fresh, and 0.88 ton dry, per acre.

The total yield for the plot during the season was thus 398 pounds, fresh, and 140 pounds, dry, which is at the rate of 15.92 tons of green forage and 5.60 tons of hay per acre. The third cutting contained a good deal of crab grass (*Panicum sanguinale*) which had sprung up in the plot. Ordinarily no fourth cutting would be taken, since it is desirable to leave some growth as a protection to the plants during the winter, but it

was removed to determine just what could be obtained by close cutting during a season.

An average of numerous analyses prepared by Professors Jenkins and Winton is as follows:

Water, 71.75.
Ash, 2.66.
Protein, 4.84.
Fiber, 7.39.
Nitrogen free extract, 12.39.
Fat, 0.97.

Melilotus alba (WHITE MELILOT, SWEET CLOVER, BOKHARA CLOVER).—This plant is often seen in Kentucky growing along roadsides. It is not cultivated, though I believe it is sometimes planted for bee pasture. From the rankness of its growth it is calculated to furnish a large amount of fodder, but animals do not relish it. When old, the stems become very tough. It is biennial, or sometimes annual, with us.

In our plots the dropped seeds germinated and produced a fine growth in the latter part of March. In July of the second season the plants often reached a height of 6 feet. Under date July 14, 1900, Col. W. H. Polk, of Lexington, sent me a portion of a plant of which he wrote: "I enclose a piece of plant from a bush 8 feet high that is a *persistent* grower in waste places about the city. I notice the foliage somewhat resembles that of the pea, but the bush gets more woody as it attains maturity. When young it looks like good forage. A mountain man tells me it will grow in the poorest soils, and that it is called 'mountain clover.' I notice the bees are fond of it, and as it is such a heavy cropper and so easy to grow, I think it would likely make a good bee pasturage. For stock, when young and tender, it appears to me would be good forage, but not so nutritious when full grown, on account of the woodiness of stalk and branches. Would it not, if cut when tender, make a good silage." Notes on the plant as it grew in our plot follow:

May 13, 1893.—A splendid growth nearly 2 feet high. Very dense.

June 13, 1893.—A uniform and thick growth just beginning

to flower. Some stalks reaching a height of 5 feet, 4½ inches. Average about 5 feet. Stems as much as 0.46 inch in diameter; smooth, cylindrical, with lateral branches beginning 1 to 1½ foot from the ground, these 5 to 10 inches long and bearing succulent leaflets, 1½ inch long. A strong-growing plant calculated to furnish a large quantity of forage.

June 20, 1893.—A leaf hopper (*Empoa albopicta*) very abundant, also a beetle (*Chauliognathus marginatus*). A few bees and flies.

July 19, 1893.—This now six feet high in many cases. The tips still in flower. Stalks rather hard and tough. Some of seeds ripe.

Aug. 8, 1893.—Very tall, coarse and dry. Tips of branches still with flowers.

June 22, 1894.—A pretty regular growth of this, now 12 to 14 inches high. [From dropped seed.]

July 26, 1894.—This looks well, is uniformly green, but has no flowers. Now about 18 inches high. Insects about it: Red-legged grasshopper (*Pezotettix femur-rubrum*), leaf-hoppers (*Empoa albopicta*), tarnished plant-bug (*Lygus pratensis*).

Aug. 9, 1894.—Insects about this plant: Tree crickets (Oecanthus sp.), red-legged grasshopper (*Pezotettix femur-rubrum*), leaf-hoppers (*Empoa albopicta*), spotted cucumber-bug (*Diabrotica 12-punctata*).

Aug 23, 1894.—Good; no flowers.

Sep. 22, 1894.—A fine growth, much of it in the neighborhood of 2 feet high. Has grown since late rains.

Nov. 6, 1894.—Good.

Dec. 4, 1894.—Frosted.

March 6, 1895.—Entirely dead above ground.

March 30, 1895.—New growth appearing.

April 29, 1895.—A fine growth 18 inches high.

May 24, 1895.—A fine growth 38 inches high. No flowers. Leaf-roller (*Lozotænia rosaceana*) observed about it.

June 29, 1895.—Tallest stalks 79 inches high. Average height 60 inches. Stalks ½ inch in diameter at base. Branches 12 to 18 inches long begin about one foot from ground. The

white flower clusters at extremities 3 to 5 inches long, maturing from below upward, hence lower show ripe seed pods, while terminal are in bud, and intermediate fully expanded. Flowers now attracting many flies, small Hymenoptera (bees and wasps); also some white butterflies (*Pieris protodice*).

June 25, 1895.—Still flowering. Stems tough. Visited by honey bees, June bugs (*Allorhina nitida*), etc.

Sep. 17, 1895.—Most of the plants now brown and dried out.

March 26, 1896.—Perfectly brown.

April 25, 1896.—Raked off old growth to-day. Young plants [from seeds] appearing.

July 6, 1896.—A good, young growth from seed covers plot closely. No flowers. About 1 foot high.

July 28, 1896.—No flowers. Averages 20 inches high. A fine succulent growth.

While this plant is not commonly relished by animals in this section, it is reported as being eaten readily by stock in Mississippi and other southern states. Of course only feeding tests can decide to what extent the nutriment it contains is appropriated. Chemical analyses show it to compare very favorably with forage commonly employed in Kentucky. The following percentages are from analyses of white melilot at various stages of growth made at different Experiment Stations, and compiled in a bulletin published by the Central Office of Experiment Stations:

Water, 69.20 to 80.55.
Ash, 1.27 to 2.36.
Protein, 2.45 to 4.15.
Fiber, 3.62 to 13.12.
Nitrogen free extract, 7.22 to 16.11.
Fat, 0.44 to 1.13.

Melilotus officinalis (YELLOW MELILOT).—Similar to the preceding, but less tall and with yellow flowers. Frequent along roadsides. Not cultivated for any purpose as far as observed.

Meibomia bracteosa (TICK-TREFOIL).—Kentucky (Miss S. F. Price).

Meibomia dillenii (TICK-TREFOIL).—A specimen in the Station collection was collected by Mr. G. M. Sullivan Aug. 24, 1899, in Jackson County.

Meibomia glabella (TICK-TREFOIL).—Lexington, Aug. 8, 1892.

Meibomia grandiflora (TICK-TREFOIL).—Kentucky River, Elk Lick Falls and Tyrone.

Meibomia lævigata (TICK-TREFOIL).—Kentucky (Kearney).

Meibomia marylandica (TICK-TREFOIL).—Kentucky (Kearney).

Meibomia michauxii (TICK-TREFOIL).—Jackson County, Aug. 24, 1889 (G. M. Sullivan); Corbin, July 14, 1892.

Meibomia nudiflora (TICK-TREFOIL).— Lawrence County, Aug. 16, 1894 (Professor A. R. Crandall); Cumberland Falls, July 14, 1892 (Professor C. W. Mathews).

Meibomia paniculata (TICK-TREFOIL).—Kentucky (Kearney).

Meibomia pauciflora (TICK-TREFOIL).—Henderson, July 28, 1892.

Meibomia rigida (TICK-TREFOIL).—Dix River, Sep., 1887, (Evans).

Meibomia sessilifolia (TICK-TREFOIL).—Kentucky (Asa Gray).

Meibomia tortuosa (FLORIDA BEGGAR-WEED).—A native of Florida and other Gulf states. It is an upright annual, growing in our plots and in the Vivarium to a height of from 3½ to 4 feet, but along the Gulf reaching a height of 10 feet at times. When young it bears a profusion of broad leaves and is at its best for forage. Later the stems become woody. In September the terminal branches bear numerous slender, jointed, and frequently twisted pods which like those of other members of the same genus, break apart readily. It produces a large amount of forage farther south, and is claimed to be a better green fertilizer than cowpeas.

Meibomia viridiflora (TICK-TREFOIL).—Kentucky (Kearney).

Mucuna utilis (VELVET BEAN).—We have had few forage plants on the Experiment Farm that make such a rampant growth as this. It covers the ground thickly, spreads beyond the boundaries of the plots, carpeting all adjacent paths, then if furnished with a trellis climbs up this to the extremity and launches into the air, and when by its weight brought back to the support, the new terminal growth wraps itself again and again about the old, forming a confused and tangled mass of leaf and vine, the like of which is produced by no other forage plant grown by us. But its very rankness of growth makes it a somewhat unmanagable plant.

It does not ripen its seeds at Lexington, and I have never heard of its doing so elsewhere in the State. In 1900 it produced its singular long purple flowers early in October, when the pods began to develop very rapidly and in large numbers. They appear in clusters in the axils of the leaves. The very young pod at first carries at its extremity the long style of the flower, and becomes darker as it grows, from the presence of a dense coat of erect black hairs, the whole having the effect of plush. In our plot it reached a length of 2½ inches, and a diameter of ½ inch, being rather short and stout, but produced no mature seeds, although not destroyed by frost until October 19, at which date some flowers were still being produced. The ripe seeds are not less remarkable than the plant, flower and pod. They are roundish, about ½ inch in length, the scar with protruding lip, the ground color whitish, mottled with brown, like a bird's egg.

In Florida the fodder is cut several times, and the yield during a season sometimes exceeds four tons of hay per acre. It is claimed that cowpeas will produce about as much fodder, though as seen growing the velvet bean impresses one as much the more productive. The fodder is nutritious, containing about the same per cents. of fat and protein as the cowpea. Very decided improvement in soil has been secured in southern states by plowing under the velvet bean stubble.

Onobrychis sativa (ESPARSETTE, SAINFOIN).—This has been highly recommended as forage in hilly and rather sterile sections. It is a perennial, and a good bee plant. Seeds planted

in 1900 in a plot did not germinate, probably because they were old. They are quoted in a 1901 seed list before me at $9.00 per 100 pounds.

Ornithopus sativus (SERRADELLA).—A slight, low-growing annual, introduced from Europe. It is said to be partial to sandy soil. It produces with us only a small amount of forage, and has proved rather difficult to grow, suffering especially from dry weather. We have soils in the State containing some sand in which it might do better. In the plots, where it has been grown several seasons, it produced tufts 6 inches high and about 8 inches in diameter of soft herbage of a grayish green color. The flowers began to appear about the middle of June and continued until November.

Pisum arvense (CANADA FIELD PEA).—This is highly recommended for planting at the north, but does not do well here owing to the heat of summer. On May 18, 1898, a plot of the "Russian field pea" and another of the "Rostow sugar pea" were planted. They started evry well, but were soon suffering from mildew, and by the first of August the sugar peas began to wither without having produced good pods, those developed containing only one or two seeds. The Russian field pea is later, being in flower about the first of August, a peculiarity that renders it unsuitable for this climate, since our most trying season for shallow rooting annuals such as these, comes in late summer when they should be growing most rapidly.

It is doubtful if these field peas will prove valuable here. Seed has sometimes been sold under the name "stock pea." As this name is commonly applied in Kentucky to the cowpea, farmers have sometimes bought the northern pea supposing they were getting the cowpea, and the result was disappointment. In one instance known to me a buyer who made this mistake took the matter into court and won his case. The seeds of the Canada field pea are nearly spherical, but without the decided indentations commonly present on garden peas, and are of a uniform yellowish white color, without markings. The cowpea or stockpea, on the other hand, is a true bean, and shows it in the general shape of the seed, which is somewhat

flattened and elongate, while the colors may be red, black, mottled, white with a black eye, or, in a few varieties, such as the "white table" and the "lady," are white and unmarked. The foliage of the field pea again is much like that of the common garden pea, while that of the stock or cowpea is plainly that of a bean.

Phaseolus polystachyus (WILD BEAN).—Kentucky (Short and Peter).

Psoralea onobrychis.—Kentucky (Britton and Brown).

Psoralea pedunculata.—Jackson County, June 25, 1889 (G. M. Sullivan); Corbin, June 19, 1892.

Psoralea stipulata.—Kentucky (Gray).

Robinia pseudacacia (BLACK LOCUST).—A well-known tree, to be found throughout the State about dwellings, and sometimes encountered among natural growths. In flower about May 18.

Rhynchosia erecta.—Kentucky (Miss Price).

Rhynchosia tomentosa (TWINING RHYNCHOSIA).

Strophostyles helvola (TRAILING WILD BEAN).—Lexington, Ky., Sept. 24, 1901, (Miss Mary L. Didlake).

Strophostyles pauciflora (SMALL-FLOWERED WILD BEAN).—Clinton, Ky., July 29, 1901.

Strophostyles umbellata (PINK WILD BEAN).—Fulton, Ky., Aug. 11, 1892; Lexington, Aug. 26, 1892.

Stylosanthus biflora (PENCIL FLOWER).—Corbin, June 19, 1892; Lawrence Co., Aug. 16, 1894 (A. R. Crandall); Jackson Co., June 15, 1889 (G. M. Sullivan).

Trifolium alexandrinum (EGYPTIAN CLOVER).—This has been tried but once at the Station. A moderately good growth was secured, resembling alfalfa in some ways. June 29 the height was about 12 inches. The flower clusters are white and small, like those of white clover, the corollas at length disappearing, leaving the developed seeds in a compact head about ¾ inch long. Mr. D. G. Fairchild, of the U. S. Department of Agriculture, says it is the important forage crop of Egypt. One variety is employed for sowing on mud, immediately after the subsidence of an overflow of the Nile River. Might it not be so used by our farmers on bottom-

lands along the Ohio and Mississippi Rivers? It is possible that the clover will some time find a place in the agriculture of this country. It is an annual.

Trifolium arvense (RABBIT-FOOT CLOVER).—In several counties west of Louisville this little annual has been found to be common on rather poor soils. It was observed to be abundant June 25, 1896, on the banks of Nolin River at Dickey's Mills in Edmonson and Grayson Counties. It has since been collected at Big Clifty in Grayson County, and last summer was found to be very common along roadsides at Vine Grove in Hardin County. It is a slight plant of upright growth, measuring in preserved specimens from 10 to 12 inches high, the flowers forming finally an elongate woolly head, which has given the species the name "pussy clover." It was introduced originally from Europe, but is thoroughly at home here. Probably of no agricultural value.

Trifolium hybridum (ALSIKE CLOVER, ALSATIAN CLOVER).—Alsike clover looks like a hybrid between red and common white clover. It is intermediate in size, its flower clusters rather larger than those of white clover and with more purple, the leafage more like that of white than red clover. It is adapted to wet situations, where it will produce a very good yield of nutritious forage. On our drier soils in Blue-grass Kentucky it is likely to be affected by dry weather in late summer, from which it suffers more than red clover. Because of this weakness it has not lasted well in our plots. A plot in the spring of 1892 was in very good condition in June of 1893 when ready to cut. The average height was 1 foot, 6 inches; the flower heads about ¾ inch long and ¾ inch in diameter, the central flowers white with a pink tinge, the outer of a decided rose color, but at length turning brown. Stems 0.10 inch in diameter. Leaflets about one inch long.

When cut it sent up a fresh growth, but with the advent of dry weather ceased to grow, though showing signs of life until January, 1894. In June of 1894 no trace of it was left in the plot. In the spring of 1895 the plot was replanted, with the same result, the plants having disappeared in the spring of the following year. A plot planted on better land April

14, 1900, showed a fair stand on April 20. June 29, it was noted as 8 inches high and looking well in the main, but with the tips of leaflets reddish as if from the effect of the sun. It was not cut. In 1901 it was in full bloom May 31, and averaged 16 inches high. It was cut June 18, yielding at the rate of four tons of green fodder and 1.44 ton of hay. This yield is less than the clover is capable of, since the stand was not a perfect one, only about ¾ of the surface being fully occupied.

The plant is a native of Europe, North Africa, and parts of Asia, where it is a perennial. Thus far it has proved with us little more than an annual, though a different report might have to be made if it were grown in soil that kept its moisture better than ours.

Trifolium incarnatum (CRIMSON CLOVER, ITALIAN CLOVER). With good seed, planted at the proper time, this clover has done well in the plots. It has value for this region, as a catch crop both for fodder and for improving land. Planted in August, it may be cut by May 20 of the following season, giving a crop of good hay and furnishing a valuable stubble to be turned under for the use of some hot weather crop, such as corn. I have several times tried sowing it in the spring, but it has failed invariably. Two plantings noted below illustrate our experience.

A plot planted April 14, 1900, was up by April 20, only a fair stand, however. By June 29 it was about 10 inches high, but looked feeble, and from this time began to decline with a very scant production of imperfect flower clusters.

Another plot planted August 25, 1900, gave a good stand of young plants by August 31. These were in full bloom and should have been cut May 20, when the plot presented a beautiful sight. Cut June 7, the plot yielded 174 pounds of fresh fodder (6.96 tons per acre,) and 52 pounds of hay (2.8 tons per acre).

Unlike common red clover this annual is very attractive to honey bees, and they are always very busy about our plots when the clover is in flower.

In the matter of nutritiousness it is quite the equal of red

clover, but it is necessary to cut it for hay as soon as the flowers expand, for the reason that as the seeds develop the heads become dry and hairy, and are accused of causing digestive troubles. "Hair balls" are sometimes thought to result from eating hay from over-ripe plants.

The soil should be well prepared for the seed, and the sowing may be either broadcast or in drills, followed by the use of a drag or roller. About 15 pounds of seed per acre may be used.

Trifolium medium (MAMMOTH CLOVER).—A near relative of common red clover, which it greatly resembles. It is a coarser plant, makes a greater amount of forage, and is somewhat later. Common red clover seed is often sold by dealers under this name; the result is that one sometimes encounters people who think they know this clover, but who have never seen it. It should be planted like red clover, but because of its rank growth a little less seed can be used. In our plots it averaged 8 inches in height by the middle of May, and is ready to cut from the 15th to the 20th of June. A plot grown in 1893 is referred to in the following record, made June 13:

A very rank growth here. Taller and coarser than on No. 34 [common red clover]. Very few heads. Those present so nearly like those of red clover in size and color it would be hard to find a difference. Average height of this clover 2 ft., 4 inches. Looks like splendid forage. Has the appearance of being more succulent and tender than red clover. Stems hairy, at base nearly ¼ inch in diameter. Leaflets 2 to 2½ inches long.

It lasts about as well as red clover, and is of about the same nutritive value, although farmers sometimes claim that the hay is not quite as good as that made from common red clover. It is better adapted to wet land than the common species.

Trifolium pratense (RED CLOVER).—We have few forage plants to which farmers are more attached than to this. For hay, for pasture, for renewing exhausted land, he has so long depended on it that it is with great reluctance he turns his attention to less familiar plants. Red clover still does very well

in this part of Kentucky, and we have never failed to get a stand in plots on the Experiment Farm. But complaints are becoming frequent that red clover does not do as well as formerly. Such complaints come most often from farmers residing in the western half of the State. No satisfactory explanation is offered by the farmers themselves, though the suggestion is sometimes made that insects have to do with it.

We have in the State many of the clover insects known to occur in the eastern United States, but none of these seem to be at the bottom of the trouble. Nor is it, apparently, the work of parasitic fungi. Certain of our soils appear to be clover sick, and I would suggest the use of moderate applications of lime in sections where the per cent. normally in the soil is low. I referred to this matter at a Farmers' Institute held at Lebanon some months ago, and my remarks will be found on pages 508 to 510 of th 14th Biennial Report of the State Bureau of Agriculture, recently issued.

In some of the field work of this Station, Director Scovell found that a deficiency of potash in some soils led to a failure of clover, and that when muriate of potash (160 lbs. per acre) was applied, clover grew well. In an article written by him for the Farmers Home Journal and published in the issue of April 7, 1900, he suggests that the Station will co-operate with farmers in experiments made to test applications of potash for restoring clover sick soils.

In most of our blue-grass sections the root nodules appear to be normal to clover. It is possible that in some of the poorer soils in the State these nodules may not be present, and that if they could be induced to grow by artificial means clover would be helped. There are several ways of introducing the nodule bacteria into soils.

(1) Soil may be taken from a field of thrifty clover and sown over one in which clover does not grow well. It should be remembered in doing this that the soil used for the purpose must not be allowed to become dry, and should not be exposed for any length of time to sunlight. It can be best introduced while the land is being plowed or harrowed, so that it will be worked in at once.

(2) Soil from a field of clover bearing nodules may be stirred thoroughly into a quantity of water in a barrel, and seed to be planted may then be immersed for a time in the water.

(3) Pure cultures of the nodule organism may be applied to seed just before these are planted. Cultures of the bacteria were tried by us at the Station this season, but owing to the lateness at which they were received no perceptible results could be discerned.

Sowing. The quantity of seed used by farmers varies widely. Some use as little as three pounds per acre; others use as much as fifteen pounds on the same area. Very early spring sowing on wheat or rye land is perhaps the favorite practice. But clover may be, and frequently is, sown successfully in fall, the seeding being followed by a light harrow. The hay is cut when the plants are in full bloom.

Testing clover seed. Clover seed is sometimes mixed with medick, and the two are so closely alike that it is difficult for the farmer to detect the fraud. Weed seeds, such as the narrow-leaved plantain, or buckhorn, are sometimes common in samples offered for sale. The samples submitted to the Station for testing have, however, generally proved well cleaned, and of very good quality. Farmers themselves can easily test seeds for germination. It is only necessary to place a sample between moist cloths and keep these between a couple of plates for a few days. If less than 85 per cent. germinates the seeds are not as good as they should be. Samples sent to the Station for testing sometimes test as high as 90 per cent.

Trifolium procumbens (LOW HOP-CLOVER).—In pastures and along roadsides this slight annual is often seen in Kentucky, where it appears to have been introduced with the seeds of more valuable plants. Cattle eat it, but the product is so insignificant that it can not be said to have an agricultural value. The flowers are pale yellow. It has sometimes been sent to the Station by correspondents under the supposition that it was Japan clover. It is in flower during June and the early part of July.

Trifolium reflexum (BUFFALO CLOVER).—This is a native annual or biennial clover that was credited to the State by Drs. Short and Peter. It differs from the running buffalo clover, also credited to the State, in the stems being slightly downy, in the seed pods containing more than two seeds, and in lacking the running habit. It has been grown by me from seed in the Vivarium of this Station, and made a very attractive growth. It has not often been encountered growing wild in Kentucky. A specimen was sent me from Greenville, Muhlenberg County, June 8, 1897, by Mr. J. W. Barkley. It was observed on the place of Downer and Brother at Guthrie, July 31, 1901. Its transient character will probably prevent its ever becoming of value on the farm.

Trifolium repens (WHITE CLOVER, DUTCH CLOVER).—This is the common pasture and lawn clover of Kentucky, being sown sometimes with blue-grass seeds, but oftener grows spontaneously and without receiving attention. The flowers begin to appear about the middle of May, and by the middle of June the plant is at its best, the height of flower stems being about 10 inches, while the growth of leaves will average 6 inches. It is a valuable honey plant. For pasture it is also good, and animals often eat the young growth in preference to blue-grass. When the growth is very succulent cattle are sometimes made sick by it, and horses are made to "slobber." In moderate quantity, however, it is to be considered a valuable ingredient of pasturage.

Trifolium stoloniferum (RUNNING BUFFALO-CLOVER).—A native perennial, possibly worth trial on the farm. Kentucky (Short and Peter).

Trigonella fœnum-græcum (FENUGREEK).—An annual from South Europe and North Africa. It was formerly much used as a medicine for horses, and is still employed for forage. In a plot grown on the Farm in 1900 it stood about 12 inches high June 29, bearing long, slender, tapering pods (5½ inches long in some cases). The central root is very long and tapering, with few lateral branches. The leaves are thick, somewhat like those of the garden plant known as live-for-ever, but smaller and 3-divided, like the clovers. The plants give off a singular

odor, difficult to describe, perhaps as near that given off by the inner bark of slippery elm as anything we have in this country.

Ulex europæus (FURZE, GORSE, WHIN, BROOM).—A prickly, perennial shrub, common on barren hills, etc., in Ireland, Wales, and other parts of Great Britain, where it is valued for forage. Its valuable quality appears to be its capacity to grow on sterile soils. It has been grown in our Vivarium.

Vicia americana (AMERICAN VETCH).—Kentucky (Britton and Brown).

Vicia caroliniana (CAROLINA VETCH).—Filson, Ky., May 8, 1893.

Vicia cracca (TUFTED VETCH).—Kentucky (Gray); Lexington, May 26, 1893.

Vicia sativa (COMMON VETCH).—Accidental in grass plots, Experiment Farm, June 23.

Vicia villosa (RUSSIAN VETCH, HAIRY VETCH).—This is a trailing plant with weak stems and soft gray-green foliage, that has done remarkably well wherever planted on the Farm. It is an annual, but when left to itself sends up a profusion of young plants each year from seeds dropped the preceding summer. It produces large numbers of lobed tubercles on the roots and is thus an active nitrogen gatherer. From its trailing habit it is not an easy plant to cut, and it is probable it will be found better as a catch crop to turn under than for anything else. Its vigorous growth is a pleasure to see when other plants are suffering from unfavorable weather. To keep it from the ground it may be sown with some small grain, such as wheat, oats, or rye. It may be planted either in the spring or fall, using about one bushel of seed to an acre.

Vigna catjang (COWPEA).—During the past eight years cowpeas have risen rapidly in favor with Kentucky farmers. Hundreds of bushels are planted every year, and the demand for seed is still growing. It has been learned that they have a decidedly beneficial effect on soil, furnish a good quality of hay, though requiring special care in curing, make good silage, while the seed makes good feed for most kinds of stock, some varieties furnishing besides a welcome addition to our

table fare. Originally from China or India, the plant has long been known in the southern states, to which from its sensitiveness to cold it will probably always be somewhat closely restricted, though it can be and is to some extent grown at the North as a green fertilizer. The seeds do not germinate and start off well while the soil is cold, and better crops are always secured by delaying planting until unbroken warm weather arrives.

Practice in this State varies a good deal in regard to manner of sowing. If for hay and "turning under" the seeds are generally sown broadcast, covering with a harrow. But some farmers prefer to sow with a wheat drill without stopping any of the holes. For seed, some sort of drill is generally used, the rows being thirty inches or more apart, so that the plants can be cultivated a couple of times. From about three pecks to a bushel and a half of seed per acre are sown.

The plant will grow in most soils, clay, sand or loam, and has a special value for poor soils, in a rotation with crops of grain.

The variety most often grown in the State is the "whippoorwill." It makes a good quantity of fodder, and a fair crop of seeds, which can be counted on to mature before frosts occur. Next in favor with Kentucky farmers is the "black." It also matures its seeds here. In our plots it has given the better yield of seeds of the two. Seeds of other varieties are sold, but for one reason or another have not proved as popular as these two. Notes on varieties grown in the plots in 1901 follow:

Whippoorwill. Trails moderately. Planted May 3. Many seeds ripe Aug. 10, but still flowering. Pods 7 to 8 inches long; 0.375 inch from front to back; simply curved; 1 to 2 in a place. 16 seeds in a pod; length of seed, 0.36 inch; diameter from scar to back, 0.27 inch; thickness, 0.22 inch; light leather color, varying to decided tan-brown, rather closely speckled with purplish brown. Product of vine, medium. Product of seeds, 5⅓ bushels per acre.

Seed bought of T. W. Wood & Sons, Richmond, Va.

Black. Trails moderately. Planted May 3. Pods all young

and green Aug. 10; numerous blossoms; foliage gray-green. Pods 7 to 8.50 inches long; 0.44 inch from front to back; simply curved; 1 to 2 in a place. 14 seeds in a pod; length of seed, 0.40 inch; diameter from scar to back, 0.30 inch; thickness, 0.25 inch; black. Product of vine good. Product of seeds, 21⅓ bushels per acre.

Seed bought of T. W. Wood & Sons.

Clay. Trails; foliage small. Planted May 3. Very few pods formed Aug. 10. Still growing Aug. 31. Oct. 17 still green where not killed by frost. Few ripe pods. Pods 5 to 7 inches long; 0.37 to 0.50 inch from front to back; 1 to 3 in a place, generally 2. 12 seeds in a pod; length of seed, 0.38; diameter from scar to back, 0.30; thickness, 0.20; light leather color, more or less rust color about scar. Product of vine good. Product of seed 2⅔ bushels per acre. Too late for seed in Blue-grass Kentucky, but could doubtless be grown profitably in the southwestern part of the State.

Seed bought of T. W. Wood & Sons.

Calico. Trails moderately. Foliage gray-green. Planted May 3. Numerous green pods Aug. 10. Some ripe pods Aug. 31. Pods 6 to 7 inches long; with a compound curve; plump; 0.37 inch from front to back. 15 seeds in a pod; length of seed, 0.32 inch; diameter from scar to back, 0.25 inch; thickness, 0.20 inch; color, cream-white, with an extensive area about scar drab, and frequently with scattered dots of this color. Product of vine, medium; of seeds, 10⅔ to 13⅓ bushels per acre. This seems well adapted to this region.

Seed bought of C. S. Brent, Lexington, Ky.

Taylor. Trails moderately. A vigorous grower. Numerous flowers August 10; some small pods. Great numbers of pods August 31, some ripe, foliage rather scant. Pods 8½ to 9 inches long; 0.50 inch in diameter from front to back, 2 pods in a place; 14 to 16 seeds in a pod; length of seed, 0.42 inch; diameter of seed from scar to back, 0.30 inch; thickness of seed, 0.24 inch; of a pale leather color, flecked with dark blue, gray, or black, the scar enclosed with black. Product of vine medium; of seed, 26⅔ bushels per acre. Well adapted to Kentucky. The seeds resemble in a general way those of the

whippoorwill variety, but are larger and the dots are smaller with an evident bluish cast, though ordinarily they would be considered black.

Seed bought of T. W. Wood & Sons.

Extra early black-eye. A bunch cowpea, but with some disposition to trail. Planted May 3. Some pods ripe July 19; some blossoms same date. Pods 5 to 9 inches long; 0.40 inch from front to back; forming a compound curve; frequently contracted and containing imperfect seeds in outer portion; 1 to 3 in a place, generally 2. 14 seeds in a pod; large, elongate, incurved at scar; finely wrinkled crosswise; cream-white, with a large black blotch about scar; length 0.48 inch; diameter from scar to back, 0.32 inch; thickness, 0.26 inch. This is a good table variety, and does well here. Yield of seed, 18⅔ bushels per acre.

Seed bought of T. W. Wood & Sons.

Large black-eye. Trails moderately. Foliage gray-green. Some ripe seeds August 10; some flowers same date. Pods variable, often with tips and space at middle with imperfect seeds; 6 to 9 inches long; 0.37 inch from front to back; 1 to 3 in a place, occasionally as many as 6. 14 perfect seeds in a pod; length of seed, 0.42 inch, diameter from scar to back, 0.28 inch; thickness, 0.24 inch; cream-white, with black blotch about scar; not impressed at scar nor finely wrinkled. Yield of seed, 18 bushels per acre. Not adapted for forage, but a good table variety.

Seed bought of T. W. Wood & Sons.

Red ripper. A trailer, and late. Planted May 3. Some flowers and small pods Aug. 10. Aug. 31, still growing. Oct. 17, still green. Pods short and plump; 4 to 5 inches long; 0.37 inch from front to back. 15 seeds in a pod; crowded, so that ends are blunt; length of seed, 0.26 inch; diameter from scar to back, 0.28 inch; thickness, 0.25 inch; color, a deep shade of red. Product of forage, good; product of seed, 2⅔ bushels per acre. A late variety for this region, possibly better adapted to the western end of the State.

Seed bought of the J. Stechler Seed Company, New Orleans.

Red. Trails moderately. In flower July 22. Some young pods Aug. 10. Pods 8 to 9 inches long; diameter from front to back, 0.44 inch; 2 to 3 in a place; straightish. 17 seeds in a pod; length of seed, 0.36 inch; diameter from scar to back, 0.26 inch; thickness, 0.22 inch; color varying from orange red to a purplish red. Product of seed, 2⅔ bushels per acre. The seeds resemble those of red ripper in general color, but are flatter and not blunt at the ends, while the pods are much larger and entirely different in appearance. It is a little too late for this region, judging by one rather unfavorable season with it.

Seed bought of C. S. Brent, Lexington, Ky.

Wonderful or Unknown. A great trailer. Planted May 3. Aug. 10, no flowers yet, but a large growth of vines. Aug. 31, a few flowers, the vines still growing. Oct. 17, still green, where not injured by frost. Pods 7 to 8 inches long; 0.50 inch from front to back; one pod in a place, sometimes two. 17 seeds in a pod; length, 0.38 inch; diameter from scar to back, 0.28 inch; thickness, 0.21 inch; uniform tan-brown. Product in fodder, the best of all the varieties tried. Too late for this region.

Seed bought of T. W. Wood & Sons.

Lady. Trails a little. Slight. Foliage gray-green. Pods small and slender; 5 to 5½ inches long; diameter from front to back, 0.31 inch. 14 perfect seeds in a pod; length of seed, 0.32 inch; diameter from scar to back, 0.20 inch; thickness, 0.18 inch; cream-white, faintly yellow about scar. Very late. No seeds of consequence obtained. Seeds smaller than those of any other variety known to me; elongate, like those of many common beans.

Seed bought of the J. Stechler Seed Company, New Orleans.

Another variety with a round seed is sometimes called by the above name, according to acquaintances who live south. We have in this State a variety with uniform white seeds that is grown for table use. It is known under the name "white crowder" or "white table" cowpea. It has not been grown in the plots.

2. Notes on True Grasses Growing in the Plots in 1900-1901.

By H. GARMAN, ENTOMOLOGIST AND BOTANIST.

Agrostis alba (RED-TOP).—Plot planted April 13, 1900. Grass cut June 20, 1901: Weight, fresh, 4.80 tons per acre; dry, 3.04 tons per acre.

Agrostis canina (RHODE ISLAND BENT-GRASS).—Planted April 13, 1900. Cut July 2, 1901: Weight, fresh, 3.68 tons per acre; weight, dry, 1 ton.

Alopecurus pratensis (MEADOW FOXTAIL).—Planted April 12, 1900. Cut May 17, 1901: Weight, fresh, 3.48 tons per acre; weight, dry, 1 ton.

Andropogon sorghum (WHITE MILLO MAIZE).—This is one of the non-saccharine sorghums, adapted for green fodder. Planted May 10, 1901, in hills 3 feet apart each way. August 24, 1901, ten feet high. Blades 32 inches long, 3¾ inches wide. Panicles rather compact, 9½ inches long, and about 1½ inch in diameter. Stems at base ⅞ inch thick. Cut September 6: Weight, fresh, 25.04 tons per acre; weight, dry, 14 tons.

Andropogon sorghum (YELLOW MILLO MAIZE).—This is another non-saccharine sorghum adapted for soiling. Planted May 10, 1901, in hills, 3 feet apart each way. August 24, nine feet high. No panicles. Blades 33 inches long, 3¼ inch wide, sometimes reaching a width of 4½ inches. Some stems 1½ inch in diameter at base. Long-bladed to top of stem, and this calculated to produce a heavy yield. Cut September 6: Weight, fresh, 28.16 tons per acre; weight, dry, 14.08 tons per acre.

Anthoxanthum odoratum (PERENNIAL SWEET VERNAL GRASS).—Planted August 31, 1900. Cut June 18, 1901: Weight, fresh, 2.80 tons per acre; weight, dry, 1.28 ton per acre.

Arrhenatherum elatius (TALL OATS GRASS).—Planted April 13, 1900. Cut June 19, 1901: Weight, fresh, 6.08 tons per acre; weight, dry, 4.08 tons per acre.

Bromus erectus (MEADOW BROME-GRASS).—Planted April

10, 1900. Cut June 1, 1901: Weight, fresh, 7.28 tons; weight, dry, 2.40 tons.

Bromus inermis (SMOOTH BROME-GRASS).—Planted April 10, 1900. Cut June 17, 1901: Weight, fresh, 7.2 tons per acre; weight, dry, 3.04 tons per acre.

Bromus unioloides (RESCUE GRASS).—Planted April 12, 1900. Cut June 17, 1901: Weight, fresh, 5.84 tons per acre; weight, dry, 2.48 tons per acre.

Dactylis glomerata (ORCHARD GRASS).—Planted April 12, 1900. Cut June 12, 1901: Weight, fresh, 8.4 tons per acre; weight, dry, 3.6 tons per acre.

Euchlæna luxurians (TEOSINTE).—Planted April 30, 1901, in hills, 3 feet apart. Cut September 3: Weight, fresh, 45.44 tons per acre; weight, dry, 14.02 tons per acre. A second plot planted in drills, 3 feet apart, May 10, 1901, was cut September 3: Weight, fresh, 53.6 tons per acre; weight, dry, 15.52 tons per acre.

Festuca ovina (SHEEP'S FESCUE).—Planted April 10, 1900. Cut June 12, 1901: Weight, fresh, 5.44 tons per acre; weight, dry, 2.24 tons per acre.

Festuca elatior (ENGLISH BLUE-GRASS).—Planted April 10, 1900. Cut June 12, 1901: Weight, fresh, 9.28 tons per acre; weight, dry, 3.44 tons per acre.

Lolium italicum (ITALIAN RYE-GRASS).—Planted April 13, 1900. Cut June 19, 1901: Weight, fresh, 3.68 tons per acre; weight, dry, 2.24 tons per acre.

Lolium perenne (PERENNIAL RYE-GRASS).—Planted April 13, 1900. Cut June 8, 1901: Weight, fresh, 6.56 tons; weight, dry, 2.32 tons per acre.

Panicum texanum (TEXAS MILLET). — Planted May 3, 1901. Cut Aug. 24, 1901: Weight, fresh, 17.8 tons; weight, dry, 9.44 tons per acre. The weight of forage from this plot was most surprising.

Pennisetum typhoideum (PEARL MILLET, PENCILLARIA, MAND'S WONDER FORAGE PLANT, ETC.).—This forage plant is being extensively advertised among farmers, chiefly under the name Pencillaria. It was tested on the Experiment Farm for the first time in 1901. It is a tall, coarse annual, with a long

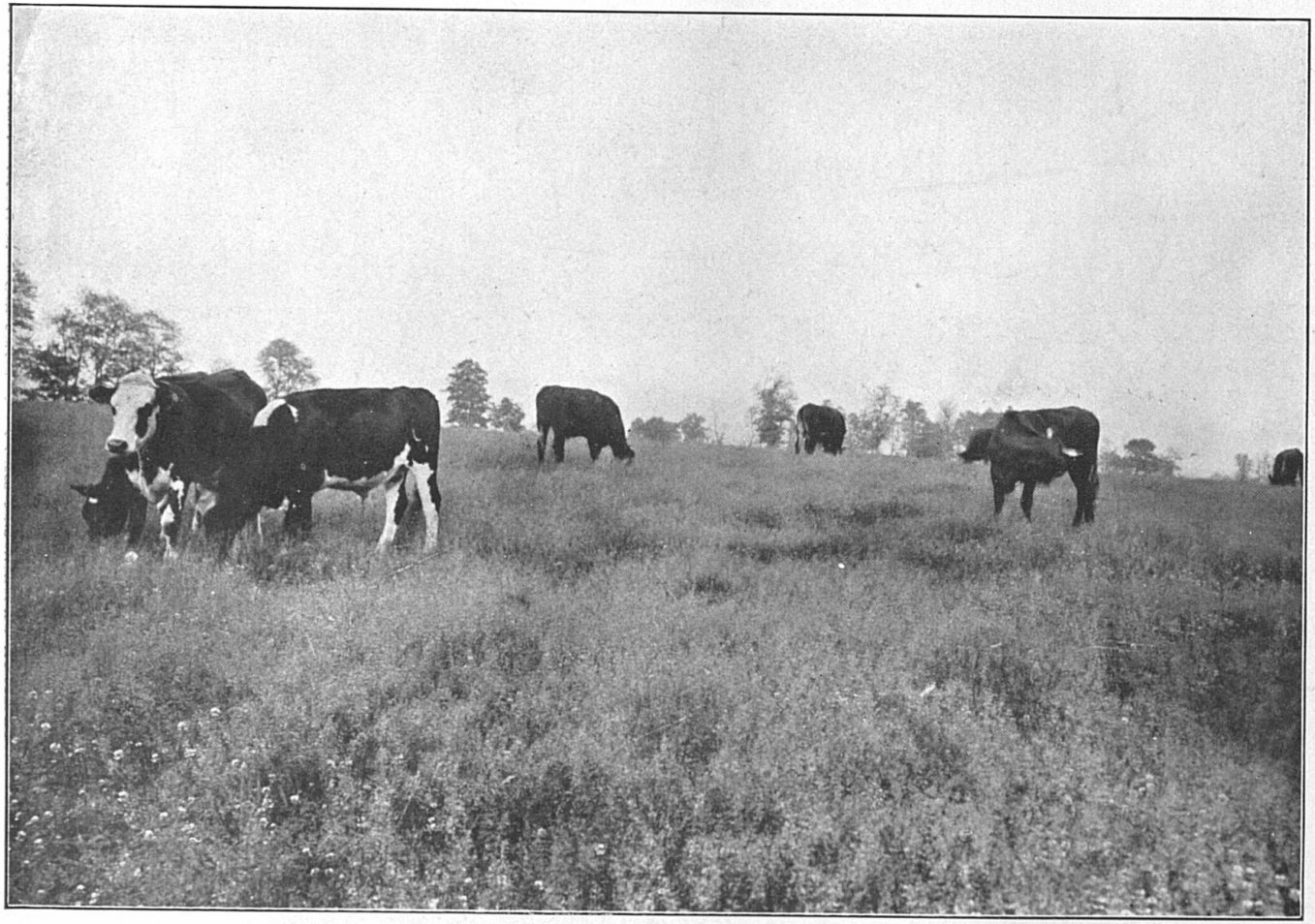


FIG. 1.—White Clover and Blue-grass Pasture, Nicholasville Pike, 3 miles South of Lexington, May 26, 1900. Photographed by H. G.



FIG. 2.—Harvesting Red Clover on the Experiment Farm, June 19, 1900. Photographed by H. G.



FIG. 3.—Crimson Clover from Plot, May 28, 1901. Natural size. Photographed by H.G.

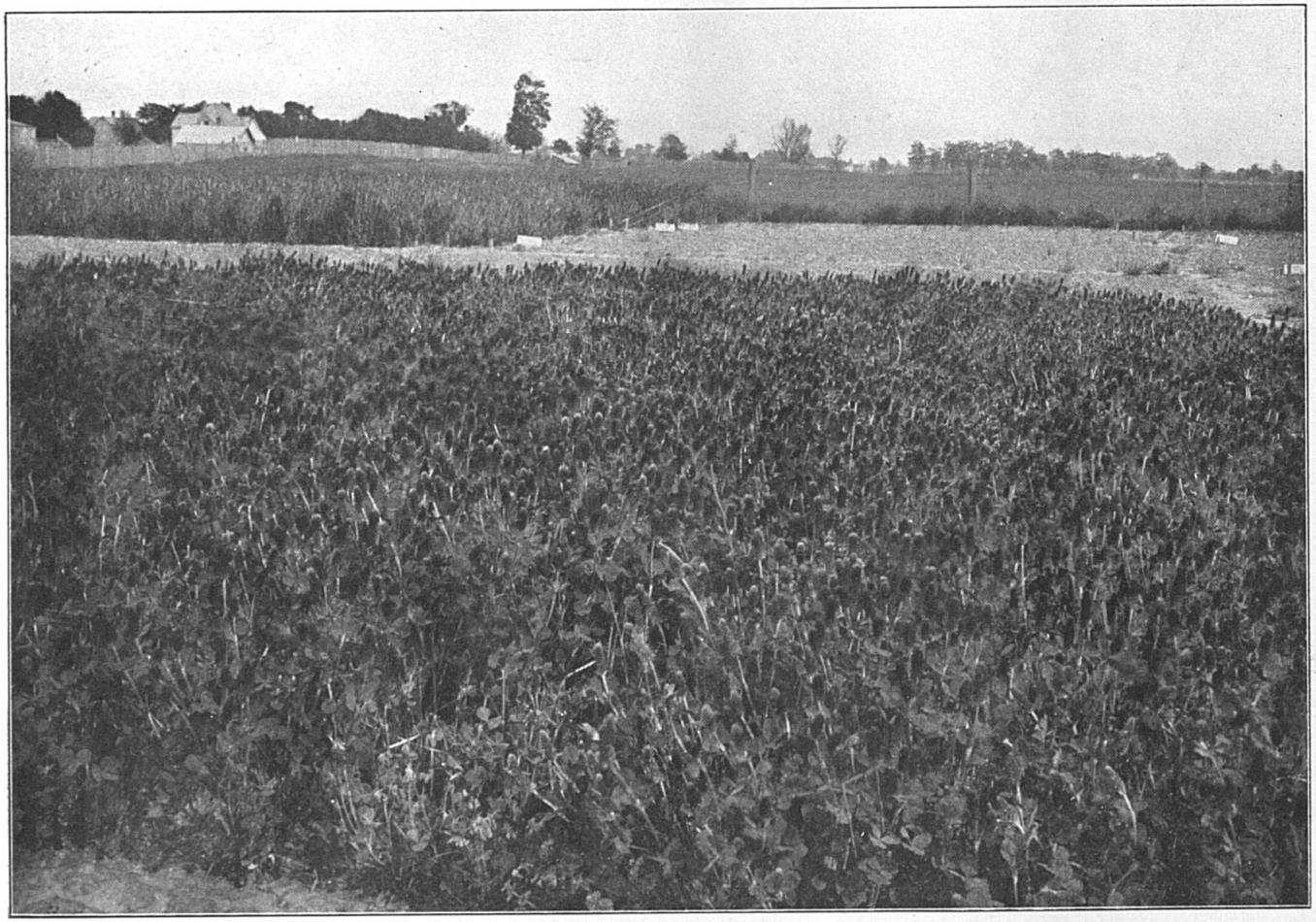


FIG. 4.—Crimson Clover Plot, May 20, 1901. Photographed by H. G.

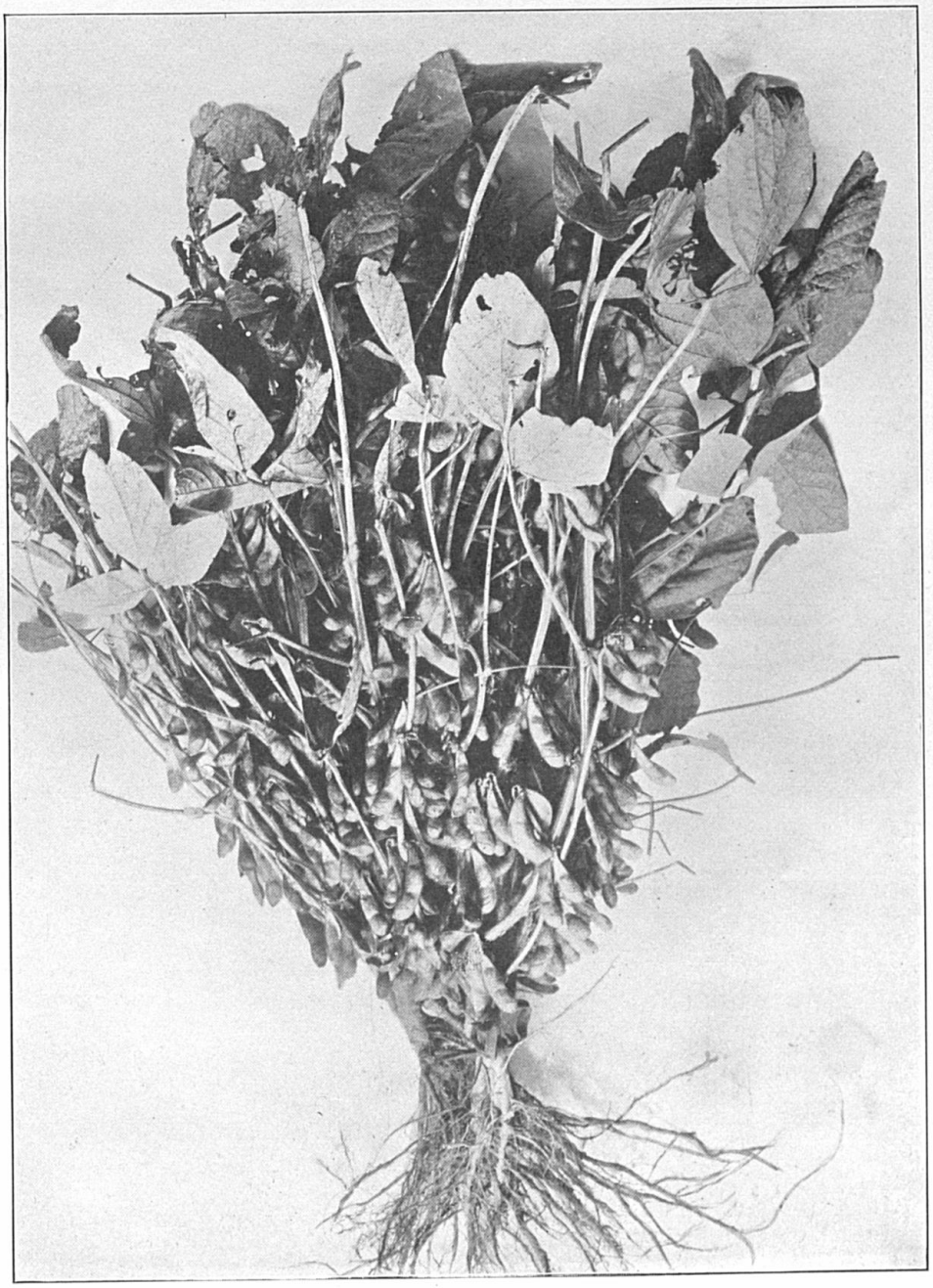


FIG. 5.—Soy Bean Plant from Plot, Aug. 20, 1900. Photographed by H. G.

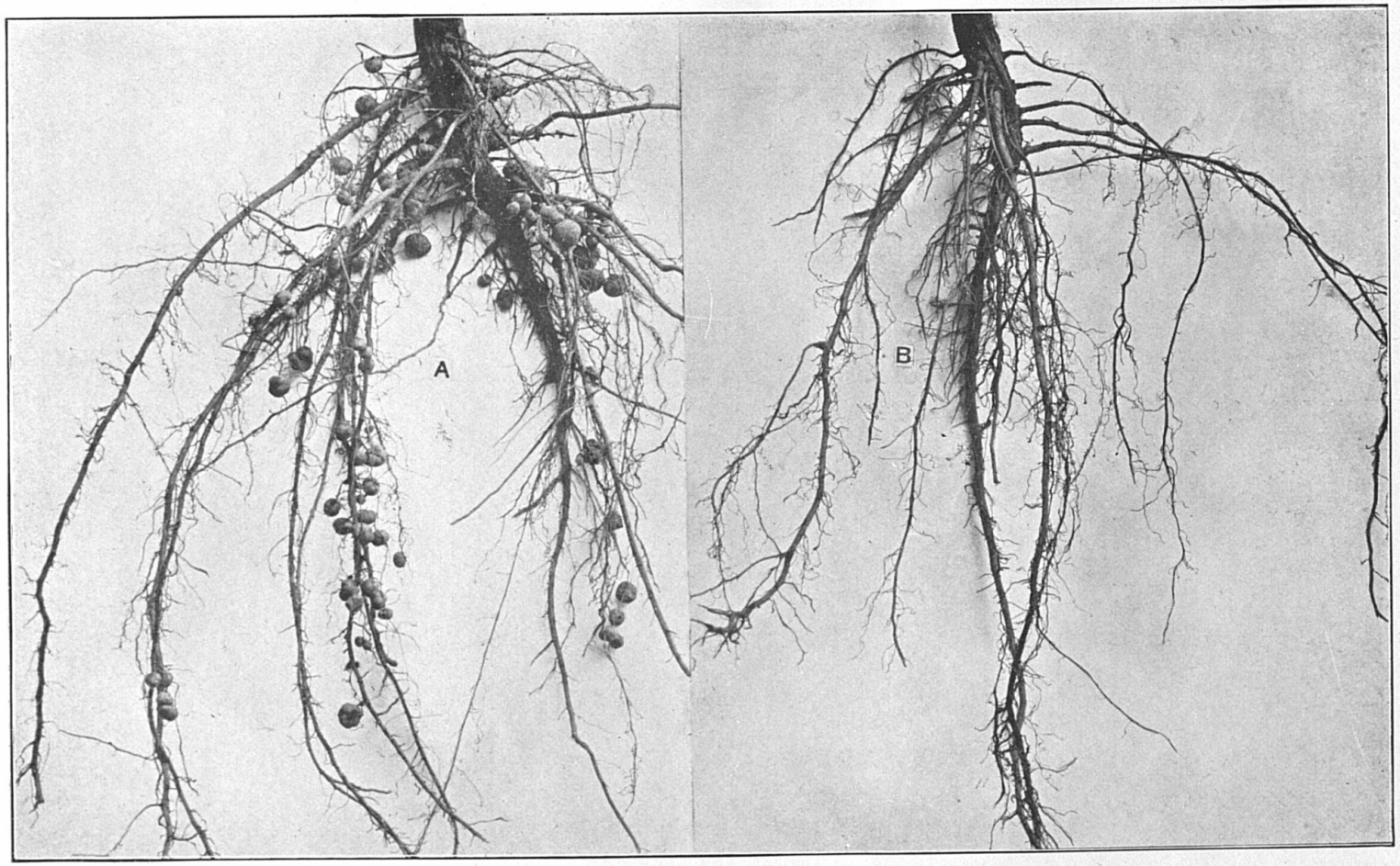


FIG. 6.—Roots of Soy Beans from Plots: A, Seed Treated with Bacterial Culture from Dr. Hiltner; B, Seed not Treated. Reduced to one-half natural size. Photographed, Oct. 1, 1901, by H. G.

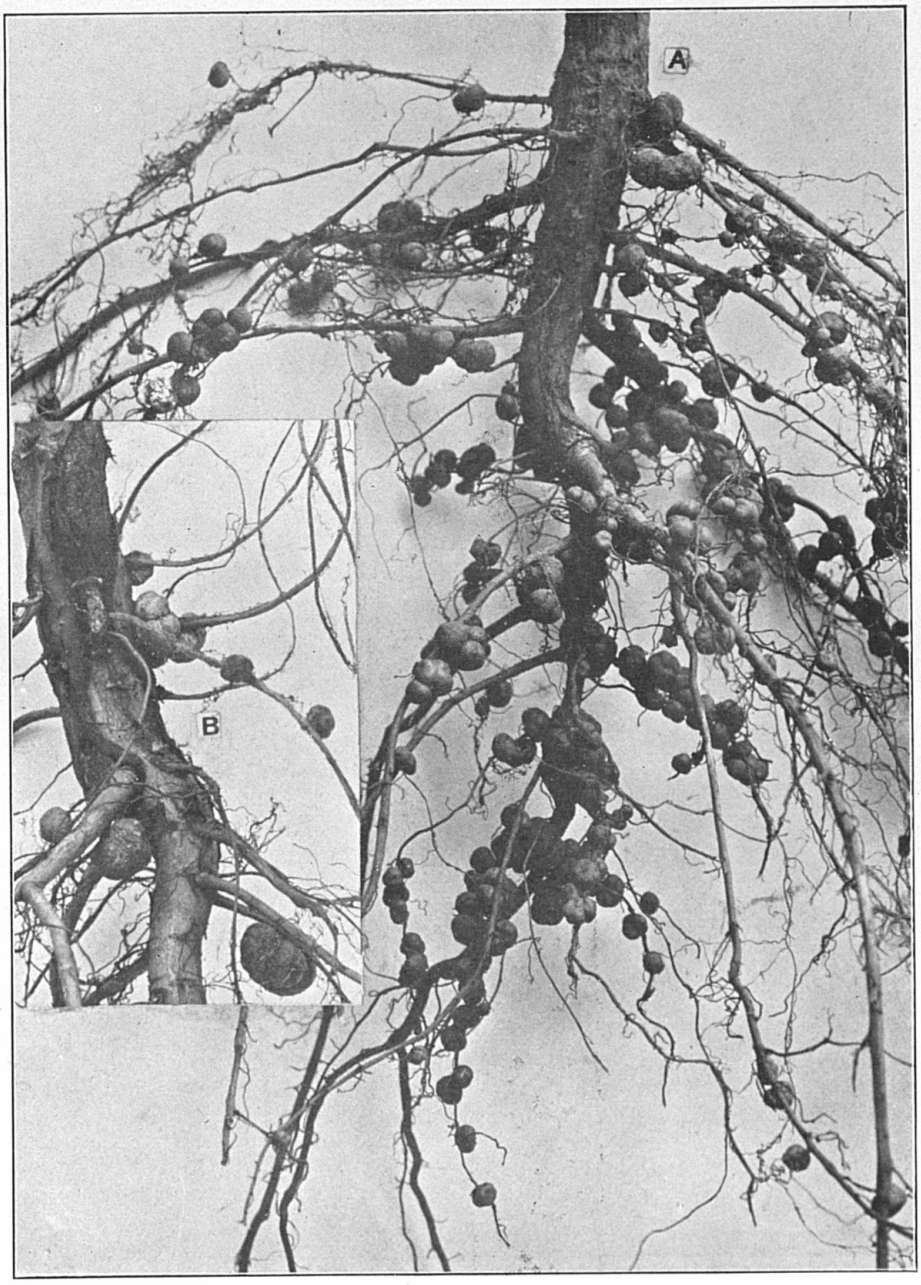


FIG. 7.—Roots of Soy Bean Grown the Second Season on the Same Soil. Both A and B, natural size. Photographed, Sept. 26, 1901, by H. G.

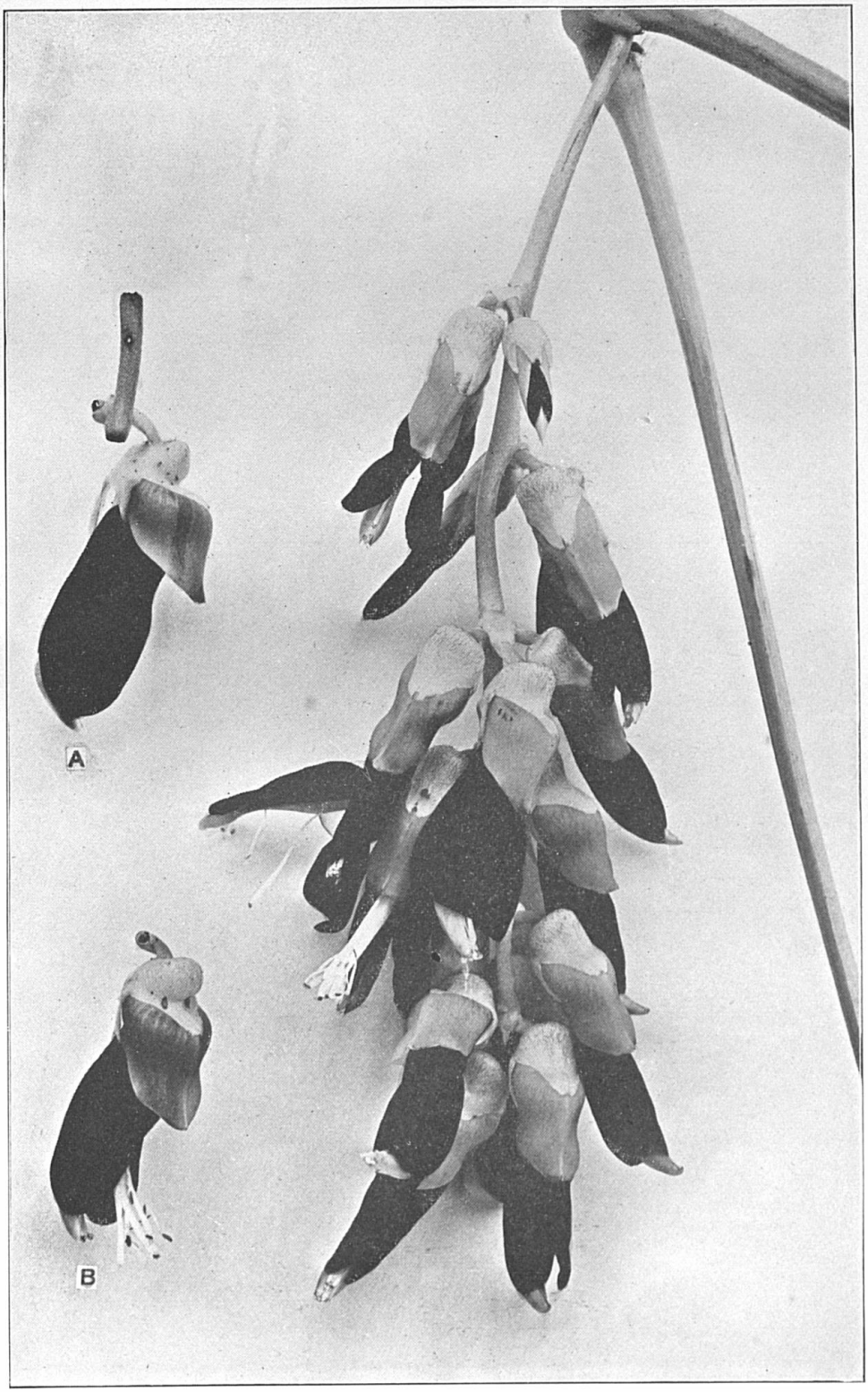


FIG. 8.—Flowers of the Velvet Bean, from Plot, Oct. 5, 1900.
Natural size. Photographed by H. G.



FIG. 9.—Pods of Velvet Bean from Plot, Oct. 5, 1900. Natural size.
Photographed by H. G.



FIG. 10.—Kentucky Blue-grass Ready for the Stripper. Woodland Pasture at Ashland, The Home of Henry Clay, June 4, 1900. Photographed by H. G.



FIG. 11.—A Plot of Teosinte, Aug. 20, 1900 (at A). Burnet at B. Photographed by H. G.



FIG. 12.—A Plot of White Millo Maize, Aug. 24, 1901. (Soy Beans in the foreground.) Photographed by H. G.



FIG. 13 —A Plot of Yellow Millo Maize, Aug. 24, 1901. (Soy Bean in the foreground.) Photographed by H. G.

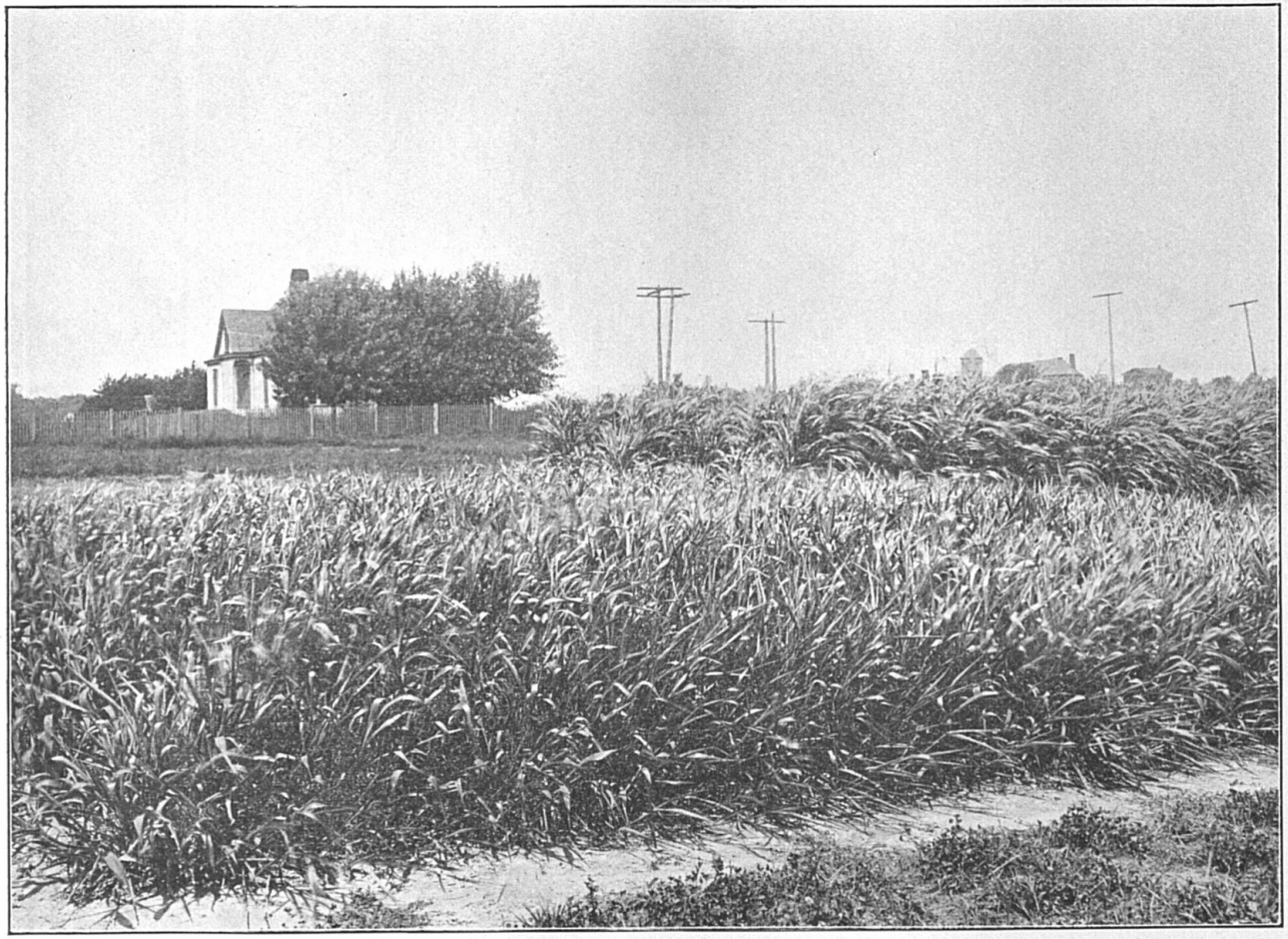


FIG. 14.—A Plot of Texas Millet, Aug. 9, 1901. Photographed by H. G.



FIG. 15.—A Plot of Pearl Millet, Aug. 24, 1901. Photographed by H. G.

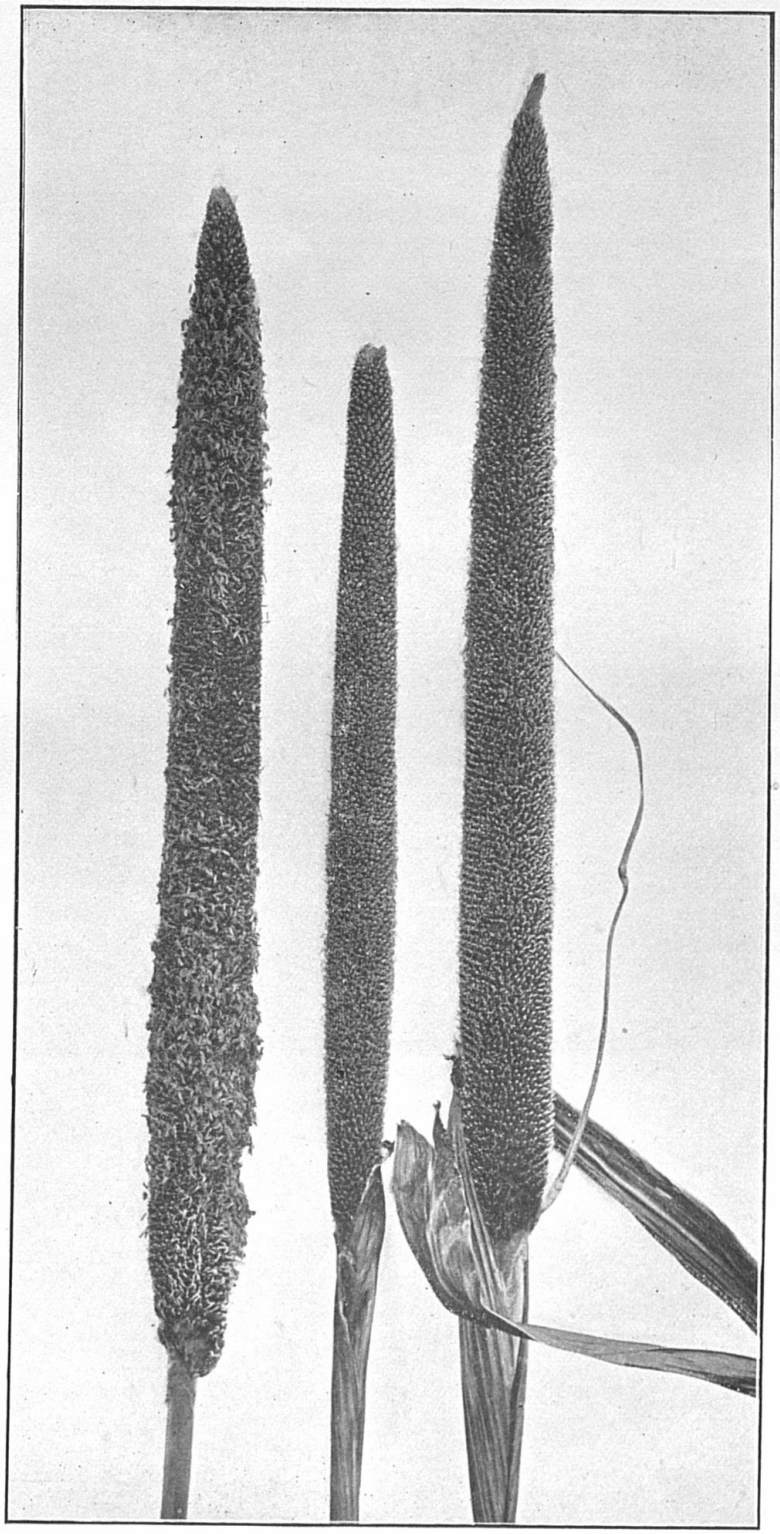


FIG. 16.—Heads or Spikes of Pearl Millet, from Plot, Sept. 20, 1901. Reduced to about one-half natural size. Photographed by H. G.

spike-like head, somewhat like that of timothy, but reaching a length of 1 foot and a diameter of 1 inch. Two cuttings can be obtained from it during a season.

A half plot cut July 17, 1901, produced at the rate of 20.8 tons of fresh fodder per acre, which dried to 7.2 tons. The second cutting from the same plants, Sep. 26, 1901, gave a yield of 19.36 tons of fresh fodder per acre and 9.2 tons of dry fodder. This half plot thus produced at the rate of 40.16 tons of fresh fodder and 16.4 tons of dry fodder per acre. It was planted in drills, 3 feet apart.

Phalaris arundinacea (REED CANARY-GRASS).—Planted April 14, 1900. Cut June 19, 1901: Weight, fresh, 8.08 tons per acre; weight, dry, 4.16 tons per acre.

Phleum pratense (TIMOTHY).—Planted April 12, 1900. Cut July 2, 1901: Weight, fresh, 7.12 tons per acre; weight, dry, 3.68 tons per acre.

Poa compressa (CANADA BLUE-GRASS).—Planted April 12, 1900. Cut June 19, 1901: Weight, fresh, 2.64 tons per acre; weight, dry, 1.6 ton per acre.

Poa pratensis (KENTUCKY BLUE-GRASS).—Planted April 14, 1900. Cut June 11, 1901: Weight, fresh, 4.08 tons per acre; weight, dry, 1.68 ton per acre.

The proper time to gather blue-grass seeds. Mr. Edgar Brown, of the Seed Laboratory, U. S. Department of Agriculture, spent some time at this Station last June, and in conjunction with the Station had gathered on the Farm blue-grass seeds at fourteen different dates, covering the period when the seed is at its best and also at its worst. It has seemed to some of us who have been watching the work of harvesting blue-grass seed that it is often gathered before it is sufficiently ripe, and that this, together with the excessive heat to which it is at times subjected during the curing process, explains the poor quality of some seed shipped out of Blue-grass Kentucky. The seed gathered under Mr. Brown's direction has recently been tested in the Vivarium of my Division, and the results presented below indicate that seeds gathered either very early or very late in June are likely to show a low per cent. of germination, and that from about June 12 to June 20 is the best time to gather seeds.

Blue-grass Seed Gathered on Kentucky Experiment Station Farm in June, 1901. Tested by Planting in Benches in Vivarium in Fall of Same Year.

Date of Gathering Seed	Plot 1.—Equal bulks of seed. Planted Sept. 29, 1901. Examined Nov. 8, 1901.	Plot 2.—Equal bulks of seed. Planted Oct. 11, 1901. Examined Nov. 27, 1901.	Plot 3—Equal bulks of seed. Planted Oct. 14, 1901. Examined Nov. 27, 1901.	Plot 4.—500 seeds of each. Planted Nov. 11, 1901. Examined Dec. 2, 1901.	
	Plants produced.	Plants produced.	Plants produced.	Plants produced.	Per cent. germinated.
June 8	294	192	125	225	45
10	290	182	112	195	39
12	398	270	148	.....	....
14	600	284	172	316	63.2
15	484	296	157	.....	.....
17	632	335	163	310	62
18	620	263	165	.....	.....
19	553	247	140	.....	.....
20	427	260	134	.....	.....
21	453	236	130	.....	.....
22	397	204	142	.....	....
24	430	245	150	.. ..	.....
25	387	233	147	312	62.4
26	412	216	132	191	38.2

3. Analyses of Forage Plants from the Plots

By A. M. PETER, Chemist.

In the following tables will be found analyses of a number of the forage plants grown on the experimental plots, not including what have been published in Bulletin 87, but including a few analyses of material obtained from other sources. The analyses were made at different times by different members of the chemical force; the later ones by Messrs. La Bach, Averitt and Beatty, and the older ones by Messrs. Frazer, Curtis and Peter. The methods used were those adopted by the Association of Official Agricultural Chemists.

Wherever not otherwise indicated in the tables, the samples were taken from the plots by cutting off the plants two or three inches above the ground as they would be cut for hay. The material was then brought to the laboratory as quickly as possible and weighed, then well dried in a warm room, weighed again, ground to powder and analyzed. The results printed in the table of analyses represent the composition of this room dried material, which is usually somewhat dryer than the same material would have been if dried in the field as in making hay. Besides the substances which are usually determined in the analysis of feed stuffs, we have also given the phosphoric acid, nitrogen and potash, as these are important in judging the value of a forage plant as a manure-maker, or for enriching the soil. A large part of these constituents of fertilizers passes into the manure, when the material is fed to stock, and the richer the food is in these the more valuable the manure is likely to be.

In the following tables the first column contains the number of the sample and the second the common name of the plant. After this follows the analysis, calculated upon the dry material prepared by drying in the air of a warm room; next is a column showing the time of cutting, and lastly the number of the sample is repeated.

20310

Station Number.	NAME OF PLANT.	In the air-dry sample, per cent.				
		Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.
3570	Alfalfa	8.07	8.41	15.25	27.59	39.40
3571	"	8.69	6.58	12.94	30.48	40.16
3585	"	9.13	7.08	12.50	25.82	44.04
3608	"	9.44	8.33	19.31	29.08	32.58
9265	" Samarcand	6.20	10.76	18.31	29.93	31.79
3572	Alsike clover	9.51	9.06	15.81	26.70	37.44
3573	" "	9.42	7.74	13.88	26.90	40.46
5704	" "	9.09	9.84	18.72	17.14	43.16
7686	Australian salt bush	7.26	15.93	18.93	24.63	31.45
7726	" " "	6.33	15.96	17.68	23.85	34.66
5701	Black medick	9.15	12.21	20.94	18.99	36.56
3569	Bush clover, native	8.25	5.22	9.19	36.68	38.64
5712	Canada blue-grass	8.44	4.20	5.28	26.75	52.83
5710	Canary reed-grass	8.41	7.16	7.69	27.07	47.74
7787	Cheat	6.35	6.90	9.68	32.46	42.53
5727	Cowpeas, whippoorwill, whole plant	9.55	8.28	14.31	25.02	40.82
9254	" " " "	7.36	19.21	26.19	22.32	22.84
9249	" wonderful " "	8.25	16.84	26.37	20.70	25.59
9250	" lady " "	6.84	19.79	27.25	24.08	20.02
9251	" ex, early bl'keyed, whole plant	7.43	17.41	25.81	21.75	25.52
9252	" large blackeyed, whole plant	7.19	19.89	26.44	18.03	26.26
9253	" red ripper " "	7.45	18.94	29.44	17.86	23.90
9255	" calico " "	8.19	18.42	26.31	19.83	25.45
9256	" Clay " "	7.89	18.20	26.87	23.19	22.02
9257	" Taylor " "	8.35	19.09	26.75	18.60	25.23
9258	" black " "	8.19	18.24	27.75	18.17	25.88
9259	" unknown " "	8.05	18.77	27.25	19.59	22.65
9297	" roots, not bearing tubercles	5.40	.....	11.31	.. ..	.....
9298	" " bearing tubercles	5.56	11.28	16.87	.. ..	.....
9400	" whippoorwill, seeds	11.46	3.58	25.63	4.06	54.35
9397	" extra early blackeyed, seeds	10.69	3.57	25.12	2.61	56.76
9398	" large blackeyed, seeds	9.45	3.55	25.12	3.83	57.06
9399	" red ripper "	9.18	3.19	23.19	4.48	58.92
9401	" calico "	9.40	3.60	24.69	4.60	56.77
9402	" Clay "	10.69	3.50	25.31	4.98	54.56
9403	" Taylor "	11.34	3.16	23.06	3.77	57.62
9404	" black "	10.80	3.25	23.44	4.16	57.32
9405	" unknown "	9.40	3.38	25.50	4.57	56.27
5700	Crimson clover	9.66	8.57	16.69	25.48	37.77

ERRATUM.

Analyses Nos. 9297 and 9298 on pp. 52 and 53 are of roots of soy bean, not cowpeas, and should have been printed on pp. 56 and 57.

In the air-dry sample per cent.				WHEN GATHERED.		Station Number.
Fat.	Phosphoric Acid.	Nitrogen.	Potash.			
1.28	0.64	2.44	0.98	June 12, 1893.		3570
1.15	0.66	2.07	1.46	June 28, 1893.		3571
1.43	0.55	2.00	0.93	" 22, 1894.	In bloom	3585
1.26	0.75	3.09	1.03	May 24, 1895.		3608
3.01	0.68	2.93	3.12	" 24, 1901.	Beginning to bloom	9265
1.48	0.97	2.53	1.35	June 14, 1893.		3572
1.60	0.99	2.22	0.96	" 28, 1893.		3573
2.05	0.94	2.99	0.94	" 5, 1897.		5704
1.80	1.66	3.03	6.32	Nov. 2, 1899.	From vivarium	7686
1.52	1.05	2.83	4.96	Oct. 6, 1900.		7726
2.15	0.75	3.35	0.68	May 19, 1897.		5701
2.02	0.21	1.47	1.25	July 19, 1895.	Wild growth, Louisa, Ky.	3569
2.50	0.48	0.84	1.46	" 1, 1897.		5712
1.93	0.53	1.23	1.91	" 1, 1897.		5710
2.08	0.68	1.55	1.82	June 9, 1900.	College campus	7787
2.05	0.71	2.29	2.05	Aug. 26, 1898.		5727
2.08	1.36	4.19	6.07	July 2, 1901.		9254
2.25	0.97	4.22	4.55	" " "	Same as 9405	9249
2.02	0.94	4.36	5.20	" " "		9250
2.08	0.99	4.13	4.73	" " "		9251
2.19	1.07	4.23	5.57	" " "		9252
2.41	1.35	4.71	5.71	" " "		9253
1.80	1.08	4.21	4.81	" " "		9255
1.83	1.16	4.30	5.22	" " "		9256
1.98	0.99	4.28	4.00	" " "		9257
1.77	1.03	4.44	4.25	" " "		9258
3.69	1.14	4.36	5.15	" " "	Same as 9249	9259
.....	.....	1.81	.....		Exclusive of the tap root	9297
.....	1.04	2.70	1.38		" " " " "	9298
0.92	1.19	4.10	1.61	Sept. 21, 1901.		9400
1.25	1.30	4.02	1.60	Aug. 20, "		9397
0.99	1.34	4.02	1.55	Sept. 19, "		9398
1.04	1.01	3.71	1.49	Oct. 22, "		9399
0.94	1.17	3.95	1.57	" " "		9401
0.96	1.18	4.05	1.57	" " "		9402
1.05	0.74	3.69	1.53	" " "		9403
1.03	1.15	3.75	1.52	" " "		9404
0.88	1.24	4.08	1.60	" " "		9405
1.83	0.84	2.67	0.95	May 19, 1897.		5700

Station Number.	NAME OF PLANT.	In the air-dry sample; per cent.				
		Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.
9267	Crimson clover	7.52	12.06	14.44	24.54	38.56
7690	Egyptian clover	6.93	10.70	16.81	23.68	38.10
5711	English blue-grass	9.00	6.58	7.81	30.80	43.78
5713	" "	9.13	6.09	11.87	30.00	40.69
5732	Fenugreek	10.03	12.41	20.13	20.96	34.92
7689	"	6.90	11.20	21.93	19.49	37.99
5709	Fiorin	8.51	5.53	6.19	28.16	49.64
9248	Flat pea, whole plant	8.13	6.18	23.60	27.48	32.02
3616	Florida beggar, weed	11.20	18.14	22.13	14.50	32.03
3620	" " "	8.43	7.98	7.31	29.81	45.08
3632	" " "	8.01	7.78	14.50	28.41	39.41
7790	Furze	5.47	6.96	11.62	38.56	35.43
3629	Japan clover	7.71	8.74	16.94	27.01	37.00
5716	Johnson grass	8.29	5.38	4.00	33.12	47.77
5717	" " root	9.89	8.19	3.81	25.93	50.99
3578	Kidney vetch	8.59	12.99	7.69	28.02	41.54
5699	" "	9.59	13.17	16.00	18.46	40.76
5733	" "	10.00	11.98	13.56	26.00	36.62
5734	" " roots	9.17	15.12	10.81	27.18	36.35
5735	" "	10.36	6.72	11.31	33.47	36.67
5708	Low hop clover	11.18	7.40	12.75	25.25	41.79
3574	Mammoth clover	9.19	8.37	15.31	26.37	39.24
3575	" "	8.76	7.53	12.69	32.71	36.85
7786	Oats	6.13	11.69	14.50	25.21	39.51
7791	"	6.63	8.27	10.31	26.35	45.63
5703	Orchard grass	8.17	5.99	7.00	32.25	44.43
5707	Rape, dwarf Essex	9.91	16.45	23.94	10.91	35.71
5714	" " "	11.01	13.39	12.62	14.08	45.44
5715	" " "	10.00	11.33	11.50	13.60	51.22
5718	" " "	10.92	18.18	24.56	11.35	31.93
231	Red clover	10.00	7.04	13.78	19.41	46.43
242	" "	10.00	6.15	13.65	19.97	47.71
5724	Rostow sugar pea	10.24	6.54	16.00	25.84	38.89
5725	Russian field pea	10.41	5.84	16.69	25.66	38.58
5726	" " "	10.03	6.75	15.13	28.78	37.22
5728	Russian vetch	9.31	7.82	25.31	22.37	32.80
5729	" "	10.65	6.12	19.56	28.92	32.96
5730	" "	10.49	5.70	19.38	20.26	41.35
5731	" "	11.62	9.83	27.00	23.16	26.32

In the air-dry sample; per cent.				WHEN GATHERED.		STATION NUMBER.
Fat.	Phosphoric Acid.	Nitrogen.	Potash.			
2.88	0.63	2.31	2.73	May 24, 1901.	In full bloom	9267
2.78	0.63	2.69	2.48	June 18, 1900.		7690
2.03	0.57	1.25	2.19	July 1, 1897.	Festuca elatior	5711
2.23	0.66	1.90	1.75	" 1, "	" pratensis	5713
1.55	0.74	3.22	4.49	June 2, 1899.	From Vivarium	5732
2.49	0.75	3.51	4.96	June 13, 1900.		7689
1.97	0.54	0.99	1.66	" 29, 1897.		5709
2.59	0.80	3.69	2.94	July 2, 1901.		9248
2.00	1.27	3.54	4.51	May 28, 1896.		3616
1.39	0.95	1.17	2.76	July 18, 1896.		3620
1.91	0.59	2.32	1.10	Sept. 8, 1896.		3632
1.96	0.65	1.86	2.44	June 8, 1900.		7790
2.60	1.08	2.71	2.17	July 31, 1896.	From Vivarium	3629
1.44	0.43	0.64	1.15	" 31, 1897		5716
1.19	1.05	0.61	4.26	Aug 6, 1897.		5717
1.18	1.79	1.23	2.09	June 28, 1893.		3578
2.02	0.48	2.56	1.08	May 19, 1897.	In bloom	5699
1.84	0.67	2.17	1.03	June 3, 1899.		5733
1.37	1.15	1.73	0.59	" 3, "		5734
1.47	0.61	1.81	1.16	" 17, "		5735
1.63	0.73	2.04	2.08	June 11, 1897.	Wild growth, Danville, Ky.	5708
1.52	0.78	2.45	1.11	" 21, "	Beginning to bloom	3574
1.46	0.62	2.03	0.84	" 28, "		3575
2.96	1.34	2.32	5.66	June 19, 1900.		7786
2.81	0.92	1.65	3.60	July 16, 1900.		7791
2.16	0.54	1.12	1.88	June 5, 1897.	In bloom	5703
3.08	1.44	3.83	5.72	" 22, "		5707
3.46	1.40	2.02	4.86	July 8, "		5714
2.35	1.23	1.84	3.17	" 31, "		5715
3.06	1.01	3.93	5.12	Nov. 4, "	Second growth	5718
3.34	.....	.....	.....	May 28, 1887.	In bloom—College Campus.	231
2.52	....	.....	.....	June 13, 1887.	" " " "	242
2.49	0.73	2.56	1.27	July 23, 1898.		5724
2.76	0.74	2.67	1.17	" " "		5725
2.09	0.76	2.42	1.26	Aug. 6, "		5726
2.39	1.26	4.05	1.99	July 19, 1898.		5728
1.79	1.06	3.13	1.74	Sept. 15, "	Some seeds ripe	5729
2.82	0.93	3.10	1.49	Nov. 16, "		5730
2.07	1.37	4.32	3.45	May 8, 1899.	Spontaneous growth	5731

Station Number.	NAME OF PLANT.	In the air-dry Sample, per cent.				
		Water.	Ash.	Protein.	Fiber.	Nitrogen-free extract.
9296	Russian vetch	6.90	12.76	22.19	27.64	26.79
3584	Serradella	8.99	15.29	18.56	16.86	38.55
2023	"	9.47	11.78	12.50	25.50	38.64
7727	Smooth brome grass	5.77	5.87	5.56	32.91	47.82
7725	Soy bean, whole plant	6.99	8.25	16.87	23.78	42.52
7760	" " " "	8.26	8.61	21.05	26.32	32.67
9244	" " " "	7.93	13.43	24.06	21.96	31.04
7687	" " best white, 4913, whole plant	7.03	8.07	13.68	22.59	45.82
7688	" " best green, 4914, " "	7.42	9.39	17.68	25.38	37.74
7761	" " " " " " "	7.02	10.44	14.93	26.08	37.24
9246	" " " " " imported seed	8.40	12.99	26.81	18.53	31.72
9247	" " " " " homegrown "	7.28	13.61	25.19	20.25	32.41
7762	" " 4912	7.32	9.40	25.25	12.33	33.41
9245	" " "	6.85	13.69	23.56	22.28	32.49
9360	" " seeds	8.66	5.41	36.56	.....	.....
9361	" " "	8.97	5.32	36.62	.....	.....
7757	" " 4913, ripe seeds	7.11	5.71	37.31	4.63	26.84
7758	" " 4914, " "	6.57	5.64	34.68	4.66	29.60
7759	" " 4912, " "	7.03	5.89	35.56	4.89	26.14
2020	Spurry, entire plant	8.69	12.65	12.81	22.14	40.38
3577	Sweet clover	8.01	4.81	11.38	34.65	40.03
3607	" "	9.41	7.73	19.13	26.89	35.13
2053	" "	9.69	6.58	19.31	16.44	44.78
3627	" "	8.42	6.47	18.44	24.96	39.97
3628	" "	8.54	5.29	15.25	29.40	39.63
5702	" "	8.91	8.31	16.19	23.61	40.81
7724	Teff	6.23	9.21	11.87	26.22	44.38
7723	Teosinte	6.50	12.29	7.93	27.12	44.54
7691	Velvet bean	6.54	8.94	20.12	25.14	36.13
7789	Virginia wild rye	6.17	7.64	9.37	31.07	44.41
7728	White lupine	6.73	12.82	20.56	20.16	37.15

In the air-dry sample, per cent.				WHEN GATHERED.		Station Number.
Fat.	Phosphoric Acid.	Nitrogen.	Potash.			
3.72	1.04	3.55	4.17	Aug 24, 1901.	.....	9296
1.75	1.04	2.97	1.52	June 22, 1894.	In bloom	3584
2.11	.....	.....	.....	Aug. 24, 1892.	Through blooming	2023
2.07	0.43	0.89	2.23	" 19, 1900.	.....	7727
1.59	0.73	2.70	2.23	" 1, "	.....	7725
3.09	0.69	3.37	2.74	Sept. 17, 1900.	.....	7760
1.58	0.95	3.85	3.84	July 3, 1901.	.....	9244
2.81	0.75	2.19	2.46	Aug. 1, 1900.	.....	7687
2.39	0.72	2.83	2.85	" 1, "	.....	7688
4.29	0.88	2.39	2.09	Sept. 17, "	.....	7761
1.55	0.85	4.29	3.42	July 3, 1901.	.....	9246
1.26	0.85	4.03	3.48	" 3, "	.....	9247
12.29	1.18	4.04	2.37	Sept. 17, 1900.	.....	7762
1.13	0.88	3.77	3.80	July 3, 1901.	.....	9245
.....	1.69	5.85	1.79	Oct. 1, 1901.	From plantswithout tubercles	9360
.....	1.65	5.86	1.96	Oct. 1, 1901.	From plants with tubercles.	9361
18.40	1.63	5.97	2.67	Sept. 8, 1900.	.....	7757
18.85	1.78	5.55	2.54	Oct. 10, "	.....	7758
20.49	1.61	5.69	2.50	Sept. 20, "	.....	7759
3.33	.....	.....	.....	June 14, 1892.	In full bloom	2020
1.12	0.53	1.20	0.66	June 28, 1893.	.....	3577
1.71	0.82	3.06	1.02	May 24, 1895.	.....	3607
3.20	.....	.....	.....	Oct. 5, 1892.	First year	2053
1.74	0.79	2.95	1.45	July 30, 1896.	" "	3627
1.89	0.77	2.44	1.04	Aug. 25, "	" "	3628
2.17	0.96	2.59	1.45	May 22, 1897.	Second year	5702
2.09	0.80	1.90	2.34	Aug. 2, 1900.	.....	7724
1.62	0.88	1.27	6.21	" 2, "	.....	7723
3.23	0.61	3.22	2.55	Oct. 5, 1900.	.....	7691
1.34	0.66	1.50	2.05	June 24, "	.....	7789
2.58	1.17	3.29	4.52	June 8, 1900,	.....	7728

It may not be out of place here to repeat from Bulletin 87 a brief statement explanatory of the nature of the substances into which a feed stuff is usually separated by analysis.

Water is contained in all feed stuffs and its amount varies greatly, being usually largest in the young plant, becoming less as the plant becomes more woody. In dried materials like hay it may be about 10 per cent., but is quite different in different materials, and varies in the same material with the moisture of the air in which it is kept.

Ash is the mineral matter which is left when the feed stuff is burned. It usually consists mainly of carbonates and phosphates of lime and potash. The ash of grasses usually contains also a large proportion of silica. Besides the mineral substances which are actually contained in the vegetable matter itself, the ash usually contains more or less sand or soil that has adhered to the plant in the form of dust. Animals derive the phosphates of their bones from the ash constituents of their food, but the phosphates and potash are only partly used up in this way, the rest going to enrich the manure.

Protein is the name for a class of substances containing nitrogen. This is one of the most important constituents of feed stuffs, as it is the one which furnishes the material for making flesh, blood, muscles, &c. Protein is often divided by analysis into *albuminoids*, or substances similar to albumin or white of egg, considered very valuable as food, and *amids*, which are considered less valuable. In very young, tender grasses the proportion of amids is apt to be large.

Fiber is the woody part of plants and is the least digestible constituent of feed stuffs. A part of it, however is usually capable of being digested and serves a similar purpose in the food to the nitrogen-free extract.

Nitrogen-free extract is the starchy part of the feed stuff, including, besides starch, the sugars, gums, &c., and is an important part of a food. As grasses become ripe the proportion of nitrogen-free extract largely increases.

Fat is that part of the feed stuff that is soluble in ether and includes, besides true fat or oil, the wax and green coloring matter of plants. The fat of food may be stored up in the

body as fat, or burned to keep up the heat and energy of the animal.

Some general ideas of the relative value of different forage plants as food may be had from a comparison of their analyses, but a correct estimate can only be made when the proportion of each constituent that is digestible—that is, the co efficient of digestibility—is known.

Below are given the co-efficients of digestibility of some dried forage plants, taken from Prof. W. A. Henry's "Feeds and Feeding" 2nd edition, 1900. Most of these figures were determined by the American Experiment Stations, but a few are from foreign sources. The co-efficients of digestibility show how many parts in each 100 of each constituent were found to be digestible. Thus, in the first line of the table, opposite "Alfalfa hay," we find, in the column headed "Protein," the number 74, which means that seventy-four hundredths of all the protein in alfalfa hay was digestible. If alfalfa hay contains 15.25 per cent. of protein, the digestible protein in the hay will be seventy-four hundreths of this amount, or 11.28 per cent. The digestibility as well as the composition of forage plants varies considerably at different stages of growth as well as in different years.

Average Digestion Co-efficients of Some Forage Plants.

MATERIAL.	Dry Matter.	Protein.	Fiber.	Nitrogen-free Extract.	Fat.
Alfalfa hay	60.	74.	43.	66.	39.
Alsike clover hay	62.	66.	53.	71.	50.
Cowpea-vine hay	59.	65.	43.	71.	50.
Crimson clover hay	62.	69.	45.	62.	44.
Hungarian grass hay	65.	60.	68.	67.	64.
Johnson grass hay	55.	45.	58.	64.	39.
Orchard grass hay	56.	60.	61.	62.	51.
Red clover hay, cut in bloom	61.	62.	49.	69.	62.
Redtop hay	60.	61.	61.	62.	51.
Serradella hay, cut in bloom	62.	75.	50.	63.	65
Soja bean hay	62.	71.	61.	69.	29.
" " meal	79.	87.	..	73.	85.
Timothy hay, all trials	57.	48.	52.	63.	57.
" " cut in bloom	60.	56.	58.	63.	57.
" " " soon after bloom	53.	45.	47.	60.	53.
Vetch "	65.	76.	54.	66.	60.

INDEX TO COMMON NAMES.

Page.

Alfalfa....24, 52, 59
Australian Salt-bush....52
Bean, Velvet....33, 56, Figs. 8, 9
Bent-grass, Rhode Island....47
Black Medick....23, 52
Blue-grass, Canada....49, 52
English....48, 54
Kentucky....49, Fig. 10
Brome-grass, Meadow....47
Smooth....48
Broom....42
Bush-clover....22
Hairy....22
Narrow-leaved....22
Nuttall's....22
Slender....22
Stuve's....22
Wand-like....22
Butterfly Pea....15
Canada Field Pea....34
Canary-grass, Reed....49, 52
Cat-gut....15
Cheat....52
Clover, Alsatian....36
Alsike....36, 52, 59
Bokhara....29
Buffalo....41
Crimson....37, 52, 59, Figs. 3-4
Dutch....41, Fig. 1
Egyptian....35, 54
Italian....37, Figs. 3, 4
Japan....22, 54
Low Hop....40, 54
Mammoth....38, 54
Rabbit-foot....36
Red....38, 54, 59, Fig. 2
Sweet....29, 56
White....41, Fig. 1

Page

Coffee Bean....15
Cowpea....42, 52, 59
Esparsette....33
False Indigo....13
Fenugreek....41, 54
Field Pea, Canada....34
Fiorin....54
Flat Pea....21, 54
Florida Beggar-weed....32, 54
Foxtail, Meadow....47
Furze....42, 54
Goat's Rue....15
Gorse....42
Ground-nut....14
Hagweed....15
Hog Peanut....15
Hop-clover, Low....40
Johnson Grass....54, 59
Kentucky Coffee-tree....15
Kidney Vetch....13, 54
Locust, Black....35
Honey....15
Water....15
Low Senna....14
Lucerne....24
Lupine, Blue....23
White....22
Yellow....23
Mand's Wonder Forage Plant....48
Medick, Black....23, 52
Melilot, White....29, 56
Yellow....31
Milk Pea, Downy....15
Milk Vetch, Carolina....14
Millet, Texas....48, Fig. 14
Pearl....48, Figs. 15, 16
Millo Maize, White....47, Fig. 12
Yellow....47, Fig. 13

Page.
Mimosa, Illinois.....13
Oats.....54
Oats-grass, Tall..... 47
Orchard Grass 48, 54, 59
Partridge Pea.....14
Pea, Sensitive 14
Peanut, Hog.....15
Pencil Flower 35
Pencillaria 48
Prairie Clover, Leafy. 21
White 21
Violet.....21
Rape..... 54
Red-bud 14
Red-top.....47, 59
Reed Canary-grass..... 49, 52
Rescue Grass 48
Rhode Island Bent-grass 47
Rhynchosia, Twining 35
Rye-grass, Italian.....48
Perennial.....48
Sainfoin.....33
Salt-bush, Australian.....52
Serradella,.....34, 56, 59
Scotch Broom 15
Senna, Low 14
Sensitive Pea..... 14
Sheep's Fescue 48
Page.
Soja Bean .....16, 56, 59, Figs. 5, 6, 7
Soy Bean .....16, 56, 59, Figs. 5, 6, 7
Spurry 56
Sweet Vernal Grass, Perennial.....47
Teff.....56
Teosinte .....48, 56, Fig. 11
Tick-trefoil 32
Timothy 49, 59
Velvet Bean..... ..33, 56, Figs. 8, 9
Vetch, American.....42
Carolina 42
Common 42, 59
Hairy 42
Kidney.....13, 54
Russian.....42, 54, 56
Tufted..... 42
Vetchling, Marsh.....21
Whin 42
Wild Bean.....35
Pink 35
Small-flowered.....35
Trailing 35
Wild Indigo.. 14
White..... 14
Wild Rye, Virginia 56
Wisteria, American 21
Wild Senna 14
Yellow-wood ... .15

KENTUCKY

Agricultural Experiment Station

OF THE

STATE COLLEGE OF KENTUCKY.

BULLETIN NO. 99.

OATS.

1. Test of Varieties.
2. Treatment for Smut.
3. Test of Fertilizers.
4. Relative Value of the Varieties for Feeding.

LEXINGTON, KENTUCKY.
APRIL, 1902.
63

KENTUCKY

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KENTUCKY AGRICULTURAL EXPERIMENT STATION,

LEXINGTON, KY.

BULLETIN NO. 99.

OATS.

1. Test of Varieties.

By J. N. Harper, Agriculturist.

The soil of the Blue-grass Region of Kentucky is not ideal for the production of oats. However by the application of potash fertilizers with good tillage and proper rotation, a fair yield can be had.

The value of the oat crop as food for animals is recognized by all. Its superiority to corn as a food for work animals is quite generally, if not universally, admitted. But in this section of the State, where land is held at such a high value, it does not pay to raise oats as a grain crop, except in proper rotation. It is getting to be quite a common practice with many farmers of this section to harvest their oats before the grain is mature and cure them for hay. This is a very profitable way to treat the oat crop. The only difficulty is that the oat plant is not ideal for making hay as it is difficult to cure.

Oats, when not sown too thickly, is considered one of the best crops to give bluegrass a start, the advantage over other crops being that the oat crop matures early enough to allow the young grass to get a good start in the fall.

For the test of varieties last season, as for several years past, the seed was planted in drills eight inches apart and at the rate of six pecks per acre. Eleven of the plots were 1-20 acre each, the rest being 1-40 acre, and they were all planted March 19th. They were harvested on July 13th and 16th, the earlier ripening varieties on the former date.

Table 1 gives the yield of grain and straw, calculated to the acre, the former in bushels of 32 pounds; also the character of grain and straw and the time when the grain was fully ripe. In table 2 have been collected the yields of these same varieties for four years. The seed planted each year was saved from the crop of the year before. The oats were not grown year after year upon the same plots, but were changed each year to a different acre. In 1898 the varieties were planted on Acre S. April 29, and were harvested July 22. Acre S had been in potatoes in 1897 and corn in 1896. In 1899 they were planted on Acre I, April 11, and harvested July 12. Acre I had been in wheat in 1898 and 1897, and in clover in 1896. In 1900 the only available place for the oats, unfortunately, was Acre O., the two halves of which had received different treatment in past years, rendering them unequal in fertility. This difference in fertility is very apparent from the larger yield of the first nine varieties in 1900. The oats were planted this year on April 7 and harvested July 11. Acre O was in clover in 1899 and sorghum in 1898. The first half was in potatoes in 1897 and 1896 and the last half was in sorghum in 1897 and corn in 1896. In 1901 the varieties were planted on Acre B March 19 and harvested on July 13 and 16. This acre had been in timothy continuously for five years, and its soil was much better than that of any other acres upon which the oats have been planted; a circumstance which will in great measure account for the much better yields obtained last year than in previous years.

Table 3 gives the weight of a measured bushel of each variety as observed for three years past, and the average of the three determinations.

Two tables, giving rainfall, temperature and some other meteorological data, have been included in the last part of this bulletin and will be found interesting in connection with the tables of yields.

Winter Oats.

In the fall of 1900 the Station received some black winter oat seed from Texas, which were planted October 19th of that year. They stood the winter well, only a very small percentage being winter killed. They were harvested June 24th and

TABLE 1.—YIELD OF GRAIN AND STRAW IN 1901, ETC.

PLOT NO.	NAME OF VARIETY.	YIELD PER ACRE.		Color of Grain.	Character of Straw.	When fully ripe.
		Grain, bu.	Straw, lbs.			
24	White Russian	49.	3300	White	Strong	July 9
13	Improved Welcome	47.6	3400	"	Weak	" 14
16	Negro Wonder	46.9	3600	Black	Strong	" 13
22	White Belgian (see No. 27)	46.9	3600	White	"	" 9
17	New American	46.2	3000	"	"	" 9
21	White Baltic	45.9	3400	"	"	" 9
27	White Belgian (see No. 22)	45.9	3300	"	Medi'm	" 10
20	Wideawake	45.5	3550	"	"	" 13
23	White Maine	45.5	3600	"	Strong	" 9
28	Mixed Oats	45.5	3650	"	Medi'm	" 13
15	Mammoth Cluster	44.8	2700	"	Weak	" 5
26	" "	44.2	3600	"	Medi'm	" 10
4	American White	43.4	3900	"	Strong	" 13
18	Pringle's Progress	42.7	3500	"	"	" 7
29	American Banner (see No. 1.)	42.4	3200	"	"	" 13
14	Lincoln	42.0	3200	Black	Medi'm	" 14
7	Badger Queen	41.3	3400	White	"	" 12
11	Hopetown,	40.3	3400	"	V'ry s'g	" 13
12	Imported Black Tartarian	39.9	3300	Black	Weak	" 16
3	American Triumph	39.6	2900	White	Strong	" 6
25	Yellow German	39.6	3100	"	"	" 9
19	Probsteir	38.8	3050	"	Medi'm	" 10
5	Australian	38.5	3200	"	Strong	" 12
8	Giant Yellow French	38.5	3200	"	Medi'm	" 16
6	Banner	37.8	3200	"	Strong	" 12
1	American Banner (see No. 29.)	37.4	2800	"	Strong	" 13
2	American Beauty	35.0	3200	"	"	" 10
9	Golden Giant Side	33.6	3300	"	"	" 16
10	Green Mountain	29.4	2700	"	"	" 16

TABLE 2.—YIELDS OF GRAIN AND STRAW FOR FOUR YEARS.

NAME OF VARIETY.	1898		1899		1900		1901	
	Grain, Bushels.	Straw. Pounds.	Grain, Bushels.	Straw, Pounds.	Grain. Bushels.	Straw, Pounds.	Grain. Bushels.	Straw, Pounds.
American Banner	9 5	1090	18.9	800	35 7	2000	37.4	2800
American Beauty	17.5	1320	17.9	1050	36.1	2190	35.	3200
American Triumph	12.6	1100	23.8	1080	38.9	1690	39.6	2900
American White	18.3	1600	19.6	1120	43.1	2270	43.4	3900
Australian	11.9	1100	18.9	1000	37.5	1780	38.5	3200
Banner	10.9	1250	17.9	930	38.9	1990	37.8	3200
Badger Queen	16.5	1330	20.7	810	39.2	1580	41.3	3400
Giant Yellow French	10.9	1350	15 1	770	30.5	2030	38.5	3200
Golden Giant Side	12.6	1520	11.6	710	32.6	1690	33.6	3300
Green Mountain	9.1	1280	10.2	970	18.2	1380	29.4	2700
Hopetown	11.9	1240	22.4	1120	29.4	1060	40.3	3400
Imported Black Tartarian	10.9	1270	18.2	640	21.7	2360	39.9	3300
Imported Welcome	9.8	1000	18.9	940	27.3	1820	47.6	3400
Lincoln	9.1	1100	13.3	820	23.1	1480	42.	3200
Mammoth Cluster	12.6	1080	22.4	920	31.2	1340	44.8	2700
Negro Wonder	7.	960	14.7	1140	30.1	1260	46.9	3600
New American	9 1	980	14.7	780	28.7	1780	46.2	3000
Pringle's Progress	15	1120	16.8	880	28.7	1300	42.7	3500
Probsteir	13.3	940	18.2	920	28.7	1220	38.8	3050
Wideawake	8	1040	15.4	760	29.4	1560	45.5	3550
White Baltic	11.2	1080	14.7	700	20.3	1460	45.9	3400
White Belgian	9.1	880	14	640	24.5	1220	46.9	3600
White Maine	11.9	1020	10.5	580	27.3	1100	45.5	3600
White Russian	11.9	1040	13.3	620	28.	1320	49.	3300
Yellow German	12.6	960	9.8	600	27.3	1360	39.6	3100
Mammoth Cluster	12.6	1040	12.6	720	24.9	1140	44 2	3600
White Belgian	7	920	13.3	580	23.8	1120	45.9	3300
Mixed Oats	8	920	14.7	620	19.6	920	45.5	3650
American Banner	7.7	1580	13.0	640	19.6	1320	42.4	3200

TABLE 3.—WEIGHT OF A MEASURED BUSHEL FOR THREE YEARS.

Plot No.	NAME OF VARIETY.	1899	1900	1901	AVERAGE.
1	American Banner	27	24	27	26
2	American Beauty	27	27	28	27.3
3	American Triumph	27½	27½	29½	28.1
4	American White	26	26	27	26 3
5	Australian	27	28	28½	27.8
6	Banner	30	29	30½	29 8
7	Badger Queen	25	24	27½	25.5
8	Giant Yellow French	24	23	26	24.3
9	Golden Giant Side	24	24	26½	24.8
10	Green Mountain	22	23½	24	23.1
11	Hopetown	30	30	32½	30.8
12	Imported Black Tartarian	26	26	27½	26.5
13	Imported Welcome	28	30½	32½	30.3
14	Lincoln	22	26	26½	24.8
15	Mammoth Cluster	28	29½	29½	29
16	Negro Wonder	24	23	26	24.3
17	New American	25	25	27	25.6
18	Pringle's Progress	32	32½	33	32.5
19	Probsteir	31	31	31½	31.1
20	Wideawake	25	27	27½	26.5
21	White Baltic	25	26	27	26
22	White Belgian	28	29	30	29
23	White Maine	28	29½	29½	29
24	White Russian	28	28	29½	28.5
25	Yellow German	29	30	30½	29.8
26	Mammoth Cluster	26	27½	28	27.1
27	White Belgian	29½	29½	29½	29.5
28	Mixed Oats	26	27	27½	26.8
29	American Banner	26	25½	29½	27

yielded 50.8 bushels per acre. Seed from this crop were planted October 29th, 1901, and were up growing well November 20th, but when examined March 11th not one sprig could be seen. They were completely winter killed. This result may have been due to the very severe cold weather in the middle of December, the temperature having fallen to eight degrees below zero on the 15th of that month.

2. Treatment for Smut.

The varieties of oats have been free from any smut since 1897. They were given the hot water treatment the spring of that year and the seed have since been kept in clean boxes and sacks. The hot water treatment recommended is to immerse the seed oats in hot water at a temperature of 134°F. for 15 minutes. The method is the same as recommended for wheat in Bulletin No. 69 by Prof. Garman, whose description is quoted below from that Bulletin:

"Careful comparative tests of bluestone solutions and of hot water as preventives of smut show that hot water is quite as effective in checking the disease and has the advantage of not injuring the sound seed. When treating seed with hot water it is well to be provided with the following: A good Fahrenheit thermometer. A large kettle in which water can be heated. Three barrels.

"The water in the kettle is kept near the boiling point, and the supply in it must be replenished as fast as it is used. In the first barrel keep ordinary water, and the other two should be about two-thirds full of water kept at a temperature of 131 degrees Fahrenheit.

"First put a bag of wheat in the barrel of cool water and leave it until the seeds are moist. It may be left for half an hour, or longer, but ordinarily two or three minutes is sufficient. Drain out the surplus cold water, then immerse for a minute or two in the second barrel, containing warm water. The object of this is to warm the wheat so that it will not cool the water in the third barrel. When warm, plunge quickly in the third barrel and leave it fifteen minutes. If the temperature shows a disposition to fall below 131 degrees, add a little hot wate

from the kettle till it reaches the 131 mark again. It should never be allowed to fall below 130 degrees, nor to go above 134 degrees Fahrenheit. With a good supply of hot water at hand it is very easy to regulate the temperature in the barrel, much easier than would be supposed by one who has not tried it. At the end of fifteen minutes the wheat is removed from the water and spread out to dry. But it must never be spread out on a floor upon which smutted wheat has lain. The convenience, cleanliness and cheapness of this method of preventing smut will certainly commend it to farmers, and I have no doubt but that it will displace the use of bluestone in course of time."

3. Test of Fertilizers.

The oats in this experiment were planted April 15, 1899, and harvested July 10th. Plot No. 1 was one acre in area; the other plots were ½ acre each.

The fertilizers were sown May 27th. The fertilizers used and yields obtained, both calculated to the acre, were as follows:

Plot 1. 160 lbs. Nitrate of Soda, yielded 37.1 bus. Grain; 2,007 lbs. Straw.

Plot 2. No fertilizer, 31.5 bus. Grain; 1,700 lbs. Straw.

Plot 3. 160 lbs. Muriate of Potash, 30.4 bus. Grain; 1,506 lbs. Straw.

Plot. 4. No fertilizer, 23.7 bus. Grain; 1,487 lbs. Straw.

There seems to have been a material increase of yield from both the nitrate of soda and the muriate of potash. This experiment was made upon the new farm where the soil is of the kind having a red clay subsoil. Tests reported in former bulletins, made on the old farm where the subsoil is yellow, have shown the largest increase from the application of potash salts.

4. Relative Value of the Varieties for Feeding.

BY A. M. PETER CHEMIST.

In order to test this question analyses were made of two sets of samples from the oats on each plot, one taken July 5th when the earliest varieties appeared to be ripe, the other, two or three days later. The samples were weighed, dried, and the nitrogen determined in each. These analyses were made by Mr. S. D. Averitt. From the analyses of the ripest samples and the total weight of the crop harvested from each plot, the number of pounds of perfectly dry matter and of protein which would have been contained in the crop from one acre of each variety have been calculated and are presented below in tabular form. The proportion of protein in the dry matter also is stated.

As protein is the most valuable constituent of feeds, that variety of oats which produces a crop containing the largest amount as well as the largest proportion of this substance should, other things being equal, be considered the best. These results, however, must be regarded as only approximate and tentative. The main reason for this is that the samples for analysis were taken five days to a week before the oats were harvested and weighed, and the changes which took place in this time in the relative composition of some of the later sorts may have been considerable. Besides this, we must take into consideration the difficulty in obtaining fairly representative samples for analysis. The samples were carefully taken by Mr. Harper who exercised his best judgment in selecting an average, but it would evidently be a practical impossibility for any one, no matter how skillful, to go into a 1-20 acre of oats in which some plants are fully ripe while others are more or less green and select a small quantity that would in every instance correctly represent the whole crop. For these reasons, as well as because the accuracy of the calculation may be effected by other sources of error, small differences between the figures for different varieties must not be regarded as important.

TABLE 4.—AMOUNT OF PROTEIN AND DRY MATTER PRODUCED PER ACRE.

Plot Number.	Name of Variety.	Total Weights in Pounds per Acre.			Per cent of Protein in the Water-Free Substance.	Date When Sampled.
		Crop as harvested.	Water-Free Substance.	Protein.		
						July
1	American Banner	3997	3633	224	6.17	8
2	American Beauty	4320	4026	270	6.69	8
3	American Triumph	4167	3876	286	7.37	8
4	American White	5289	4940	337	6.87	8
5	Australian	4432	4116	291	7.05	7
6	Banner	4410	4092	265	6.47	7
7	Badger Queen	4722	4422	310	7.01	7
8	Giant Yellow French	4432	4162	292	6.98	8
9	Golden Giant Side	4375	4109	298	7.24	8
10	Green Mountain	3641	3430	261	7.62	8
11	Hopetown	4690	4393	284	6.46	6
12	Imported Black Tartarian	4577	4314	326	7.55	8
13	Improved Welcome	4923	4601	314	6.80	7
14	Lincoln	4544	4255	289	6.80	8
15	Mammoth Cluster	4134	3881	256	6.58	7
16	Negro Wonder	5101	4817	341	7.10	7
17	New American	4478	4200	296	7.06	7
18	Pringle's Progress	4866	4578	283	6.18	7
19	Probsteir	4292	4016	303	7.55	7
20	Wideawake	5006	4707	278	5.90	7
21	White Baltic	4869	4581	295	6.43	7
22	White Belgian	5101	4796	322	6.71	7
23	White Maine	5056	4752	322	6.79	7
24	White Russian	4868	4572	304	6.66	7
25	Yellow German	4367	4103	267	6.50	7
26	Mammoth Cluster (See No. 15)	5021	4703	276	5 87	7
27	White Belgian (See No. 22)	4769	4469	292	6.52	7
28	Mixed Oats	5106	4789	325	6.79	7
29	American Banner (See No. 1)	4559	4265	279	6.53	7
	Averages,	4624	4331	293	6.77	

The average yield of protein for all varieties, calculated to one acre, is 293 pounds and the average percentage of protein is 6.77. It should be fair, therefore, to estimate that those varieties credited with 300 pounds or more of protein per acre

and more than 7 per cent of protein in the dry matter are the best to grow for feeding. Selecting by this system, we have the Imported Black Tartarian, Negro Wonder and Probsteier ranking first, followed closely by Badger Queen, Golden Giant Side, American Triumph, New American, Australian and Giant Yellow French. The Green Mountain, having the largest per centage of protein, ranks well, although its small yield prevents its being placed in the first rank. American White, the Mixed Oats, White Maine, White Belgian, Improved Welcome and White Russian also rank well because of their relatively large yields, though their percentages of protein are only average.

To compare the amount of protein in the oats at an earlier stage of ripeness with that at a later stage, the analyses of the set of samples taken on July 5th from each plot are presented in table No. 5 in comparison with those of the samples taken two or three days later. From the rapidity with which the oats ripened, it was evident that the first set of samples should have been taken several days earlier.

The analyses show some marked irregularities that are probably due to the difficulty in obtaining representative samples already mentioned. In a general way, however, the results show a diminution in the percentage of protein in the dry substance and an increase of dry substance, while the percentage of protein in the fresh plant was practically the same. Thus, the average per cent of protein in the water-free substance of the first set of samples was 6.96 and in the second set 6.77. The average percentage of water-free substance was 31.11 in the first and 31.87 in the second. The average percentages of protein in the fresh samples, however, were 2.16 and 2.15 respectively. This result is no doubt brought about by the formation of woody and starchy matter in the plant and the loss of water during ripening. It is apparent that if the oats had been cut July 5th instead of at the later date, the crop would have been slightly richer in protein, but the total yield would have been less. Just how much less the yield would have been, we have not the data to estimate, but we have planned an experiment for next season that will give some definite figures bearing upon this question.

TABLE 5.—ANALYSES OF OATS CUT ON DIFFERENT DATES.

Plot No.	Name of Variety.	First Sampling, July 5.			Second Sampling, July 6, 7 and 8.			Date of Sampling.
		In the Fresh Sample.		Protein in the water-free substance, per cent.	In the Fresh Sample.		Protein in the water-free substance, per cent.	
		Water-free substance, per cent.	Protein, per cent.		Water-free substance, per cent	Protein, per cent.		
1	American Banner	31.12	1.86	5.99	31.61	1 95	6.17	*8
2	American Beauty	29.11	2.04	7.01	33.01	2.21	6.69	8
3	American Triumph	32.75	2.25	6.87	34.60	2.55	7.37	8
4	American White	24.85	2.00	8.05	29.70	2.03	6.87	8
5	Australian	37.02	2.53	6.83	29.36	2.07	7.05	7
6	Banner	32.87	2.16	6.07	35.24	2.28	6.47	7
7	Badger Queen	33.56	1.99	5.93	33.86	2.37	7.01	7
8	Giant Yellow French	27.82	2.36	8.48	19.92	1.39	6.98	8
9	Golden Giant Side	24.66	1.71	6.93	28.04	2.03	7.24	8
10	Green Mountain	25.96	2.24	8.63	27.82	2.12	7.62	8
11	Hopetown	34 78	2.56	7.36	34.84	2.25	6 46	6
12	Imp. Black Tartarian	24.95	2.06	8.26	29.68	2.24	7.55	8
13	Improved Welcome	30.30	2.09	6.90	31.75	2.16	6.80	7
14	Lincoln	31 60	2.10	6.65	32.20	2.19	6.80	8
15	Mammoth Cluster	34.57	2.48	7.17	39.18	2.58	6.58	7
16	Negro Wonder	33.26	2.22	6.67	33.26	2.36	7.10	7
17	New American	32.18	2.17	6.74	32.30	2.28	7.06	7
18	Pringle's Progress	32.74	2.15	6.57	35.74	2.21	6.18	7
19	Probsteir	35.37	2.25	6.36	32.92	2.48	7.55	7
20	Wideawake	32.72	2.25	6.88	32.53	1.92	5 90	7
21	White Baltic	32.86	2.01	6.12	30.77	1.98	6.43	7
22	White Belgian	31.85	2.13	6.69	31.02	2.08	6.71	7
23	White Maine	30.36	2 02	6.65	30.06	2.04	6.79	7
24	White Russian	30.86	2.14	6.93	33.50	2.23	6.66	7
25	Yellow German	28.80	1.89	6.56	32.47	2.11	6.50	7
26	Mammoth Cluster (see No. 15)	29.17	2.00	6.86	29.12	1.71	5.87	7
27	White Belgian (see No. 22)	31.21	2.06	6.60	31.89	2.08	6.52	7
28	Mixed Oats	32.21	2.19	6.80	30.77	2.09	6.79	7
29	American Banner (see No. 1)	32.57	2.70	8.29	37.20	2.43	6.53	7
	Averages	31.11	2.16	6.96	31.87	2.15	6.77	

*July.

To show how much the young oat plant differs in composition from the same when ripe and what very nutritious hay could be made from such young plants, two analyses are presented below of samples taken at different times from a plot of oats grown in 1900 among Prof. Garman's grass plots on another part of the farm. The soil upon which these oats grew was much richer than that on which the variety test was made in 1901, which may account for the larger proportion of protein shown in the ripe plant. Sample No. 7786 was taken June 16th and No. 7791 at the time of harvesting on July 19th. The yield was not recorded.

ANALYSES OF THE FRESH SAMPLES.

Station Number	7786.	7791.
Time of Collecting,	June 16.	July 19. (When fully ripe.)
	Per Cent.	Per Cent.
Water	84.74	55.18
Ash	1.90	3.97
Protein	2.36	4.95
Fiber	4.10	12.65
Nitrogen-free extract	6.42	21.90
Fat	0.48	1.35
Total	100.00	100.00
Phosphoric acid	0.22	0.44
Nitrogen	0.38	0.79
Potash	0.92	1.73

Composition of the water-free substance, calculated from the above.

Station Number	7786.	7791.
	Per Cent.	Per Cent.
Ash	12.45	8.86
Protein	15.45	11.04
Fiber	26.86	28.22
Nitrogen-free extract	42.09	48.87
Fat	3.15	3.01
Total	100.00	100.00
Phosphoric acid	1.43	0.99
Nitrogen	2.47	1.77
Potash	6.03	3.86

Meteorological Summary.

To show something of the character of the season, the following table has been compiled from the records of observations on temperature, rainfall and sunshine taken at the United States Weather Bureau Station on the College Campus:

TABLE 6.—METEOROLOGICAL SUMMARY BY MONTHS FOR THE SEASON OF 1901.

Months, 1901.	Per cent. of Sunshine.	Rainfall in Inches.				Temperature, Degrees F				
		Total for each Month.	Monthly Average for 14 years	Deficiency for the month.	Accumulated deficiency since Jan 1, 1900.	Highest.	Lowest.	Mean.	Mean for 14 years.	Accumulated deficiency since Jan. 1, 1901.
January..	39.	1.49	4.10	2.61	13.04	63.	11.	34.	34.	0.
February.	47.	0.62	3.35	2.73	15.77	61.	9.	29.	34.	140.
March.....	42.	2.23	5.01	2.78	18.55	76.	4.	44.	43.	109.
April.....	45.	4.52	3.38	—1.14*	17.41	84.	30.	49.	55	289.
May.....	62.	2.67	3.81	1.14	18.55	87.	45.	63.	64.	320.
June.....	73.	3.70	4.25	0.50	19.05	94.	46.	74.	74.	320.

*More than the average.

It is noteworthy that the season of 1901 was perhaps the best for oats we have had for four years past, probably on account of the favorable rains in April. The records show that there has been a deficiency of rainfall for three years past and for two years this has been very marked in the spring months. These conditions would naturally have a bad effect upon spring crops.

TABLE 7.—MONTHLY RAINFALL AND MEAN TEMPERATURE FOR FOUR YEARS.

MONTHS	1898.		1899.		1900.		1901.		Average for 14 Years.	
	Rainfall. Inches.	Temperature Degrees F.	Rainfall. Inches.	Temperature Degrees F.	Rainfall. Inches.	Temperature Degrees F.	Rainfall. Inches.	Temperature Degrees F.	Rainfall. Inches.	Temperature Degrees F.
January	9.56	38	6.69	34	2.13	36	1.49	34	4.10	34
February.....	2.20	36	2.84	26	3.17	31	0.62	29	3.35	34
March.....	8.18	49	8.61	42	1.98	40	2.23	44	5.01	43
April.....	3.29	51	2.16	56	1.23	55	4.52	49	3.38	55
May.....	6.13	65	3.63	67	3.54	66	2.67	63	3.81	64
June.....	7 84	72	2.55	75	2.19	72	3.70	74	4.25	74
July.....	5.72	76	0.97	77	2.80	77	2.61	80	4.18	76
August.....	2.99	76	4.18	77	5.75	79	3.74	74	4.09	74
September. .	3.55	72	1.90	68	1.85	73	2.18	67	2.59	69
October.....	5.27	56	2.09	61	0.79	65	1.33	58	2.11	57
November....	2.89	43	1.70	48	6.38	45	1.73	40	3.82	44
December.....	2.80	33	2.92	33	1.86	37	3.50	31	3.07	37
Total ..	60.52	.....	40.24	.....	33.67	.....	30.32	.....	43.76	.....

KENTUCKY

AGRICULTURAL EXPERIMENT STATION

OF THE

STATE COLLEGE OF KENTUCKY.

BULLETIN NO. 100.

INSPECTION AND ANALYSES OF FOODS.

LOUISVILLE, KY.:
THE GEO. G. FETTER PRINTING CO.
FEBRUARY, 1902.

Kentucky Agricultural Experiment Station.

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Address of Station,
Lexington, Kentucky.

Letter of Transmittal to the Governor from the Director of the Kentucky Agricultural Experiment Station.

BULLETIN NO. 100.

Inspection and Analyses of Foods.

Summary by
M. A. SCOVELL, Director.

Under an act of the Legislature of 1900 regulating the manufacture and sale of food, this Station is empowered with the enforcement of its provisions. This bulletin gives the results of the work to Jan. 1, 1902.

The present law went into effect June 15, 1900, but owing to the difficulty in getting funds from the State at that time, little work was done until the beginning of last year. In the meantime, however, preparations were made for thoroughly organizing the work under a division in this Station. A circular of information embodied in this report was prepared and sent, together with a printed copy of the law, to the grocers of the State and the manufacturers of food products and other parties, whom it was thought would be directly interested in the law and its enforcement. A thorough inspection in the large towns of the State was begun in January, 1901, as soon as we received check from the Auditor for the work previously done.

During the year 748 samples were taken by inspectors and tested for adulterations. Of these samples 227 were found to be adulterated or mis-branded under the law. In every case where a sample was found adulterated, the prosecuting attorney in the district where found was notified. Indictments have been made in Louisville, Lexington, Owensboro, Frankfort, and other places. In Owensboro and Frankfort, parties indicted plead guilty. I am informed by Mr. Kohn, my attorney in Louisville, that the pure food cases will come up in February.

Kentucky, situated as it is on the border of States which have rigidly enforced food laws, was made a dumping ground for adulterated foods which could not be sold in those States. Oleomargarine was advertised and sold as butter. Distilled vinegars, costing only a few cents to manufacture, were labeled apple or cider vinegars, and retailed in some cases as high as 40 cents per gallon. Peppers and other spices, containing in some cases as high as 50

per cent. of adulterants, were sold as genuine. Jellies made from the peelings and cores of apples and containing acid, sometimes sulphuric, in order to cause jellying quickly, and colored usually with some coal tar dye to imitate the color of jelly desired, plum, currant, raspberry, etc., were labeled and offered for sale as pure plum, currant, etc., jellies. So strong was the sulphuric acid in a sample inspected that it acted on the mucous membrane of the mouth, even while testing it. It certainly would have been very injurious to have eaten a very small quantity of this jelly. We found all tomato catsups containing some antiseptic and usually salicylic acid. This antiseptic was sometimes in unduly large quantities. By the use of such preservatives, the manufacturers can, during the busy season, work the tomatoes up into "stock," that is, to partially boil the tomatoes, add the antiseptic and then store them away in vats until the busy season is over. Often the "stock" is shipped to jobbers without being bottled, and if showing any fermentation, it is again "doped" with antiseptic, and finally when bottled, antiseptic is added again as it is heated up. If no antiseptic is used, the tomato catsup would have to be bottled at the time it was made, insuring thereby cleanliness and healthfulness.

The good resulting from the enforcement of the law can be seen in the sale of almost every food product in the markets. The manufacturers and dealers are taking an interest, as shown by the many inquiries concerning the food standards, and this means that the goods will come into the markets properly labeled. The prohibiting of the sale of all injurious articles, and compelling all imitative, artificially preserved and adulterated articles to be so labeled, and to be sold on their own merits, is bringing a noticeably better class of foods to the Kentucky public. People will not buy adulterated goods if they know it. The consequence is, those goods which have to be labeled adulterated are not being brought into the State. The manufacturers of the various brands of baking powder are putting some kind of label on their packages to designate whether they are alum, or cream of tartar, or phosphate baking powders. The manufacturers of tomato catsup are either putting on the Kentucky market catsups containing no antiseptic or using a milder antiseptic benzoate of soda in small quantity, in which case they are labeling according to the law. In our first inspection we found formaldehyde, boracic acid, freezine, and

other preservatives used in milk. In our last inspection, no milks were found adulterated in this manner. The imitation fruit jellies and preserves are either being driven from the market or being labeled as such. There is more care among the confectioners as to the flavors served in soda fountain drinks than formerly. Distilled vinegars are being labeled, and sold as such, and I believe as soon as the cases can be tried in Louisville that oleomargarine will not be sold in the State, or sold in accordance with the law.

The manufacturers in some cases are evading the intent of the law by putting on adulterated foods labels of small type, placed in obscure places on the bottles, cans or packages. This question of labeling will receive special notice during the coming year. Sanitation and clean surroundings in handling food products will also receive attention. There are many instances where dairies, meat markets, and grocery stores present a very unhygienic depot for distributing foods.

The report which follows includes the work done under the old law from January 1 to June 15, 1900. The analyses up to this time were made by Dr. A. M. Peter, chemist of the station, assisted by Dr. Chase Palmer, Louisville, Ky., and Prof. J. H. Kastle of the college. When the new law went into effect, the Food Division was organized, and Mr. J. O. LaBach was elected chemist, and Mr. R. M. Allen, secretary. Mr. T. S. Byars, of Simpsonville, Ky., was also employed for a time as inspector in Louisville, and collected most of the samples of dairy products and oleomargarine analyzed from there.

The analyses in the body of this report have been compiled and the report written by Mr. R. M. Allen, whose untiring efforts in the enforcement of the law, deserves special mention, and receives my highest commendation.

Very respectfully submitted,

M. A. SCOVELL, Director.

ADULTERATED FOOD PRODUCTS.

...By...
ROBT. McD. ALLEN.

PURPOSE AND EXTENT OF THE WORK.

Chapter 13 of the Acts of 1900, approved March 17, 1900, went into effect on June 13, following. Since this law became effective, charging the Director with its execution, efforts have been directed to organize the food work into a separate division of the Station. This has been nearly accomplished and the work is now being conducted by those who give their entire attention and time to the many and varied phases of the food work; inspecting, analyzing, reporting violations to the courts, and attending as witnesses for the Commonwealth the indictment and prosecution of violations.

An effort has been made to put the Division in immediate touch with the Food Department of other States; with their experiences, methods and results in the enforcement of their respective State laws. Many inquiries are had from food manufacturers and dealers in regard to the law and its rulings, and the answering of these has in many instances been an effective means for enforcing the law's provisions.

Many manufacturers of many articles of food ship their goods into the State. Many grocers are engaged in distributing the many food products of varied quality and innumerable brands and labels. Almost every day some honest interest, prejudice, trick, or deception arising out of or affecting this vast business is presented for thoughtful consideration. The work of the Division is branching in every direction. This work for purer foods, cleanliness in handling them and honesty in the food business is an important one, and if prosecuted with diligence it will result in an immeasurable good to the consumer, the honest, intelligent food dealers and the producers of foods on the farms.

As yet the principal feature of the work has been an educational one. A copy of the law and the standards it authorizes have been mailed to most of the grocers and manufacturers throughout the

State. Farmers' institutes and grocers' conventions have afforded excellent opportunities for presenting the provisions of the law. A representative from the Station attended the National Association of State Food and Dairy Departments held in Buffalo, N. Y., October 15, 16, and 17, 1901, and listened to and took part in the discussion of the important subjects that were brought before the convention. The publication of the results of the analyses, together with the names of the dealer from whom each sample was collected, and also the brand, manufacturer or producer of the article is a wise provision of the law. The publicity attending this is one of the most effective means for the enforcement of the law's intent.

Kind and Number of Samples Analyzed.

Article Sampled.	Not Found Adulterated.	Adulterated.	Total.
Baking powder	5	36	41
Canned goods	12	..	12
Butter	116	5	121
Jellies, preserves, etc.	8	7	15
Milks (sweet and butter)	300	30	330
Minced meats	2	9	11
Oleomargarine	..	62	62
Olive oil and lard	13	1	14
Tomato catsup, sauces	3	50	53
Syrups, sugar, honey	15	..	15
Soda fountain drinks	43	26	69
Feeding stuffs	4	1	5

Total number found adulterated	227
Total number not found adulterated	521
Total number of samples analyzed	748

Baking Powder.

Number of samples analyzed	41
Number of samples found adulterated	36
Number of samples not found adulterated	5
Number of samples found to be alum powders	13
Number of samples found to be phosphate powders	3
Number of samples found to be alum-phosphate powders	19
Number of samples found to be cream tartar powders	6

The baking powders analyzed were mostly samples found without labels, showing the kind of acid salt from which they were made. Thirty-three of the forty-one samples proved to be alum and alum-phosphate powders, showing a disposition on the part of

manufacturers of this class of powders to avoid labeling them. However, while these samples were being collected, hundreds of cans were noted with some kind of a label as to the acid salt used; but in many instances the labels were obscurely placed on the cans in small print or worded so as to be misleading. Several samples labeled "cream of tartar" were found by analysis to be alum or alum-phosphate powders, but in no instance was a cream of tartar powder labeled "alum" or "alum phosphate."

The relative merits of baking powders still gives rise to unsettled questions. The position of the Station toward this subject remains as stated by the Director in the first report on food adulteration:

"Baking powders are a mixture of sodium bicarbonate and some form of acid salt, together with from one-fifth to one-half of their weight of starch or flour.

"Baking powders may be classed under four kinds, depending upon the acid salt used, viz: First, cream of tartar baking powders; second, alum baking powders; third, alum-phosphate baking powders; and fourth, phosphate baking powders.

"So far as their efficiency in bread-making is concerned, they are about of equal value; that is to say they all liberate about the same amount of carbonic acid gas when fresh. It is the liberation of this carbonic acid gas in the dough in the process of baking that causes the bread to rise and to be porous.

"When baking powders are used in bread-making, a chemical change takes place, caused by the water used in mixing the dough and the heat in baking the bread resulting in the evolution of carbonic acid gas, and a fixed residue remains in the bread. This fixed residue in the case of cream of tartar baking powder is potassium sodium tartrate, usually called "Rochelle Salts." In the case of alum baking powders or alum-phosphate baking powders, this residue, if the reaction is complete, is sodium sulphate and alumina hydrate or phosphate. In the case of phosphate baking powders, the residue is calcium and sodium phosphates.

"In the case of alum baking powders, or alum-phosphate baking powders, there seems to be a difference of opinion as to whether they are injurious to health or not. It often happens that the reaction is not complete in the process of bread-making. In all such cases, alum is left in the bread. This is known to be an astringent and irritant to the mucous membranes. Even when the reaction

in bread-making is complete, the alumina hydrate is undoubtedly soluble to some extent in the juices of the stomach and albuminous substances, thus irritating weak stomachs, and is undoubtedly injurious in such cases.

"I do not believe that by the use of alum baking powders injury to health has been sufficiently proven to prohibit the sale or manufacture of such baking powders. I am strongly of the opinion, however, that baking powders should be named and plainly labeled according to the acid salt which they contain."

Butter.

Number of samples analyzed	121
Number of samples not found adulterated	116
Number of samples found adulterated	5
Number of samples found adulterated with water	2
Number of samples found adulterated with foreign fats	3
Average price paid per pound when not adulterated	$0 21
Average price paid per pound when adulterated	25

The adulteration of butter with oleo fats seems not to be practiced now as much as formerly. A fraud in the butter business is the production and sale of process butter. Process or renovated butter is made from the inferior grades of butter collected by the peddler in sections where there is little knowledge, skill or care of butter production. These scraps when collected are melted, churned and colored, and put upon the market as best dairy butter. Sometimes black pepsin or sulphate of soda are added to the mass during the process of churning, which serves to form an emulsion of the fat and water and causes the finished product to contain from forty-five to fifty per cent. of water. Close inspection is made for butter of this character.

During October of 1901 a process butter plant was started in Lexington, and the butter from the plant was put upon the market under the name and at the price of the best dairy butter. Samples were obtained very soon after the plant commenced operation, and the analyses of these samples shows that the butter contained an average of forty-five per cent. of water. As soon as discovered and the violation reported to the county attorney the managers of the plant acknowledged the fraud and ceased operation.

Much country butter of an inferior quality has been noted on the market; but this, like decayed fruit or wilted vegetables, condemns

itself, even when placed by the steward or boarding-house keeper upon the table, its odor betrays it, and there is no deception as to its quality, as might be in the case of the fruit or vegetable. This is a striking example of a great problem affecting the food industry; the problem of work and willingness wasted, because means and methods are wanting to produce a wholesome grade of the article over which much honest but misdirected labor is spent to produce.

Canned Goods.

Twelve samples of canned goods were analyzed for antiseptics and copper. This is a beginning of a study of this class of goods, and no inference can be drawn from this as to the purity of this class of foods generally. With canned goods the method of sterilization is used to preserve, but much testimony shows that antiseptics are often used to assist this method. Other results also show that copper, lead, zinc and other minerals are used to set or preserve the green color in canned foods of the character which depend upon their color or freshness for a popular sale.

Jellies, Preserves, Etc.

Number of samples analyzed	15
Number of samples not found adulterated	8
Number of samples found adulterated	7

Most of the eight samples not found adulterated were samples of home-made goods analyzed for comparison. The larger quantity of these goods bought in the open market were adulterated.

Very little of the commercial jelly is made from pure fruit juices and natural flavors. It is made largely from the by-products of the fruit canneries, such as apple peels and cores, and similar remnants of other fruits; and from glucose as a base which is jellied with commercial gelatine, flavored with an artificial acid and flavor, and colored with an aniline dye to the respective shade of the fruit it is labeled to have been made from. In a sample sulphuric acid was present in a notable quantity; in another pumpkin pulp served for filler, and this sample had the color, flavor, and label of apple butter.

Milks.

Number of samples analyzed	230
Number of samples not found adulterated	200
Number of samples found adulterated	30
Number of samples adulterated with antiseptics	15
Number of samples adulterated with water or skimmed	16
Number of samples containing formaldehyde	10
Number of samples containing boric acid	5
Number of samples containing artificial color	5

The methods of adulteration were watering, skimming, and the use of antiseptics.

Much of the milk sampled generally in Louisville was below the purity and quality of good milk. Samples taken in Newport and Lexington show very much less adulteration. Five samples of deceptive adulteration in Louisville are those that had been skimmed or watered, and then colored and thickened to represent rich milk. Similar adulterations are found in other foods, but in milk the universal food for infants, and often for invalids, this practice seems most criminal.

Milk is very easily disorganized, and readily affected by taint and impurities. Clean air, clean care, sterilization of all vessels, and ice, are the proper methods for keeping it sweet and, and insuring the wholesomeness of this delicate and important food. Antiseptics supplant this care, and their presence indicates inferior milk in addition to their harmful effect.

Mince Meats.

Number of samples analyzed	11
Number of samples found adulterated	9
Number of samples not found adulterated	2
Number of samples containing antiseptics	9
Number of samples containing borates	2
Number of samples containing benzoic acid	1
Number of samples containing boric acid	1
Number of samples containing salicylic acid	6

From the analyses of the samples collected it is evident that mince meats are as a rule preserved with antiseptics, especially since all these brands were bought in the open market. The antiseptic used in the majority of cases was salicylic acid.

Pepper.

All of the specimens of ground black pepper examined under the microscope by Prof. Garman were reported to contain some foreign material.

Ground spices and pepper are nearly always adulterated with some inert substance, which is used to increase the bulk of the article. Peanut shells, cocoanut hulls, brick dust, flour, ground corn, cracker meal, and other similar substances, are authoritatively mentioned among the list of refuse from which these fillers are made. There are factories which do nothing else but grind and color these fillers for the trade, and most of the pepper and spice houses have a regular system and plan for such adulterations. A leading example of the system was noted during an inspection tour. The proprietor of a spice and pepper grinding establishment pointed out on the third floor of his factory two long rows of barrels. One row had in each barrel a variety of pepper or spice, ground; the other had its barrels filled with a tasteless material, the color and fineness of the barrel opposite. From this floor the boxes were packed for consignment, and the proprietor stated that when a cheap pepper or spice was ordered, the order was mixed with its respective filler to suit the price. The retailer generally knows of this adulteration, but no instance has been noted where the consumer is made aware of it.

Such adulterations weaken the condiment, and instead of causing a quicker flow of the digestive juices, an extra burden of trash is put into the stomach.

Pure pepper is always cheaper than the adulterated article would be if the trash was separated from it.

Vinegar.

Number of samples analyzed	57
Number of samples found as represented	30
Number of samples not found as represented	27

Vinegar is a dilute form of acetic acid. Acetic acid is a product of alcohol, hence vinegar can be produced from all alcoholic sources. The common sources from which vinegar is produced are the apple, malt, the refuse wine in the grape countries, and the low wine from distilleries.

Apple vinegar has the superior flavor and the highest value as a condiment, and is the standard vinegar in the market. The high demand for apple vinegar causes the manufacturers of the low wine vinegars to advertise their product upon the reputation of apple vinegar, and also to label it under the name of "apple," "cider" and "fruit" vinegar, or "family" and "pickling" vinegar, which is clearly a fraud to the consumer, and an unjust competition to the fruit industries.

In August of 1901 the various vinegar factories in Louisville were inspected, and in no instance did it appear that the vinegar was being made from apples; but in most of the factories the stencils in use made it evident that the brands, "apple vinegar," "fruit vinegar," "Old Homestead apple vinegar," were in constant use. Samples taken from barrels bearing these brands were found to be spirit vinegar. The spirit vinegars were found to be colored with caramel and to contain artificial solids.

Tomato Catsup.

Number of samples analyzed	53
Number of samples found adulterated	50
Number of samples not found adulterated	3
Number of samples artificially colored	43
Number of samples containing antiseptics	47
Number of samples containing benzoic acid	42
Number of samples containing benzoic and boric acid	1
Number of samples containing salicylic acid	4
Number of samples containing saccharin	2

Color found in each instance, aniline dye.

All except three of the fifty-three samples of tomato catsup and sauces examined were found to contain antiseptics, and forty-three samples were artificially colored with the aniline dyes. The artificial coloring suggests the inferiority of the products from which the samples were possibly made. A large amount of these products are probably made from tomato cores and skins, the by-products of the various tomato canning factories.

The lower grades of catsup are generally put up in barrels or tanks and shipped to the wholesaler, who puts the article into bottles bearing his own label. A large quantity of some antiseptic is necessarily needed to preserve the goods through the first careless exposure in barrels, and to keep it until the dealer puts it into bottles. The dealer sometimes adds more antiseptic in order to further stop fermentation during the long time, sometimes several

years, that his goods may await a sale on the grocer's shelf. A Louisville grocer stated that a quantity of catsup, from which a sample was purchased, had been on his shelf for eight years.

Olive Oils and Lards.

Number of samples analyzed	14
Number of samples found adulterated or not labeled to show the exact character	1
Number of samples found as represented	13

One sample of lard analyzed contained cottonseed oil. This sample was sold as compound lard to the one who purchased it. The word compound in this case did not show the exact character of the article, and the purchaser should have been made aware of the fact that he was obtaining a lard mixed with cottonseed oil. The only obvious advantage to be gained by such a mixture is that of selling the cottonseed oil at the price of hog fat. The consumer is in no way benefited by this; but instead, fraudulently imposed upon. Cottonseed oil is a food, but it is commercially cheaper than lard, and in justice to these products, as well as to the consumer, it should be sold under its own name and upon its own merits.

Syrups, Sugar and Honey.

Number of samples analyzed	15

Granulated sugar is one of the uniformly pure foods on the market.

No attempt has been made to pass upon the flavor of the samples of maple syrups analyzed. It is evident and admitted that the larger quantity of maple syrup is not made from the sap of the tree, but from other sugars and the flavors of hickory or maple wood. Maple syrup, molasses and honey are largely adulterated with glucose. Glucose is not considered deleterious, but it is cheaper and inferior to the syrups in which it is often used to increase bulk; when used for this purpose the fact should be made known to the consumer.

Soda Fountain Drinks and Grape Juice.

Number of samples analyzed	69
Number of samples not found adulterated	43
Number of samples found adulterated	26
Number of samples containing salicylic acid	18
Number of samples containing aniline dye	16
Number of samples containing cochineal	1

The subject of adulteration with regard to the many soda fountain drinks is of no small importance. The soda fountain is patronized by children and young people largely, and to those who consume the larger portion of these drinks the antiseptics, artificial coloring matter, and artificial flavors used are most harmful.

The base of the drink served at the fountain is carbonated water, which is considered beneficial and is most refreshing. When a fresh fruit flavor is added to this carbonated water, together with ice or ice cream it is a most delightful drink. When spoiled stock, doped with antiseptic, colored with aniline, and artificially flavored, is added, the carbonated water is but contaminated with a mixture deleterious and unfit for any stomach.

An investigation of the better class of these fountains shows much adulteration that should not be permitted, or, if permitted, it should be rigidly restricted so that those who patronize them can in every instance know the character of the drink served.

Samples of a well-known brand of grape juice was analyzed, and a violation was reported to the county attorney. The manufacturers of this juice then immediately withdrew their stock, and substituted, at the same price, a grape juice containing no antiseptic. The antiseptic found was salicylic acid. Grape juice is used to a great extent in the sick room, and invalids especially should have such antiseptics regulated by a physician's prescription.

"Pepsinade," advertised to be an "aid to digestion," contained a large amount of salicylic acid, which has a strong inhibitory influence on ferments, and is recognized as the most antidigestive of the antiseptics.

Oleomargarine.

Number of samples analyzed	62
Number of samples found adulterated	62
Number of samples colored with aniline dyes in imitation of butter	54
Number of samples colored with annatto in imitation of butter	6
Number of samples colored, color not determined	2
Number of samples containing boracic acid	18

Number of samples bought as butter	19
Number of samples bought as oleomargarine	43
Number of samples bought as butter, labeled oleomargarine	17
Number of samples bought as butter, no label	2
Average price paid per pound when paid for as butter	$0 21
Average price paid per pound when paid for as oleomargarine	18

All of the samples of oleomargarine purchased were sold in violation of law. Eighteen of these contained boracic acid, and there was no instance where the purchaser was made aware that the article contained this antiseptic.

Oleomargarine is a legitimate food product. It is made from the by-products of the slaughter pens, and from cottonseed oil. When these fats are fresh and clean, and the oleomargarine made free from antiseptics and coloring matter, it is a wholesome food. It is made from fats, which have their own merits, their own food value, and their own properties, and it should be sold upon its merits, reputation, and under its own name. It is commercially cheaper than butter, for the cost is very much less to produce it. It is regarded as inferior to butter, especially by the manufacturers who mix butter with it to make the better grades, and also color it in imitation of butter in order that the consumer will believe it to be butter. At present it is not one of the foods which has a trade reputation, and whose name is its best advertisement to the consumer; but like most of the other by-products remaining from the manufacture of the various well-known foods, the manufacturers of oleomargarine, wish it to imitate and share the reputation of a superior food product.

No other food product has been sold so deceitfully in the State as oleomargarine. It is our experience that oleomargarine depends for its sale upon the reputation of butter. It is colored in imitation of butter, and this coloring is made to assume the shades which butter produced in the different seasons, in different localities, from different breeds, and under different conditions presents; if any difference, the imitation is more beautiful, for the shades of aniline are more easily controlled than the feed of the cow or the fermentation of the cream. The manufacturers of oleomargarine adopt names longest in use, or which stand for the most trade reputation in the butter business. A factory is known as "The Columbus Butter Co.," another as "The Capital City Dairy Co.;" some advertisements read "churners of creamery butterine," or under the name of "Elgin" still more reputation is sought. Many adver-

tisements of oleomargarine have been noted which present a representation of a dairy maid, dairy cow, churn and spring house.

The present Federal law prevents fraud in the original sale of oleomargarine, but has no measure to protect the consumer from the dishonest dealer, steward, and boarding-house keeper. To protect the consumer and to compel the sale of oleomargarine upon its own merits, the State law prohibits the sale of oleomargarine when it is colored in imitation of butter. Thirty-two other States have enacted a similar law, and the act has been decided constitutional by State courts and by the Supreme Court of the United States.

The Supreme Court in the well-known Plumley case, passed upon the constitutional power of the States to thus regulate the sale of oleomargarine. Mr. Justice Harlan, in handing down the court's decision, made the following much-quoted statement:

"And yet it is supposed the owners of a compound which has been put in a condition to cheat the public into believing it is a particular article of food in daily use, and eagerly sought for by people in every condition of life are protected by the Constitution in making a sale of it against the will of the States in which it is offered for sale, because of the circumstance that it is an original package and had become a subject of ordinary traffic. We are unwilling to accept this view. We are of the opinion that it is within the power of the State to exclude from its markets any compound manufactured in another State, which has been artificially colored or adulterated so as to cause it to look like an article of food in general use, and the sale of which may by reason of such coloration or adulteration cheat the general public into purchasing that which they may not intend to buy."

Artificial Coloring.

Certain colors are associated with the different foods and their condition. Bolted flour, granulated sugar and starch are white. Fruits present different shades of color by means of which the ripeness of the respective fruit is judged; pears, peaches, and apples, grapes and berries present varying shades of red, purple and yellow. The richness of milk is sometimes judged by the yellow tinge from the globules of butter fat it contains. Fresh meats have a color distinct from that of spoiled meats. Vegetables, pickles, and

some others of a similar character are green, or they present their individual garden color.

In the market foods are selected largely by their color. At the table the eye aids the taste in pleasing the senses. Color, therefore, is an important factor in foods, and when the natural color is wanting, or condemns the article, the manufacturer supplies it artificially, or changes it to the color of a better article.

Pastry and confectionery are colored, and the uses of artificial coloring matters, that are harmless, seem legitimate under proper restrictions in this class of foods. Many foods have their colors changed in the process of preservation, and the manufacturers seek to restore the original by adding some artificial coloring matter, as is especially the case with fruit products. When green vegetables are canned, their colors are preserved or set with copper, zinc, lead or alum; thus the green of peas, beans and pickles is kept from changing to the unappetizing shades of deadness when they are canned.

Artificial coloring matters are employed to cover up deficiencies and to make the imitation appear like the real. Skimmed milk is colored in order that it may appear rich; spirit vinegar is colored in imitation of cider vinegar; the oleo fats are colored in imitation of butter fats, and artificial jellies are colored to the respective shades of the fruits they are labeled to have been made from.

When artificial coloring matter is used to such an extent, or of such a poisonous character that the purity of the food is sacrificed for appearance, such use should be prohibited. When color is used to cover up defects, inferiorities, or to imitate, its use is a fraud. In every case where the law does not prohibit coloring matter on account of its poisonous character or fraudulent intent, the law commands that its use shall be made known to the customer and consumer.

The artificial coloring matters found were mostly the aniline dyes, of which there are many forms. These dyes are made from coal tar products.

The Preservation of Foods.

The question of most importance in the manufacture and sale of foods is that of preservation, and this problem presents the most tempting field for adulteration to the otherwise honest food manufacturer and producer.

As soon as the spark of life leaves the animal, putrefaction begins; as soon as milk is exposed to a warm atmosphere it commences to sour, and when ripened grains or fruits become bruised or exposed to a moulding atmosphere decay sets up. The best established theory is, that the disorganization and decay of animal and vegetable tissues, and of milk and its products are due to the action of ferments, or of fermenting bacteria. The preservation of food products depends upon the suspension of these decomposing bacteria or the counteraction of their influence, and is accomplished in four general ways; cold storage and sterilization, ripening, and the preserving influences of salt, sugar, vinegar and smoke. Thus, ice in the refrigerator and cold storage systems causes a low temperature, which delays the decay of meat and souring of milk; meats, vegetables and fruit are sterilized, or heated to a degree hot enough to kill these organisms, and then canned; the fats and caseins of milk are ripened into butter and cheese; fruits are preserved with sugar; vegetables are pickled with vinegar and salt; hams and bacon are cured with salt and smoke. Very often two or more of these methods are employed to preserve a single article of food, and when combined with clean systems they are recognized as the healthful and ideal methods for preservation of food products. Salt and vinegar, besides being used to preserve the food, are relishes and stimulate the flow of the digestive juices; their taste makes them easily detected, and when not desired they can be declined.

These methods require skill and care to execute, proper sanitation and cleanliness in shipping and storage. Manufactured goods sometime remain on the shelf for years before all of the stock is sold. Foods are often produced in unclean surroundings and handled carelessly. Such reasons, with the tendency to imitate, and to put upon the market articles of food without regard to their quality, purity or food properties cause the use of antiseptics.

Antiseptics.

The antiseptics found in the foods were salicylic acid, benzoic acid, boracic acid, saccharin, and formaldehyde. These antiseptics act as a strong paralyzant to the ferments in foods, and their lasting embalming qualities make them the surest method for food preservation, and also the cheapest plan.

The more honest manufacturers make use of them in small amounts; others use them without regard to quantity. These antiseptics, varying in effect, have a deleterious influence upon the human system, and their harmful effect in large quantities is not honestly denied.

It is claimed by the manufacturers who make use of them, and also stated by some authorities, that the use of antiseptics in small quantities in foods is not harmful. However, they are always used in sufficient quantities to delay fermentation; and fermentation stopped by such means out of the stomach will, as the food still contains the antiseptic, be stopped in the stomach to a greater or less degree, making more work for the digestive juices and consequently retarding digestion. The quantity used is often too small to have a direct effect when absorbed into the system; but, put a little formaldehyde in the milk each day; add to this a little benzoic acid in the tomato catsup, a little salicylic acid in the canned fruits and vegetables, a little boracic acid in meats and oleomargarine, a little copper or zinc from the beautiful green of the pickles and peas, and the meal has deposited some poisonous material, which, with the repeated deposits of other meals, must and does have a harmful effect upon the stomach, nerves and health.

Some manufacturers compound and put these acids upon the market under the names of "preservaline," "freezine," "freezem," and similar labels, to be used by those who are ignorant of the antiseptics from which they are made, or the effect of such antiseptics upon the system. When labeled and sold under these names they are guaranteed to be "perfectly harmless" and to "keep all kinds of perishable food substances perfectly fresh and in a sound state, in any kind of weather and temperature for any length of time without the use of ice." The strong paralyzant power claimed for antiseptics is sufficient to condemn their use in foods, for a substance which can preserve perishable foods under any conditions, and for any length of time, will also affect the delicate digestive ferments of the stomach.

There is an overwhelming testimony from scientists that these antiseptics are, for various reasons and in different degrees, harmful when taken into the system. Even those who favor their use in small quantities agree that their use should be made known to the consumer. Recognized experiments show them to be antidigestive and accumulative; that they are eliminated by the kidneys and that such elimination gives rise to various forms of kidney trouble; that some of them affect the higher nerve centers and depress the heart action.

Dr. J. Kister, of Berlin, has recently carried out some researches on the physiological effects of boracic acid. The ingestion of from 40 to 50 grains of boracic acid daily by strong and healthful subjects, gave rise in from four to ten days to albuminuria, which persisted concurrently with the administration of the drug. In further experiments 15 grains a day sufficed to produce vomiting and diarrhoea. The administration of 15 grain doses in a normal subject was followed within two hours by its appearance in the urine, complete elimination taking eight days. With half that dose excretion began at once, and lasted five days. The doctor considers that the daily ingestion of even small doses of boracic acid is apt to give rise to cumulative effects, which may ultimately determine toxic symptoms, and his experience tends to show that young persons are much more susceptible to the influence of the drug than is the case later in life.

Chief Chemist Wiley, of the U. S. Bureau of Chemistry, considers salicylic acid "very deleterious to health," and states, "There is no preservative which paralyzes the ferments which create decay that does not at the same time paralyze to the same extent the ferments that produce digestion." He also says, "The very fact that any substancepreserves food from decay, shows that it is not fit to enter the stomach, especially if the stomach be delicate and the digestion feeble, and again he states, "I maintain that no food should ever be offered for sale which contains a preservative without that fact being plainly marked upon it."

Prof. E. H. Jenkins, of the Connecticut Agricultural Experiment Station, says, "These modern preservatives are used without any notice being given by the vendor that they are used," and when this notice is not given, "that opportunity and right of the individual to find out whether they will or will not injure him is taken away."

Dr. Albert B. Prescott, of the University of Michigan, states, "I

believe that in general preservatives and antiseptics in food are unfavorable to digestion and injurious to health."

Prof. Mitchell, of Wisconsin, states, "Any antiseptic which is an active antiseptic is necessarily deleterious to health. It stops the working of the normal enzymes or ferments, and it stops the digestive processes which take place in the organs, and it stops, in a measure the changes which take place normally in the food products, possibly, in some cases."

Whatever questions concerning the use of antiseptics in foods are unsettled, these are facts; they are a cumulative, harmful drug, and should be taken into the system only upon the prescription of a physician or upon the knowledge of the one who is eating the food that it contains an antiseptic; they supplant to some degree the cleanliness and care necessary to produce wholesome foods, cover up deficiencies and cause the use of many food articles of an unhealthy character; the use of the more harmful should be prohibited, the use of small quantities of those less harmful should be rigidly restricted and only permitted when the fact of their use is made known to the actual consumer.

Watching the various food products with regard to antiseptics alone is a large task, so extensively and recklessly are they used in the numberless articles of food on the market. Many food industries are built upon this principle of preserving foods entirely with antiseptics; it is a wrong principle and should be discouraged. The representatives of such food factories present many arguments and schemes to protect the profits which accrue from the substitution of a pinch of some antiseptic for the more costly methods of ice, sugar, cleanliness and care employed by the manufacturers of the best food articles. To cite a fact, axiomatic of all drugs, that the single instance of a mild antiseptic in minutest quantities has but very little effect in the system, does not defend the reckless use of antiseptics, a practice dangerous to the public's health.

Violations Reported.

Under section 5 of chapter 13, of the Acts of 1900, 174 violations have been reported to the prosecuting attorneys, as follows:

Covington	29
Elizabethtown	10
Frankfort	19
Lexington	12

Louisville	58
Nicholasville	12
Newport	11
Owensboro	18
Richmond	3
Versailles	2

On Wednesday, February 19, 1902, cases against Louisville merchants for making and selling spirit vinegar as apple vinegar; selling foods containing antiseptics and artificial coloring matter with no label stating these facts; selling baking powder with no label on the package or can showing the kind of acid salt used, and for selling oleomargarine colored in imitation of butter, were called for trial.

The first case was that for selling a Chili sauce which contained benzoate of soda and an aniline color, but which had no label on the bottle stating these facts. The defense pleaded "not guilty" and the prosecution proceeded with the trial, producing testimony that the defendant did have in possession for sale, exposed for sale and sold on the date mentioned in the indictment; that there was an antiseptic in the food and also an artificial coloring matter, and that the article of food in question did not have a label stating these facts. To questions from the defense the witnesses for the Commonwealth gave testimony as to the injurious effects of antiseptics.

Defendant went upon the stand and admitted selling the article of food, and that there was no label on the bottle stating that it contained an antiseptic or artificial coloring matter. He stated that he had no knowledge that the article was adulterated and that he had stopped the sale of the Chili sauce as soon as he found that it was adulterated. Witnesses for the defense were put on the stand to prove that antiseptics were absolutely necessary to preserve tomato catsups and sauces, and that such antiseptics and coloring matter as were found in the bottle of Chili sauce were not injurious to the human system. One of the leading vinegar manufacturers took the stand in the defendant's behalf and gave testimony of this character, who, on being cross-examined by the prosecution stated that aniline color was made from burnt sugar, and that benzoate of soda was just ordinary cooking soda used every day in bread making. The defense then rested their case and it went to the jury for trial.

The instructions of the learned judge cover well the points in the testimony and emphasize strongly the fact that the public

must be protected by holding a dealer responsible for what he sells as food for human consumption. The jury returned a verdict of "guilty"; but since the defendant had stated that he would not sell any more of the unlabeled food, the fine was made one dollar and costs.

On the following morning the other cases were called for trial. After consultation with the attorney for the food department the defendants agreed to plead guilty, pay a fine of five dollars and costs each, and promise not to violate the food law further.

JEFFERSON CIRCUIT COURT.

Criminal Division.

Commonwealth of Kentucky Plaintiff.

vs. INSTRUCTIONS.

———— Defendant.

No. 1. If the jury believe, from all the evidence in this case, to the exclusion of every reasonable doubt, that in this county and within 12 months next before the finding of this indictment, the accused, ————, did sell to one, ———— a bottle of Chili sauce, which was then and there an article of food for human consumption, and which contained an antiseptic or an artificial coloring matter, or both, but which said bottle did not have a label showing that said Chili sauce contained said antiseptic matter or said artificial coloring matter, or either or both, and at the time of the sale, if there was one, the said ———— did not disclose to or inform the said purchaser that said bottle of Chili sauce contained said antiseptic or said artificial coloring matter, then they should find him guilty as charged in the indictment, and fix his punishment by a fine not to exceed one hundred dollars, or by fine and imprisonment in the county jail for not more than fifty days, or they may both so fine and imprison him in their discretion.

No. 2. The jury are instructed that it is immaterial whether or not the defendant, ————, at the time of the sale mentioned in instruction No. 1, knew whether said bottle of Chili sauce was adulterated as set forth in said instruction No. 1, but they may consider the evidence on that question in mitigation of punishment, if any; and they are further instructed that it is

immaterial whether the ingredient used in adulterating said Chili sauce, if it was so adulterated, was or was not injurious to the human system.

No. 3. The law presumes the innocence of the accused, and it is the duty of the jury, if they can reasonably do so, to reconcile and harmonize all of the facts and circumstances of the case with that presumption; and if upon the whole case the jury entertain a reasonable doubt of the guilt of the accused, or of any material fact necessary to constitute his guilt of the offense charged in the indictment having been proven, they should find him not guilty.

HENRY S. BARKER, Judge.

Compiled Report.

Following are the results of the analyses, together with a compiled report from the Inspector's data. Those samples containing adulterations are placed under the head of "Found Adulterated." Samples in which no adulterant was found and which were labeled according to law, are under the head of "Not found Adulterated." Attention is called to the fact that under the "Not Found Adulterated" column are samples which were found to contain artificial coloring matter or antiseptics, but were so labeled, and so were reported as "Not Found Adulterated."

The attention of the dealers and manufacturers is called to the fact that the labeling is not satisfactory, because in many instances the label is in such small type, so obscurely placed or in such misleading terms as to evade in part the purpose of the law. Such labeling hides the true character of the goods from the consumer, and it must be replaced by a more honest system of labeling.

BAKING POWDERS—Found Adulterated

Station No.	Name taken from Label.	Where Obtained.	Date of Collection.	From Whom Obtained.
8011	Koenig	Covington	May 14, 1901	N. L. Young
6313	Clover	Lexington	Dec. 6, 1899	J. B. Rogers & Co.
6314	White Cap	Lexington	Dec. 6, 1899	Warren Bros.
6315	Eatwell	Lexington	Dec. 8, 1899	Vogt & Foley
6316	Quaker	Lexington	Dec. 13, 1899	T. L. Campbell
7210	Queen Flake	Elizabethtown	Dec. 19, 1900	Bruner & Duell
7212	Queen Flake	Elizabethtown	Dec. 19, 1900	Davis & Williams
7214	R. T. Royal	Elizabethtown	Dec. 19, 1900	J. B. Walker
7607	Kenton	Versailles	Jan. 18, 1901	Langdon Creasey Co.
7609	R. T. Royal	Richmond	Feb. 2, 1901	E. Deatherage & Co.
7834	Col. Gildeas	Elizabethtown	March 7, 1901	T. J. Neafus
7835	Royal	Elizabethtown	March 7, 1901	T. J. Neafus
7837	Red Star	Elizabethtown	March 7, 1901	Reed & Bro.
7951	Kenton	Covington	May 13, 1901	R. Hamilton Grocery Co.
7952	Crown	Covington	May 13, 1901	R. Hamilton Grocery Co.
7967	White Cap	Covington	May 13, 1901	J. L. Hilker
7968	Red Star	Covington	May 13, 1901	J. L. Hilker
7990	Pride of Covington	Covington	May 14, 1901	W. R. Miller
8024	Campbell's	Covington	May 14, 1901	J. G. Herman
8026	Snow Drift	Newport	May 15, 1901	David Brunk
8419	American Beauty	Louisville	July 30, 1901	Wolff & Sons
8422	American Beauty	Louisville	July 30, 1901	Ed L. Meyer
8535	Good Luck	Frankfort	Aug. 23, 1901	Howard & Noonan
8543	Good Luck	Frankfort	Aug. 23, 1901	Jas. O'Donnell
8544	Faultless	Frankfort	Aug. 23, 1901	A. H. Wagner
8557	R. T. Royal	Frankfort	Aug. 24, 1901	George Salender
8559	Good Luck	Frankfort	Aug. 24, 1901	H. L. Tobbin
8560	Royal	Frankfort	Aug. 24, 1901	W. J. Scotto
8652	Clabber	Louisville	Sept. 24, 1901	F. C. Wernert
8653	Clabber	Louisville	Sept. 24, 1901	S. Goldsmith
8700	American Beauty	Louisville	Oct. 10, 1901	Wolff & Sons
8706	Water Lily	Louisville	Oct. 10, 1901	Wolff & Sons
8726	Mascot	Nicholasville	Oct. 14, 1901	H. Frye
8732	Sky	Nicholasville	Oct. 14, 1901	H. H. Lowry
8733	Pure Food	Nicholasville	Oct. 14, 1901	H. H. Lowry
8097	Our Leader	Owensboro	May 13, 1901	E. F. Sturgeon

BAKING POWDERS—Not Found Adulterated

Station No.	Name taken from Label.	Where Obtained.	Date of Collection.	From Whom Obtained.
6317	Richelieu	Lexington	Dec. 13, 1899	Campbell Tea & Coffee Co.
7144	Bon Bon	Lexington	Dec. 12, 1900	Pearson & Clarke
7145	Rabbit's Foot	Lexington	Dec. 12, 1900	Pearson & Clarke
7956	Pure Cream Tartar	Covington	May 13, 1901	Geo. C. Goode
8099	Royal	Owensboro	May 14, 1901	H. W. Meek

or Without Label Showing Kind of Acid Salt Used.

Manufacturer.	Acid Salt Found.	Remarks.
Henry Koenig Co.	Alum, Phosphate	
Clover Chemical Co., N. Y.	Alum	30 per cent. soapstone filler.
Herkin Spice Co., Cin., O.	Alum, Phosphate	Without label.
J. Lankala Co., Chat., Tenn.	Alum, Phosphate	Without label.
Quaker Co., Chicago, Ill.	Alum, Phosphate	Without label.
Northorp, Robertson & Carrier	Alum, Phosphate	Without label.
Northorp, Robertson & Carrier	Alum, Phosphate	Without label.
R. T. Royal, Louisville, Ky.	Phosphate	Labeled, Cream Tartar.
Kenton Co., Cincinnati, O.	Phosphate	Without label.
R. T. Royal, Louisville, Ky.	Phosphate	Labeled, Cream Tartar.
Boston Baking Powder Co.	Alum	Without label.
Royal Baking Powder Co.	Cream Tartar	Without label.
Ouerbacker, Gilmore Co.	Alum, Phosphate	Without label.
Kenton Co.	Alum, Phosphate	Without label.
Kenton Co.	Alum, Phosphate	Without label.
Jas. Heekin & Co.	Alum, Phosphate	Without label.
G. B. Murphy	Alum, Phosphate	Without label.
Wabash Baking Powder Co.	Alum	Without label.
Potter Parlan & Co.	Alum, Phosphate	Without label.
H. R. Droste & Co.	Cream Tartar	Without label.
Ed L. Meyer & Co.	Alum	Without label.
Ed L. Meyer & Co.	Alum	Without label.
Southern Mfg. Co.	Alum	Without label.
Southern Mfg. Co.	Alum	Without label.
	Alum, Phosphate	Without label.
R. T. Royal	Phosphate	Labeled Cream Tartar.
Southern Mfg. Co.	Alum	Without label.
Royal Baking Powder Co.	Cream Tartar	Without label.
Hulman Coffee Co.	Alum, Phosphate	Without label.
Hulman Coffee Co.	Alum, Phosphate	Without label.
Ed L. Meyer	Alum	Without label.
Wolff & Sons	Alum	Without label.
C. T. Ware Coffee Co.	Alum, Phosphate	Without label.
Sky Baking Powder Co.	Alum, Phosphate	Without label.
Fred Parker	Alum, Phosphate	Without label.
E. W. Gillett	Alum	Without label.

And With Labels Showing Kind of Acid Salt Used.

Manufacturer.	Acid Salt Found.	Remarks.
Sprague, Warner & Co.	Cream Tartar	
J. C. Grant Chemical Co.	Alum	Obscurely labeled, Alum.
J. C. Grant Chemical Co.	Alum	Obscurely labeled, Alum.
Cin. Wholesale Grocery Co.	Cream Tartar	
Royal Baking Powder Co.	Cream Tartar	

BUTTER—Not Found Adulterated.

Station No.	Make or Brand.	Where Obtained.	Date of Collection.
6117	Country	Lexington	Dec. 13, 1899
6119	Country	Lexington	Dec. 13, 1899
6120	Country	Lexington	Dec. 13, 1899
6121	Country	Lexington	Dec. 13, 1899
6134	Country	Maysville	Dec. 15, 1899
6135	Country	Maysville	Dec. 15, 1899
6137	Country	Maysville	Dec. 15, 1899
6138	Country	Maysville	Dec. 15, 1899
6136	Country	Maysville	Dec. 15, 1899
6426	Country	Versailles	Feb. 28, 1900
6427	Country	Versailles	Feb. 28, 1900
6751	Home made	Louisville	April 12, 1900
6752	Creamery	Louisville	April 12, 1900
6753	Creamery	Louisville	April 12, 1900
6754	Creamery	Louisville	April 12, 1900
6755	Creamery	Louisville	April 12, 1900
6756	Creamery	Louisville	April 12, 1900
6757	Creamery	Louisville	April 12, 1900
6758	Own make	Louisville	April 12, 1900
6759	Creamery	Louisville	April 12, 1900
6760	Creamery	Louisville	April 12, 1900
6761	Creamery	Louisville	April 17, 1900
6762	Creamery	Louisville	April 17, 1900
6763	Country	Louisville	April 17, 1900
6764	Country	Louisville	April 17, 1900
6765	Country	Louisville	April 17, 1900
6767	Country	Louisville	April 17, 1900
6766	Country	Louisville	April 17, 1900
6768	Country	Louisville	April 17, 1900
6769	Country	Louisville	May 16, 1900
6770	Country	Louisville	May 16, 1900
6771	Country	Louisville	May 16, 1900
6772	Country	Louisville	May 16, 1900
6773	Country	Louisville	May 16, 1900
6774	Country	Louisville	May 16, 1900
6775	Country	Louisville	May 16, 1900
6776	Country	Louisville	May 16, 1900
6777	Own make	Louisville	May 16, 1900
6778	Country	Louisville	May 16, 1900
6779	Own make	Louisville	May 16, 1900
6781	Country	Louisville	May 21, 1900
6782	Country	Louisville	May 21, 1900
6783	Country	Louisville	May 21, 1900
6784	Dairy	Louisville	May 21, 1900
6785	Creamery	Louisville	May 21, 1900
6786	Creamery	Louisville	May 21, 1900
6787	Country	Louisville	May 21, 1900
6788	Country	Louisville	May 21, 1900
6790	Own make	Louisville	May 21, 1900
6792	Country	Louisville	May 24, 1900
6793	Country	Louisville	May 24, 1900
6795	Country	Louisville	May 24, 1900
6797	Country	Louisville	May 24, 1900
6798	Country	Louisville	May 24, 1900
6799	Country	Louisville	May 24, 1900
6800	Country	Louisville	May 24, 1900
7030	Creamery	Lexington	Oct. 8, 1900
7031	Creamery	Lexington	Oct. 8, 1900
7032	Creamery	Lexington	Oct. 8, 1900
7923	Creamery	Owensboro	May 7, 1901
7924	Country	Owensboro	May 7, 1901
7926	Country	Owensboro	May 7, 1901
7928	Country	Owensboro	May 7, 1901
7930	Creamery	Owensboro	May 8, 1901
7931	Creamery	Owensboro	May 8, 1901
7933	Creamery	Owensboro	May 8, 1901
7959	Creamery	Covington	May 13, 1901

BUTTER—Not Found Adulterated.

From Whom Obtained.	Retail Price per pound.	Analytical Data.		
		Reichert M.	Valenta Test Degrees C.	Color.
T. L. Campbell	25	.....	40.0	Natural.
Scully & Gorman	30	.....	47.0	Natural.
J. M. Crawford	25	.....	49.0	Slight tr. art.
J. M. Crawford	25	.....	39.0	Slight tr. art.
J. C. Cablish	20	.....	54.0	Natural.
J. C. Cablish	20	.....	45.0	Natural.
Ed. Richardson	20	.....	50.0	Natural
G. W. Geisel	20	.....	46.0	Natural.
C. C. Calhoun	20	.....	48.0	Natural.
Theo. Kessler	20	.....	38.0	Natural.
Theo. Kessler	20	26.8	52.0	Natural
C. Bodenbender	25	21.3	55.5	Azo dye.
Weikel & Schuh	25	28.8	39.5	Azo dye.
F. Klusmeier	25	28.1	37.0	Azo dye.
Imorde & Bro.	30	29.9	41.0	Azo dye.
Wm. Scharf, Jr.	25	28.6	37.5	Azo dye.
A. Marcus	30	28.6	36.5	Azo dye.
Bode Bros	25	29.1	32.0	Azo dye.
J. M. Schoenbacher	30	26.9	41.0	Azo dye.
D. Montz	20	26.2	41.0	Azo dye.
Jno. Bohlsen & Sons	20	28.8	31.5	Azo dye.
George Black	30	28.5	36.5	Azo dye.
Max Levi	30	26.8	40.0	Azo dye.
A. Button	25	27.3	45.0	Natural.
Jno. Keifer	20	28.8	28.0	Natural.
A. J. Dreisel	20	30.4	35.0	Natural.
Wm. Cummings	20	25.5	40.0	Natural.
J. L. Block	20	29.1	35.0	Natural.
Weaver Bros.	25	27.7	34.5	Natural.
N. Neal	20	30.7	42.0	Natural.
C. Oldiges	20	25.4	35.5	Natural.
Ross & McCall	20	28.0	35.5	Natural.
Long & Collins	25	26.8	36.7	Azo dye.
F. Doll Gro. Co.	20	30.7	34.0	Natural.
Watkins & McCandlers	20	28.2	38.5	Natural.
Mrs. Burke	25	28.2	33.5	Natural.
Jno. Heins	20	27.8	30.0	Natural.
F. M. Derkins	25	26.4	33.0	Natural.
G. J. Churchman	25	29.5	32.0	Natural.
Ky. Dairyman's Exchange	25	29.9	34.5	Natural.
L. M. Reid	20	29.8	27.0	Natural.
W. A. Call	20	27.2	35.0	Natural.
Fred Brinke	20	30.7	42.0	Natural.
Moses & Nichols	20	29.8	32.0	Natural.
Gt. Atlantic & Pac. Tea Co.	21	28.2	37.0	Natural.
Zapp & Co.	25	29.9	39.5	Azo dye.
A. Button & Sons	20	26.3	44.0	Natural.
L. S. Clemmons	20	26.5	36.0	Natural.
N. L. Ragland & Son	20	26.2	41.5	Natural.
H. Deddins	20	30.9	33.0	Natural.
W. F. Linton	20	27.2	28.0	Natural.
R. L. Price	20	28.1	38.0	Natural.
Jno. Ross	20	26.3	21.0	Natural.
F. Hohmann	20	27.5	38.0	Natural.
R. J. Woertz	20	29.1	31.0	Natural.
August A. Faust	20	29.7	33.0	Natural.
Jno. Hutchison	30	29.7	39.0	Artificial.
A. E. Shields	30	25.3	43.0	Artificial.
Armour & Co.	.....	28.1	47.0	Artificial.
Dougherty & Berry	25	28.7	40.0	Natural.
R. B. Pottinger	20	28.2	25.0	Natural.
L. A. Nunn	25	29.9	38.0	Natural.
Thos. Steele	25	30.0	26.0	Natural.
Dawson & Yager	25	26.7	35.0	Natural.
W. F. Reinhardt	30	28.7	38.0	Natural.
Geo. Poehlin	25	26.8	34.0	
G. H. Voss	15	28.4	38.0	Aniline color.

BUTTER—Not Found Adulterated.—Continued.

Station No.	Make or Brand.	Where Obtained.	Date of Collection.
7963	Creamery	Covington	May 13, 1901
7974	Creamery	Covington	May 14, 1901
7977	Creamery	Covington	May 14, 1901
7978	Creamery	Covington	May 14, 1901
7984	Country	Covington	May 14, 1901
7985	Creamery	Covington	May 14, 1901
7989	Creamery	Covington	May 14, 1901
8000	Creamery	Covington	May 14, 1901
8002	Creamery	Covington	May 14, 1901
8005	Clover Creamery	Covington	May 14, 1901
8008	Creamery	Covington	May 14, 1901
8009	Country	Covington	May 14, 1901
8010	Country	Covington	May 14, 1901
8017	Creamery	Covington	May 14, 1901
8020	Country	Covington	May 14, 1901
8022	Creamery	Newport	May 14, 1901
8023	Country	Newport	May 14, 1901
8025	Creamery	Newport	May 15, 1901
8027	Creamery	Newport	May 15, 1901
8031	Creamery	Newport	May 15, 1901
8038	Country	Newport	May 15, 1901
8039	Creamery	Newport	May 15, 1901
8040	Country	Newport	May 15, 1901
8093	Country	Owensboro	May 13, 1901
8094	Country	Owensboro	May 13, 1901
8098	Country	Owensboro	May 14, 1901
8108	Country	Owensboro	May 15, 1901
8109	Country	Owensboro	May 15, 1901
8441	Country	Louisville	Aug. 3, 1901
8789	Creamery	Lexington	Oct. 29, 1901
7927	Country	Owensboro	May 7, 1901
7929	Creamery	Owensboro	May 7, 1901
7954	Creamery	Covington	May 13, 1901
8101	Country	Owensboro	May 14, 1901
8102	Country	Owensboro	May 14, 1901
8103	Creamery	Owensboro	May 14, 1901
8104	Country	Owensboro	May 14, 1901
8714	Creamery	Louisville	Oct. 10, 1901
*9066	Creamery	Lexington	Dec. 20, 1901

*Sent for infomation.

BUTTER—Not found Adulterated.—Continued.

From Whom Obtained.	Retail Price per pound.	Analytical Data.		
		Reichert, M.	Valenta Test Degrees C.	Color.
J. J. Schular	25	27.5	42.0	Aniline color.
E. J. Goebel	25	26.6	41.0	Aniline color.
I. H. Steppenfield	26	27.9	41.0	Aniline color.
I. H. Steppenfield	26	29.4	40.0	Azo dye.
M. Niehaus	25	31.0	33.0	Natural.
M. Niehaus	14	29.0	43.0	Azo dye.
W. R. Miller	25	29.5	36.0	Azo dye.
G. T. Ellison	25	28.9	40.0	Natural.
Jno. Dalheim	25	27.2	40.0	Aniline.
Jno. Evans	20	29.7	40.0	Aniline color.
Omeara Bros.	25	29.4	42.0	Aniline color.
Siffen Bros.	22	30.0	36.0	Natural.
N. L. Young	30	28.0	38.0	Natural.
G. H. Voss	23	29.3	37.0	Azo dye.
H. Voss, Myer & Bro.	20	29.6	34.0	
J. G. Herman	30	30.6	31.0	Azo dye.
J. G. Herman	20	33.3	33.0	Azo dye.
David Brunk	26	29.9	39.0	Azo dye.
Ed Quinn	24	30.0	41.0	Azo dye.
Otto Deppenbrock	30	30.1	35.0	Azo dye.
Frank Fecker	16	27.0	37.0	Azo dye.
T. W. Wilson	25	29.7	37.0	
T. W. Wilson	20	33.0	31.0	
J. J. Gavin, Jr.	25	31.1	32.0	
Ed Francke & Son	25	30.8	34.0	
H. W. Meek	25	26.4	45.0	
J. R. Lancaster	25	27.9	37.0	
R. H. O'Flaherty	25	28.3	38.0	
E. B. Swift	20	27.2	35.0	Natural.
Vogt & Foley	25	.....	42.0	
C. E. Fournier	25	31.6	30.0	
Frank Meier & Bro.	25	29.0	40.0	Azo dye.
R. Hamilton Grocery Co.	25	27.6	43.0	Azo dye.
G. O. May	25	24.5	44.0	
Linegar & Linegar	25	26.5	49.0	
J. W. Reinhardt	25	26.9	27.0	
J. W. Reinhardt	20	27.5	28.0	
Great A. & P. Tea Co.	24	31.9	43.0	Aniline.
Foster Butner	.....	.....	32.0	No antisept.

BUTTER—Found Adulterated.

Station No.	Name of Brand or Make.	Where Obtained.	Date of Collection.	From Whom Obtained.
6886	Fresh Butter	Ky. D'ryman's Ex. Louisville	Aug. 28, 1900.....	J. Rule, Goshen, sent sample.
8788	Dairy Butter	Lexington	Oct. 28, 1901	Mrs. Ella Chinn sent sample..
8791	Creamery Butter	Lexington	Nov. 1, 1901.....	Wm. Lyons .....
8793	Creamery Butter	Lexington	Nov. 2, 1901.....	J. M. Moberly .....
				Blue Grass Gro. Co. .....
6789	Creamery Butter	Louisville		J. W. Pittinger .....

CANNED GOODS.

Station No.	Where Obtained.	From Whom Obtained,	Date of Collection.	Price Paid.	Manufacturer.
8697	Louisville	M. Wolff & Sons .	Oct. 10, 1901	10	Gibbs Preserving Co. .....
8699	Louisville	M. Wolff & Sons .	Oct. 10, 1901	10	Morgan & Clarke .....
8704	Louisville	M. Wolff & Sons .	Oct. 10, 1901	15	.....
8712	Louisville	M. Wolff & Sons .	Oct. 10, 1901	15	J. T. Schroth .....
8713	Louisville	M. Wolff & Sons .	Oct. 10, 1901	10	Circleville Canning Co. .....
8720	Nicholasville	J. R. Miller	Oct. 14, 1901	10	Peckaway Canning Co. .....
8725	Nicholasville	R. L. Goucher ...	Oct. 14, 1901	10	J. L. Hayner & Co. .....
8728	Nicholasville	H. Higgs & Son .	Oct. 14, 1901	10	Cobb Preserving Co. .....
8730	Nicholasville	D. S. Waide	Oct. 14, 1901	15	Thos. J. Myers & Co. .....
8736	Nicholasville	Robt. Hare	Oct. 14, 1901	10	New London Canning Co. ...
8729	Nicholasville	D. S. Waide	Oct. 14, 1901	10	Hageman & Harting .....
7972	Covington	E. J. Goebel	May 14, 1901	13	Martin Wagner Co. .....

BUTTER—Found Adulterated

Retail Price Per Lb.	Analytical Data. Reichert, M.	Valenta Test Degree C.	Fat Per Cent.	Water Per Cent.	Color.	REMARKS.	
25	21.7	59.0	.....	.....	Artific'l	20% Oleomargarine	
....	.....	48.0	.....	49.37	Artific'l	Process Butter	
25	.....	47.0	49.49	44.30		Process Butter	Salt, 3.9%, Casein, 2.31%.
25	.....	44.0	46.88	46.07		Process Butter ...	Salt, 4.62%, Casein, 2.43%.
25	19.4	51.0	.....	.....	Natural	Oleomargarine, 25%	

CANNED GOODS.

Brand.	Antiseptic.	REMARKS.
Choice Cove Oysters	None found.	Not found adulterated.
Early June Peas	No Salicylic or Boric Acid....	
French Peas	No Salicylic Acid	Not found adulterated—no copper.
Frankfurt Sausage	No Boric Acid	Not found adulterated.
Early Valentine String Beans	No Salicylic	Not found adulterated.
Sugar Corn	No Salicylic	Not found adulterated.
Sugar Corn	No Salicylic	Not found adulterated.
Sugar Corn	No Salicylic	Not found adulterated.
Grated Pine Apple	No Salicylic	Not found adulterated.
Purity Sugar Corn	No Salicylic	Not found adulterated.
Warren's Sugar Corn	No Salicylic	Not found adulterated.
Ex. Des. Grated Pine Apple..	No Salicylic or Benzoic Acid..	Polariz'on Dir. + 0.4, Invert—4.3 T. 26°C

FEEDING STUFFS—Not Found Adulterated.

Station No.	Name.	Date of Collection.	Where Obtained.	From Whom Obtained.
7120	Bran	Nov. 30, 1900	Louisville	Callahan & Sons
7121	Bran	Nov. 30, 1900	Louisville	Callahan & Sons
7123	Bran	Nov. 30, 1900	Louisville	Oscar Farmer & Son
7124	Bran	Nov. 30, 1900	Louisville	Geo. Becker & Co.

FEEDING STUFFS—Found Adulterated.

Station No.	Name.	Date of Collection.	Where Obtained.	From Whom Obtained.
7122	Mixed Feed	Nov. 30, 1901	Louisville	A. C. Schuff

PEPPER, SPICES, ETC.—Not Found Adulterated.

7996 Black pepper, bought of B. H. Kroger, Covington Ky., May 14, 1901, Contains too little pepper starch and too much pepper hull. Probably not adulterated with anything foreign in pepper berry.

FEEDING STUFFS—Not Found Adulterated,

Manufacturer.	[redacted] nt.	Foreign Material.	REMARKS.
J. D. Guthrie & Sons	15.75	Some Fragments of Gr. Cobs.	
J. D. Guthrie & Sons	17.21	.....	Very clean sample.
	16.37	Fragments of Cockle	
Ky. Milling Co.	16.62	Fragments of Cockle	

FEEDING STUFFS—Found Adulterated,

Manufacturer.	Protein Per Cent.	Foreign Material.	REMARKS.
Ky. Milling Co.	14.12	Ground Corn Cobs	

PEPPER—Found Adulterated.

8710 Ground black pepper, bought of Wolff & Sons, Louisville, October 10, 1901. Contains some foreign starch.

8715 Ground black pepper, Great A. & P. Tea Co., Louisville, October 10, 1901. Contains foreign starch.

JELLIES, PRESERVES, ETC.—Not Found Adulterated.

Station No.	Name or Brand on Label, or Stated.	Where Obtained.	Date of Collection.	Price Paid.	From Whom Obtained.
7964	Pure White C. Honey	Covington	May 13, 1901	10	J. L. Hilker
7971	Jello	Covington	May 14, 1901	10	E. J. Goebel
7973	Pure Honey	Covington	May 14, 1901	20	E. J. Goebel
7979	Strawberry Pomona	Covington	May 14, 1901	10	I. H. Seppenfield
7980	Pure Honey	Covington	May 14, 1901	13	I. H. Seppenfield
8106	Damson Preserves	Owensboro	May 15, 1901	50	R. B. Pottinger
8783	Wild Plum Jelly	Lexington	Oct. 25, 1901	.....	Mrs. T. H. Clay
8785	Green Gage Jam	Lexington	Oct. 25, 1901	.....	Mrs. T. H. Clay
8787	Gooseberry Jam	Lexington	Oct. 25, 1901	.....	Mrs. T. H. Clay
8107	Raspberry Jam	Owensboro	May 17, 1901	20	R. B. Pottinger
8003	Currant Jelly	Covington	May 14, 1901	10	Jno. Dalheim

JELLIES, PRESERVES, ETC.—Found Adulterated.

Station No.	Name or Brand on Label, or Stated.	Price Paid.	Where Obtained.	From Whom Obtained.	Date of Collection.
7213	Raspberry Jelly	.....	Elizabethtown	Davis & Williams	Dec. 19, 1900
7215	Apricot Jam	.....	Elizabethtown	G. Watkins	Dec. 19, 1900
7611	Apple Butter	10	Richmond	Higgins & Ellis	Feb. 2, 1901
7953	Raspberry Jam	10	Covington	R. Hamilton Gro.	May 13, 1901
8014	Currant Jelly, Acme	10	Covington	Geo. Reedy	May 14, 1901
8016	Crab Apple Jelly	10	Covington	Geo. Reedy	May 14, 1901
8650	Red Raspberry Pres.	25	Louisville	Wm. Cummings	Sept. 26, 1901

JELLIES, PRESERVES, ETC.—Not Found Adulterated.

Manufacturer or Producer.	Analytical Data.		Temp.	Sugar Per Cent.	
	Polarization Direct.	Polarization Invert.			
F. W. Muth & Co.	—13.3	+15.5	31.	1.97	
Genisee Pure Food Co.	+29.	—22.0	31.	79.2	
C. H. Webber	— 8.5	—10.5	31.	1.5	
P. J. Riller	+44.	+39.2	26.	7.3	Glucose 26 per cent. so labeled.
C. H. Webber	—10.0	—12.0	31.	1.5	
	+12.4	— 7.1	31.	30.2	
Mrs. T. H. Clay	+ 6.0	—10.7	21.	....	
Mrs. T. H. Clay	— 1.2	— 9.6	21.	....	
Mrs. T. H. Clay	— 4.4	— 9.7	21.	....	
Goodwin Pres. Co.	+23.7	—17.8	31.	66.2	
Cruikshank Bros. & Co.	+19.7	— 9.8	26.	44.8	No Salicylic or Benzoic.

JELLIES, PRESERVES, ETC.—Found Adulterated.

Manufacturer or Wholesaler.	Analytical Data.				R[illegible]
	Polarization Direct.	Polarization Invert.	Sugar Per Cent.	Color.	
Louisville Preserving Co.	—127.2	+125.6	.....	.....	Gl[illegible].
Idea Preserving Co.	+119.0	+107.0	.....	.....	Gl[illegible]se.
Exley, Watkins & Co.	+ 38.0	+ 37.0	.....	.....	Glucose 25 per cent.
Austin, Nichols & Co.	+ 31.3	+ 20.4	16.6	.....	Glucose 18 per cent.
.....	+ 9.1	+ 5.5	5.5	.....	Glucose 5 per cent.
Flaccus Bros.	+ 36.2	+ 33.5	4.1	.....	Glucose 20 per cent.
Lutz & Schramm	+ 4.6	— 4.2	8.8	Aniline....	

MILK—Not Found Adulterated.

Station No.	Where Obtained.	Date of Collection.	Seller or Producer.
6651	Louisville	April 10, 1900	A. J. Phillips
6652	Louisville	April 10, 1900	F. Schurch
6653	Louisville	April 10, 1900	Gauman Bros.
6655	Louisville	April 10, 1900	Frank & Keller
6656	Louisville	April 10, 1900	F. Lacker
6660	Louisville	April 10, 1900	George Laible
6661	Louisville	April 11, 1900	H. E. Lewman
6663	Louisville	April 11, 1900	H. E. Lewman
6665	Louisville	April 11, 1900	H. E. Lewman
6667	Louisville	April 11, 1900	H. E. Lewman
6668	Louisville	April 11, 1900	H. E. Lewman
6670	Louisville	April 11, 1900	H. E. Lewman
6671	Louisville	April 13, 1900	Mrs. D. Kluer
6672	Louisville	April 13, 1900	J. G. Strohmiers
6673	Louisville	April 13, 1900	Ky. Dairyman's Exchange
6674	Louisville	April 13, 1900	F. Bauer & Sons
6675	Louisville	April 13, 1900	Ky. Dairyman's Exchange
6676	Louisville	April 13, 1900	Ky. Dairyman's Exchange
6678	Louisville	April 13, 1900	Ky. Dairyman's Exchange
6679	Louisville	April 13, 1900	Ky. Dairyman's Exchange
6681	Louisville	April 14, 1900	J. Peiper
6682	Louisville	April 14, 1900	Andy Kaelin
6683	Louisville	April 14, 1900	E. W. Sewell
6684	Louisville	April 14, 1900	U. L. Ragland
6685	Louisville	April 14, 1900	D. H. Ewing & Son
6686	Louisville	April 14, 1900	J. Thies
6687	Louisville	April 14, 1900	H. E. Lewman
6688	Louisville	April 14, 1900	H. E. Lewman
6689	Louisville	April 14, 1900	H. E. Lewman
6690	Louisville	April 14, 1900	H. E. Lewman
6691	Louisville	April 16, 1900	J. C. Straub
6692	Louisville	April 16, 1900	F. W. Meihoff
6693	Louisville	April 16, 1900	Jas. Kaelin
6694	Louisville	April 16, 1900	W. & H. Wetterau
6695	Louisville	April 16, 1900	B. Greive
6696	Louisville	April 16, 1900	M. Bisig
6697	[illegible]ouisville	April 16, 1900	D. H. Ewing & Sons
669[illegible]	[illegible]uisville	April 16, 1900	D. H. Ewing & Sons
669[illegible]	[illegible]uisville	April 16, 1900	D. H. Ewing & Sons
670[illegible]	[illegible]isville	April 16, 1900	D. H. Ewing & Sons
670[illegible]	[illegible]sville	April 19, 1900	Simon & Goldstein
670[illegible]	[illegible]ville	April 19, 1900	B. Fischner
6703	[illegible]lle	April 19, 1900	H. Harlammert
6704	[illegible]le	April 19, 1900	K. Kaelin
6709	[illegible]e	April 19, 1900	Fred Meyer
6710	[illegible]e	April 19, 1900	Fred Meyer
6711	Louis[illegible]le	April 20, 1900	B. Bodeman
6712	Louis[illegible]lle	April 20, 1900	Wm. Onill
6713	Louisville	April 20, 1900	H. Friecks
6714	Louisville	April 20, 1900	Jno. Stockenborg
6715	Louisville	April 20, 1900	J. D. Broderic
6716	Louisville	April 20, 1900	L. Leibert
6717	Louisville	April 20, 1900	Weaver Bros.
6718	Louisville	April 20, 1900	Jas. Reinert
6719	Louisville	April 20, 1900	W. P. Grigsby
6721	Louisville	April 27, 1900	Long & Collins
6722	Louisville	April 27, 1900	W. C. Cope
6723	Louisville	April 27, 1900	S. J. McCaddle
6724	Louisville	April 27, 1900	Geo. H. Young
6725	Louisville	April 27, 1900	U. Neal
6731	Louisville	April 30, 1900	E. F. Detrick
6732	Louisville	April 30, 1900	F. F. Gilmore
6733	Louisville	April 30, 1900	C. H. Merhoff & Son
6734	Louisville	April 30, 1900	U. L. Ragland & Son
6735	Louisville	April 30, 1900	Von Gounigen Bros.
6737	Louisville	April 30, 1900	Chas. Kaelin
6738	Louisville	April 30, 1900	Moser Bros.
6739	Louisville	April 30, 1900	Beadle & Son
6740	Louisville	April 30, 1900	Hall Bros.

MILK—Not Found Adulterated.

Analytical Data.						REMARKS.
Specific Gravity.	Fat Per Cent.	Solids, not Fat Per Ct.	Total Solids, Per Cent.	Antiseptic.	Color.	
1.0287	6.4	8.60	15.00	None	None....	
1.0335	3.0	9.12	12.12	"	"	Fats, low.
1.0305	3.6	8.49	12.09	"	"	Fats, low.
1.0340	3.4	9.32	12.72	"	"	Fats, low.
1.0295	3.6	8.23	11.83	"	"	Fats, low.
1.0290	4.0	8.19	12.19	"	"	
1.0300	4.1	8.46	12.56	"	"	Frank Potter.
1.0285	3.2	7.90	11.11	"	"	Fats, low—Chas. Swartz.
1.0340	3.4	9.32	12.72	"	"	Fats, low—E. A. Dun.
1.0305	3.0	8.37	11.37	"	"	Fats, low—Lewman & Graves
1.0315	3.8	8.77	12.57	"	"	Fats, low—W. S. Adair.
1.0320	3.0	8.74	11.74	"	"	Fats, low—Wm. Sims.
1.0300	3.2	8.28	11.48	"	"	Fats, low.
1.0300	3.2	8.28	11.48	"	"	Fats, low.
1.0295	3.8	8.27	12.07	"	"	J. L. Simcoe.
1.0340	3.8	8.36	13.20	"	"	
1.0300	3.6	8.36	11.96	"	"	Fats, low—Mrs. A. Corn.
1.0300	4.0	8.44	12.44	"	"	M. C. Colyer.
1.0305	3.0	8.37	11.37	"	"	Fats, low—J. P. Pound.
1.0305	4.0	8.57	12.57	"	"	A. R. Bennet.
1.0305	4.0	8.57	12.57	"	"	
1.0340	4.3	9.50	13.80	"	"	
1.0325	4.2	9.11	13.31	"	"	
1.0295	3.5	8.21	11.71	"	"	Fats, low.
1.0330	3.6	9.11	13.31	"	"	Fats, low.
1.0330	3.3	9.05	12.35	"	"	Fats, low.
1.0265	6.8	8.13	14.93	"	"	
1.0295	5.5	8.62	14.12	"	"	S. A. Prather.
1.0270	9.4	8.77	18.17	"	"	E. A. Spangler.
1.0300	4.2	8.45	12.68	"	"	Chas. Ashton.
1.0280	3.4	7.82	11.22	"	"	Fats, low.
1.0325	3.0	8.87	11.87	"	"	Fats, low.
1.0315	3.8	8.77	12.57	"	"	Fats, low.
1.0340	3.4	9.32	12.72	"	"	Fats, low.
1.0325	3.5	8.97	12.47	"	"	Fats, low.
1.0330	3.5	9.09	12.59	"	"	Fats, low.
1.0330	4.2	9.23	13.43	"	"	
1.0310	3.8	8.65	12.45	"	"	J. D. Wakefield.
1.0325	4.5	9.17	13.67	"	"	G. W. Hardin.
1.0310	3.8	8.65	12.45	"	"	J. L. Collins.
1.0310	3.0	8.49	11.49	"	"	Fats, low.
1.0320	3.9	8.92	12.82	"	"	
1.0280	3.7	7.88	11.58	"	"	
1.0280	3.6	7.86	11.46	"	"	Fats, low.
1.0315	4.0	8.82	12.82	"	"	
1.0325	4.4	9.15	13.15	"	"	A. Koehler.
1.0285	3.5	7.97	11.47	"	"	
1.0285	5.0	8.27	13.27	"	"	
1.0305	3.4	8.45	11.85	"	"	
1.0325	3.3	8.93	12.23	"	"	Fats, low.
1.0310	3.1	8.51	11.61	"	"	Fats, low.
1.0325	3.2	8.91	12.11	"	"	Fats, low.
1.0315	4.0	8.82	12.82	"	"	
1.0280	3.4	7.82	11.22	"	"	Fats, low.
1.0315	3.2	8.65	11.85	"	"	Fats, low.
1.0325	4.2	9.11	13.31	"	"	
1.0305	5.0	8.77	13.77	"	"	
1.0315	3.4	8.69	12.09	"	"	Low in Fats.
1.0315	3.3	8.67	11.97	"	"	Low in Fats.
1.0310	4.6	8.81	13.41	.....	Annatto	
1.0300	2.8	8.20	11.00	.....	None....	Low in Fats
1.0315	6.2	9.13	15.33	.....	.....	
1.0310	3.0	8.49	11.49	.....	.....	Low in Fats.
1.0315	4.0	8.82	12.52	.....	.....	
1.0340	4.4	9.52	13.92	.....	.....	
1.0340	3.0	9.36	12.96	.....	.....	Low in Fats.
1.0320	3.0	8.74	11.74	.....	.....	Low in Fats.
1.0320	4.4	9.02	13.42	.....	.....	
1.0325	3.2	8.91	12.11	.....	.....	Low in Fats.

MILK—Not Found Adulterated.

Station No.	Where Obtained.	Date of Collection.	Seller or Producer.
6741	Louisville	May 2, 1900	Jno. Tobb
6742	Louisville	May 2, 1900	L. Brumleve
6744	Louisville	May 2, 1900	A. Wilman
6747	Louisville	May 2, 1900	Henry Harlammert
6748	Louisville	May 2, 1900	F. Von Allmen, Jr.
6750	Louisville	May 2, 1900	P. Von Allmen
6936	Lexington	August 2, 1900	H. S. Lawson
6937	Lexington	August 2, 1900	R. D. Huffman
6938	Lexington	August 2, 1900	M. G. Featherston
6939	Lexington	August 2, 1900	J. R. Tucker
6940	Lexington	August 2, 1900	N. B. Haggard
6941	Lexington	August 2, 1900	N. B. Haggard
6942	Lexington	August 2, 1900	M. R. Perkins
6944	Lexington	August 2, 1900	R. L. & E. L. Parker
6945	Lexington	August 2, 1900	J. B. Baudekofel
6946	Lexington	August 2, 1900	Kriegel Bros.
6947	Lexington	August 2, 1900	Kriegel Bros.
6948	Lexington	August 2, 1900	D. A. Trapp
6949	Lexington	August 2, 1900	McGovern Bros.
6950	Lexington	August 2, 1900	John Furrer
6951	Lexington	August 2, 1900	Ed Downing
6952	Lexington	August 2, 1900	G. Kraehenbuehl
6953	Lexington	August 2, 1900	Odd Fellows' Home
6954	Lexington	August 2, 1900	M. L. Henry
6955	Lexington	August 2, 1900	Mrs. N. B. Frazier
6956	Lexington	August 2, 1900	Geo. W. Jett
6957	Lexington	August 2, 1900	W. B. Hawkins
6958	Lexington	August 6, 1900	J. E. Lilly
6959	Lexington	August 6, 1900	J. B. Hunt
6960	Lexington	August 6, 1900	Lear Bros.
6961	Lexington	August 6, 1900	Mrs. E. E. Berry
6962	Lexington	August 6, 1900	Jas. P. Headley
6963	Lexington	August 6, 1900	Mrs. G. A. Thompson
6964	Lexington	August 6, 1900	Walter Dingle
6965	Lexington	August 6, 1900	Albert Schuler
6967	Lexington	August 6, 1900	Mrs. Mary L. Sayre
6968	Lexington	August 6, 1900	R. C. Nave
6970	Lexington	August 8, 1900	E. L. Lilly
6971	Lexington	August 8, 1900	Mrs. L. B. Shouse
6972	Lexington	August 8, 1900	G. L. Ballard
6973	Lexington	August 8, 1900	J. W. Clark
6974	Lexington	Aug. 8, 1900	T. H. Wilson
6975	Lexington	Aug. 8, 1900	J. D. Yarington
6977	Lexington	Aug. 8, 1900	W. B. Taylor
6978	Lexingtin	Aug. 8, 1900	J. M. Downing
6979	Lexington	Aug. 9, 1900	J. H. Parker
6980	Lexington	Aug. 9, 1900	Jno. Furrer
6981	Lexington	Aug. 9, 1900	J. E. Muir
6982	Lexington	Aug. 9, 1900	W. B. Taylor
6983	Lexington	Aug. 9, 1900	Ed Downing
6984	Lexington	Aug. 9, 1900	M. A. Pharis
6985	Lexington	Aug. 9, 1900	W. F. Wheatley
6987	Lexington	Aug. 9, 1900	David Cahil
8048	Newport	May 16, 1901	Geo. Hilbert & Bro.
8049	Newport	May 16, 1901	P. Young & Son
8050	Newport	May 16, 1901	Wersch Bros.
8051	Newport	May 16, 1901	Wersch Bros.
8052	Newport	May 16, 1901	Wersch Bros.
8053	Newport	May 16, 1901	J. D. Burgman, Jr.
8054	Newport	May 16, 1901	F. Hunleman
8055	Newport	May 16, 1901	N. Northeide
8056	Newport	May 16, 1901	Jno. F. Long
8057	Newport	May 16, 1901	Jno. F. Long
8058	Newport	May 16, 1901	Henry Wulkot
8059	Newport	May 16, 1901	Henry Wulkot
8060	Newport	May 16, 1901	A. Young
8061	Newport	May 16, 1901	Mrs. Young & Son
8062	Newport	May 16, 1901	A. Young
8063	Newport	May 16, 1901	P. Young

MILK—Not Found Adulterated.

Analytical Data.						REMARKS.
Specific Gravity.	Fat Per Cent.	Solids, not Fat Per Ct.	Total Solids, Per Cent.	Antiseptic.	Color.	
1.0300	3.2	8.28	11.48	.....	.....	Low in Fats—Wilson Clan.
1.0320	3.2	8.78	11.98	.....	.....	Low in Fats.
1.0295	3.4	8.19	11.59	.....	.....	Low in Fats.
1.0320	5.2	9.18	14.38	.....	.....	
1.0310	3.0	8.49	11.49	.....	.....	Low in Fats.
1.0330	3.0	8.99	11.99	.....	.....	Low in Fats.
1.0320	4.1	8.83	12.93	.....	.....	
1.0340	4.6	9.44	14.00	.....	.....	
.....	0.3	.....	.....	.....	.....	Buttermilk.
1.0360	4.8	9.99	14.79	.....	.....	
.....	0.4	.....	.....	.....	.....	Buttermilk.
1.0320	5.6	9.15	14.75	.....	.....	
1.0350	4.2	8.98	13.82	.....	.....	
1.0340	5.0	9.52	14.52	.....	.....	
1.0320	6.0	9.23	15.23	.....	.....	
1.0330	5.2	9.27	14.47	.....	.....	
1.0320	0.5	8.10	8.60	.....	.....	Buttermilk.
1.0320	4.8	8.98	13.78	.....	.....	
1.0310	5.0	8.76	13.76	.....	.....	
1.0320	4.4	8.90	13.30	.....	.....	
1.0320	5.0	9.02	14.02	.....	.....	
1.0310	4.7	8.70	13.40	.....	.....	
1.0340	5.0	9.52	14.52	.....	.....	
1.0320	4.6	8.94	13.54	.....	.....	
.....	4.3	9.13	13.43	.....	.....	
1.0330	4.6	9.19	13 79	.....	.....	
1.0340	4.0	9.32	13.32	.....	.....	
1.0330	4.6	9.19	13.79	.....	.....	
1.0330	4.1	9.09	13.19	.....	.....	
1.0340	4.1	9.34	13.44	.....	.....	
1.0320	4.5	8.92	13.42	.....	.....	
1.0330	4.5	9.17	13.67	.....	.....	
1.0310	4.7	8.85	13.05	.....	.....	
1.0310	4.7	8.70	13.40	.....	.....	
1.0340	4.0	9.32	13.32	.....	.....	
1.0340	5.1	9.54	14.64	.....	.....	
1.0300	3.7	8.25	11.95	.....	.....	
1.0330	4.9	9.25	14.15	.....	.....	
1.0310	4.2	8.60	12.80	.....	.....	
1.0320	3.9	8.79	12.69	.....	.....	
1.0330	4.9	9.25	14.15	.....	.....	
1.0330	5.4	9.36	14.76	None	None....	
1.0340	4.8	9.48	14.28	"	"	
.....	0.6	.....	.....	"	"	Buttermilk.
1.0310	5.6	8.89	14.49	"	"	
1.0320	5.4	9.10	14.50	"	"	
1.0330	5.0	9.27	14.27	"	"	
.....	0.6	.....	.....	"	"	Buttermilk.
1.0340	4.8	9.48	14.28	"	"	
1.0310	4.3	8.62	12.92	"	"	
1.0320	5.4	9.10	14.50	"	"	
1.0320	4.3	8.88	13.18	"	"	
1.0320	4.8	8.98	13.78	"	"	
.....	.....	.....	.....	"	"	Sample broken.
1.034	4.2	9.36	13.56	"	"	
1.032	3.9	8.79	12.69	"	"	
1.031	4.2	8.60	12.80	"	"	
1.031	4.6	8.68	13.28	"	"	
1.029	3.2	7.89	11.09	"	"	Fats low.
1.033	4.0	9.06	13.06	"	"	
1.034	4.0	9.32	13.32	"	"	
1.034	4.2	9.36	13.56	"	"	
1.034	4.2	9.36	13.56	"	"	
1.033	4.1	9.08	13.18	"	"	
1.031	5.6	8.89	14.49	"	"	
1.034	4.5	9.42	13.92	"	"	
1.034	3.9	9.30	13.20	"	"	
1.034	4.2	9.36	13.56	"	"	
1.032	4.0	8.81	12.81	"	"	

MILK—Not Found Adulterated.

Station No.	Where Obtained.	Date of Collection.	Seller or Producer.
8064	Newport	May 16, 1901	P. Young
8065	Newport	May 16, 1901	Wm. Percy
8066	Newport	May 16, 1901	Wm. Percy
8067	Newport	May 16, 1901	Mrs. H. A. Northcott
8068	Newport	May 16, 1901	Schurman Bros.
8069	Newport	May 16, 1901	Schurman Bros.
8070	Newport	May 16, 1901	Albert Fieldman
8071	Newport	May 16, 1901	Albert Fieldman
8072	Newport	May 16, 1901	Jno. Kuchler
8073	Newport	May 16, 1901	Jno. Kuchler
8074	Newport	May 16, 1901	Jno. Kuchler
8075	Newport	May 16, 1901	Jno. Kuchler
8076	Newport	May 16, 1901	P. Young
8077	Newport	May 16, 1901	P. H. Sauerbeck
8078	Newport	May 16, 1901	P. H. Sauerbeck
8079	Newport	May 16, 1901	P. H. Sauerbeck
8080	Newport	May 16, 1901	P. Young
8225	Lexington	July 18, 1901	Ky. Pasteurizing Co.
8226	Lexington	July 18, 1901	Ky. Pasteurizing Co.
8227	Lexington	July 18, 1901	Ky. Pasteurizing Co.
8228	Lexington	July 18, 1901	Ky. Pasteurizing Co.
8229	Lexington	July 18, 1901	N. F. Berry
8230	Lexington	July 18, 1901	H. S. Lawson
8231	Lexington	July 18, 1901	J. R. Tucker
8232	Lexington	July 18, 1901	G. R. Ballard
8233	Lexington	July 18, 1901	Ky. Pasteurizing Co.
8234	Lexington	July 18, 1901	W. B. Hawkins
8235	Lexington	July 18, 1901	Ed. Patterson
8236	Lexington	July 18, 1901	R. C. Nave
8237	Lexington	July 18, 1901	" "
8238	Lexington	July 18, 1901	" "
8239	Lexington	July 18, 1901	J. A. Thompson
8240	Lexington	July 18, 1901	Mrs. M. B. Frazee
8241	Lexington	July 18, 1901	B. A. Wilson
8242	Lexington	July 18, 1901	J. E. Lilly
8243	Lexington	July 18, 1901	J. M. Downing
8244	Lexington	July 18, 1901	McGovern Bros.
8245	Lexington	July 18, 1901	J. D. Yarrington
8246	Lexington	July 18, 1901	L. & H. Kreigal
8247	Lexington	July 18, 1901	Williams Bros.
8248	Lexington	July 18, 1901	Odd Fellows' Home
8249	Lexington	July 18, 1901	W. B. Taylor
8274	Lexington	July 23, 1901	W. L. Honaker
8275	Lexington	July 23, 1901	E. W. Jackson
8276	Lexington	July 23, 1901	J. W. Clarke
8277	Lexington	July 23, 1901	N. B. Haggard
8278	Lexington	July 23, 1901	M. R. Perkins
8279	Lexington	July 23, 1901	Mrs. E. E. Berry
8280	Lexington	July 23, 1901	E. T. Lilly
8281	Lexington	July 23, 1901	A. Schuler
8282	Lexington	July 23, 1901	W. B. Taylor
8283	Lexington	July 23, 1901	W. B. Taylor
8284	Lexington	July 23, 1901	I. H. Parker
8285	Lexington	July 23, 1901	Lear Bros.
8224	Lexington	July 18, 1900	Jno. Furrer
9057	Lexington	December 14, 1901	J. D. Yarrington
9058	Lexington	December 14, 1901	" "
9061	Lexington	December 18, 1901	" "
9061(b)	Lexington	December 18, 1901	
8379	Lexington	July 20, 1901	L. & H. Kreigel
7888	Lexington	May 7, 1901	
7889	Lexington	May 7, 1901	

MILK—Not Found Adulterated.

Analytical Data.						REMARKS.
Specific Gravity	Fat Per Cent.	Solids not Fat Per Ct.	Total Solids Per Cent.	Antiseptic.	Color.	
1.032	4.6	8.94	13.54	None	None....	
1.034	4.0	9.32	13.32	"	"	
1.034	3.6	9.24	12.84	"	"	Fats, low.
1.033	4.8	8.47	13.27	"	"	
1.030	6.6	.....	.....	"	"	
1.033	3.8	9.02	12.82	"	"	
1.026	4.2	7.34	11.54	"	"	
1.032	3.0	8.61	11.61	"	"	Fats, low.
1.034	3.8	9.28	13.08	"	"	
1.034	4.2	9.36	13.56	"	"	
1.035	4.8	9.75	14.55	"	"	
1.033	4.2	9.11	13.31	"	"	
1.035	3.6	9.49	13.09	"	"	Fats, low.
1.031	4.6	8.68	13.28	"	"	
1.031	5.2	8.81	14.01	"	"	
1.027	10.0	.....	.....	"	"	Cream, low in fat.
1.034	4.3	9.38	13.68	"	"	
1.032	4.4	8.90	13.30	"	"	
1.032	4.7	8.96	13.66	"	"	
1.032	4.9	9.00	13.90	"	"	
1.031	4.6	8.68	13.28	"	"	
1.032	5.8	9.19	14.99	"	"	
1.033	4.7	9.21	13.91	"	"	
1.033	4.5	9.17	13.67	"	"	
1.030	4.1	8.33	12.43	"	"	
1.032	4.3	8.88	13.18	"	"	
1.032	3.4	8.69	12.09	"	"	Fats, low.
1.033	4.2	9.11	13.31	"	"	
1.032	4.8	8.98	13.78	"	"	
1.036	4.3	9.89	14.19	"	"	
1.031	4.4	8.64	13.04	"	"	
1.031	4.5	8.66	13.16	"	"	
1.032	4.8	8.98	13.78	"	"	
1.033	5.1	9.29	14.39	"	"	
1.033	5.0	9.27	14.27	"	"	
1.032	5.3	9.08	14.38	"	"	
1.032	5.2	9.06	14.26	"	"	
1.031	4.7	8.70	13.40	"	"	
1.033	4.8	9.23	14.03	"	"	
1.032	4.3	8.88	13.18	"	"	
1.032	4.9	9.00	13.90	"	"	Fats, low.
1.033	3.1	8.88	11.98	"	"	" "
1.032	3.6	8.73	12.33	"	"	
1.030	4.5	8.41	12.91	"	"	
1.032	4.6	8.94	13.54	"	"	
1.032	4.4	8.90	13.30	"	"	
1.033	3.7	9.00	12.70	"	"	Fats, low.
1.031	4.6	8.68	13.28	"	"	
1.030	5.0	8.51	13.51	"	"	
1.030	3.5	8.21	11.71	"	"	Fats, low.
1.030	6.4	.....	.....	"	"	His own sample.
1.032	3.4	8.94	12.34	"	"	Fats, low.
1.030	3.4	8.19	11.59	"	"	" "
1.031	3.9	8.54	12.44	"	"	
1.033	4.8	9.23	14.03	"	"	
1.030	5.2	8.55	13.75	"	"	
1.035	5.3	9.82	15.12	"	"	
1.032	3.4	8.69	12.09	"	"	Sent by R. VanDyke.
1.031	3.4	8.44	11.84	"	"	" " "
.....	.....	.....	.....	"	"	Sent by W. H. Warren.
1.028	4.4	7.89	12.29	"	"	Sent by F. W. Gann.
1.028	4.5	7.91	12.41			

MILK—Found Adulterated.

Station No.	Where Obtained.	Date of Collection.	Seller or Producer.
6654	Louisville	April 10, 1900	J. T. Davis & Son
6657	Louisville	April 10, 1900	M. Norris
6658	Louisville	April 10, 1900	Blue Grass Milk Depot
6659	Louisville	April 10, 1900	Hikes & Hess
6662	Louisville	April 11, 1900	H. E. Lewman
6664	Louisville	April 11, 1900	" "
6666	Louisville	April 11, 1900	" "
6669	Louisville	April 11, 1900	" "
6677	Louisville	April 13, 1900	Kentucky Dairyman's Exchange
6680	Louisville	April 13, 1900	" " "
6705	Louisville	April 19, 1900	Louis Meyer
6706	Louisville	April 19, 1900	" "
6707	Louisville	April 19, 1900	" "
6708	Louisville	April 19, 1900	" "
6720	Louisville	April 20, 1900	Mrs. L. C. Marsh
6726	Louisville	April 27, 1900	Katie Sauer
6727	Louisville	April 27, 1900	J. R. Wigginton
6728	Louisville	April 27, 1900	J. W. Pittinger
6729	Louisville	April 27, 1900	M. J. Steinmetz
6730	Louisville	April 27, 1900	Mrs. Burke
6736	Louisville	April 30, 1900	B. M. Leinert
6743	Louisville	May 21, 1900	F. Sanders
6745	Louisville	May 21, 1900	Geo. Berry
6749	Louisville	May 21, 1900	Jno. Gassman
6943	Lexington	August 2, 1900	W. F. Wheatley
6959	Lexington	August 6, 1900	J. B. Hunt
6966	Lexington	August 6, 1900	E. W. Jackson
6976	Lexington	August 8, 1900	W. B. Taylor
6986	Lexington	August 9, 1900	E. W. Jackson
6746	Louisville	May 21, 1900	J. Nielsen
	Lexington	April 17, 1900	W. B. Taylor

MILK—Found Adulterated.

Analytical Data						REMARKS.
Specific Gravity.	Fats Per Cent.	Solids not Fat Per Ct.	Total Solids, Per Cent.	Color.	Antiseptic.	
1.0298	3.6	8.36	11.96	None.....	Formalin	Fats low.
1.0320	3.2	8.78	11.98	"	"	" "
1.0325	4.6	9.19	13.79	"	"	
1.0315	2.4	8.50	10.90	"	None	Fats below standard.
1.0235	3.0	6.62	9.62	"	"	Watered.
1.0250	3.2	7.03	10.23	"	"	"
1.0245	3.0	6.87	9.87	"	"	"
1.0280	2.6	7.66	10.26	"	"	"
1.0225	2.7	6.23	8.93	"	"	"
1.0275	3.2	7.66	10.26	"	"	"
1.0305	3.9	8.55	12.45	"	Boric acid	
1.0330	4.4	8.52	12.92	"	"	
1.0315	4.1	8.84	12.94	"	"	
1.0325	3.7	9.01	12.71	"	"	
1.0250	2.2	6.83	9.03	"	None	Watered.
1.0250	3.0	6.39	9.39	Annatto..	"	" and colored.
1.0275	3.8	7.78	11.58	"	"	" " "
1.0235	2.3	7.09	9.39	"	"	" " "
1.0285	3.8	8.03	11.83	"	"	" " "
1.0295	3.7	8.25	11.25	"	"	" " "
1.0290	3.5	8.09	11.59	None.....	Formalin	
1.0300	4.3	8.50	12.80	"	"	
1.0300	4.3	8.50	12.80	"	"	
1.0325	2.3	8.73	11.03	"	None	Watered or skimmed.
1.0320	4.8	8.98	13.78	"	Formaldehyde	
1.0330	4.1	9.09	13.79	"	"	
1.0270	2.8	7.31	10.11	"	None	Watered.
1.0340	4.8	9.48	14.28	"	Formaldehyde	
1.0250	3.4	7.00	10.4	"	None	Watered.
1.0315	3.6	8.73	12.33	"	Boric acid	
				"	Formaldehyde	Sent by George Neal.

OLEOMARGARINE—Found Adulterated.

Station No.	Bought as	Price per lb.	Where Obtained.	Date of Collection.	From Whom Obtained.
6118	Butter	20c	Lexington	Dec. 13, 1899	Blue Grass Grocery Co.
6780	Dairy Butter	20c	Louisville	May 16, 1900	Louisville Tea & Coffee Co...
6791	Dairy Butter	20c	Louisville	May 24, 1900	Hiram Forn
6794	Dairy Butter	20c	Louisville	May 24, 1900	J. & B. Kupper
6796	Dairy Butter	20c	Louisville	May 24, 1900	J. B. Smith
7807	Butter	20c	Louisville	March 16, 1901	E. H. Jenne
7808	Butter	20c	Louisville	March 16, 1901	J. W. Weatherton
7809	Butter	20c	Louisville	March 18, 1901	Louisville Tea & Coffee Co...
7810	Butter	20c	Louisville	March 18, 1901	J. B. Swift
7811	Oleomargarine	20c	Louisville	March 18, 1901	A. Button & Son
7812	Butter	20c	Louisville	March 19, 1901	M. Wolff & Sons
7813	Oleomargarine	20c	Louisville	March 19, 1901	Chas. A. Heusser
7814	Butter	20c	Louisville	March 19, 1901	E. B. Evans
7815	Butter	25c	Louisville	March 19, 1901	Geo. E. Adams
7816	Oleomargarine	20c	Louisville	March 20, 1901	Jno. Bohlson
7817	Oleomargarine	20c	Louisville	March 20, 1901	Fred. Brinke
7818	Oleomargarine	20c	Louisville	March 20, 1901	G. W. Brown
7819	Oleomargarine	20c	Louisville	March 22, 1901	J. C. Becker
7820	Oleomargarine	20c	Louisville	March 22, 1901	W. C. Brown
7821	Butter	20c	Louisville	March 22, 1901	W. C. Cope
7822	Oleomargarine	20c	Louisville	March 22, 1901	Chas. Deckel
7823	Oleomargarine	20c	Louisville	March 25, 1901	Edward Frank
7824	Oleomargarine	20c	Louisville	March 25, 1901	W. P. Grigsby
7826	Butter	20c	Louisville	March 26, 1901	Jno. Hardy
7827	Oleomargarine	20c	Louisville	March 27, 1901	S. S. Jones
7828	Oleomargarine	20c	Louisville	March 27, 1901	A. E. Jones
7829	Oleomargarine	15c	Louisville	March 28, 1901	Wm. Kunker
7830	Oleomargarine	20c	Louisville	March 28, 1901	Robt. Lucas
7831	Butter	25c	Louisville	March 29, 1901	Anton Meyer
7832	Oleomargarine	20c	Louisville	March 29, 1901	Thos. F. Morgan
7833	Butter	25c	Louisville	March 29, 1901	Paul A. Neff
7921	Oleomargarine	20c	Owensboro	May 7, 1901	C. F. Sturgeon
7922	Oleomargarine	25c	Owensboro	May 7, 1901	Lee Birk
7925	Oleomargarine	25c	Owensboro	May 7, 1901	Scherer & Haffendorfer
7932	Butterine	25c	Owensboro	May 8, 1901	Dugan & Rogers
7955	Oleomargarine	15c	Covington	May 13, 1901	R. Hamilton Grocery Co.
7957	Oleomargarine	15c	Covington	May 13, 1901	Geo. C. Goode
7961	Oleomargarine	15c	Covington	May 13, 1901	Great China & Tea Co.
7969	Oleomargarine	20c	Covington	May 13, 1901	J. L. Hilker
7987	Oleomargarine	15c	Covington	May 14, 1901	J. M. McKinley
7988	Oleomargarine	10c	Covington	May 14, 1901	J. M. McKinley
7992	Oleomargarine	20c	Covington	May 14, 1901	B. H. Kroger
8001	Oleomargarine	16c	Covington	May 14, 1901	G. T. Ellison
8013	Oleomargarine	12c	Covington	May 14, 1901	Joe Lalond
8028	Oleomargarine	20c	Newport	May 15, 1901	Great China & Tea Co.
8032	Oleomargarine	11c	Newport	May 15, 1901	Otto Deppenbrock
8034	Oleomargarine	12c	Newport	May 15, 1901	B. H. Kroger
8037	Oleomargarine	13c	Newport	May 15, 1901	Frank Fecker
8045	Oleomargarine	15c	Newport	May 15, 1901	B. H. Kroger
8436	Butterine	15c	Louisville	Aug. 2, 1901	F. H. Wirries, Manager
8439	Oleomargarine	15c	Louisville	Aug. 2, 1901	Mammoth Grocery Co.
8534	Oleomargarine	20c	Frankfort	Aug. 23, 1901	Howard & Noonan
8553	Oleomargarine	20c	Frankfort	Aug. 24, 1901	Howard & Noonan
8554	Oleomargarine	20c	Frankfort	Aug. 24, 1901	A. H. Wagner
8636	Oleomargarine	20c	Frankfort	Sept. 6, 1901	Howard & Noonan
8637	Oleomargarine	20c	Frankfort	Sept. 6, 1901	A. H. Wagner
8709	Oleomargarine	25c	Louisville	Oct. 11, 1901	M. Wolff & Sons
8716	Oleomargarine	15c	Louisville	Oct. 11, 1901	Mammoth Grocery Co.
7825	Oleomargarine	15c	Louisville	March 26, 1901	Fred Gansman
7934	Creamery Butter	25c	Owensboro	May 9, 1901	D. Deyer
7991	Creamery Butter	20c	Covington	May 14, 1901	G. B. Murphy
8440	Butter	20c	Louisville	Aug. 2, 1901	I. Felsenthal
8941	Oleomargarine	20c	Lexington	Dec. 10, 1901	T. B. Satterwhite

OLEOMARGARINE—Found Adulterated.

Manufacturer.	Analytical Data.			Antiseptic.	Label or Stamp on Package.
	Reichert, M.	Valenta Test. Degrees C	Color.		
.....	.....	96.0	Annatto	.....	Oleomargarine.
.....	1.5	88.0	Azo Dye ...	.....	None.
.....	0.34	86.0	" "	.....	Oleomargarine.
.....	2.5	89.0	Questionable	.....	" "
.....	0.86	93.0	"	.....	None.
.....	1.2	90.0	Azo Dye ...	Boric acid, 20%	Oleomargarine.
.....	1.0	96.0	" "	.....	"
.....	1.7	98.0	" "	Boric acid, 14%	"
.....	1.0	95.0	" "	.....	"
.....	.....	91.0	" "	.....	"
.....	1.2	98.0	Questionable	.....	"
.....	.....	88.0	Azo Dye ...	.....	"
.....	0.9	90.0	" "	.....	"
.....	1.0	96.0	" "	.....	"
.....	.....	94.0	" "	.....	"
.....	.....	95.0	" "	.....	"
.....	.....	95.0	" "	.....	"
.....	.....	89.0	" "	.....	"
.....	.....	92.0	" "	.....	"
.....	0.9	89.0	" "	.....	"
.....	.....	92.0	" "	.....	"
.....	.....	92.0	" "	.....	"
.....	.....	94.0	" "	.....	"
.....	0.9	90.0	" "	.....	"
.....	.....	87.0	" "	.....	"
.....	.....	89.0	" "	.....	"
Grom Bros.	.....	88.0	" "	.....	"
.....	.....	90.0	" "	Boric acid, 0.11% ..	"
.....	1.7	89.0	" "	Boric acid, 0.15% ..	"
.....	.....	89.0	" "	.....	"
.....	1.8	90.0	" "	.....	"
Braun & Fitts	.....	88.0	" "	.....	"
" "	.....	96.0	" "	.....	"
" "	.....	94.0	Aniline	.....	"
Columbus Butter Co.	2.2	90.0	"	.....	"
Kruggar & Co.	.....	87.0	"	.....	"
Mulverhill & Ruban	.....	85.0	"	Boric acid	"
Ohio Butterine Co.	.....	90.0	"	" "	"
" "	.....	90.0	"	" "	"
" "	.....	92.0	"	" "	"
" "	.....	90.0	"	" "	"
Wm. J. Moxley	.....	87.0	"	" "	"
Ohio Butterine Co.	.....	79.0	"	" "	"
" "	.....	78.0	"	" "	"
" "	.....	83.0	"	.....	"
.....	.....	84.0	"	.....	"
Ohio Butterine Co.	.....	83.0	"	Boric acid	"
" "	.....	83.0	"	.....	"
.....	.....	81.0	"	Boric acid	"
Capital City Dairy Co.	1.9	87.0	Annatto	.....	"
Falls City Dairy Co.	1.6	83.0	Aniline	.....	"
Columbus Butter Co.	.....	88.0	Annatto	.....	"
" "	.....	90.0	"	.....	"
Ohio Butterine Co.	.....	89.0	Aniline	.....	"
Columbus Butter Co.	.....	91.0	Annato	.....	"
Ohio Butterine Co.	.....	89.0	Aniline	.....	"
.....	.....	90.0	"	.....	"
.....	.....	90.0	"	.....	"
.....	.....	93.0	"	.....	"
.....	1.5	93.0	"	.....	"
.....	2.0	87.0	"	Boric acid	"
.....	2.3	87.0	"	Boric acid, 0.6%	"
Capital City Dairy Co.	.....	93.0	Annatto	.....	"

MINCE MEATS—Found Adulterated.

Station No.	Where Obtained.	Date of Collection.	From Whom Obtained.
6128	Lexington	December 8, 1899	J. W. Parrish
6130	Lexington	December 13, 1899	Honaker Grocery Co.
6221	Maysville	December 15, 1899	Jno. O. Keefe
6467	Lexington	April 2, 1900	Honaker Grocery Co.
6481	Lexington	April 14, 1900	" " "
6492	Louisville	April 18, 1900	Mammoth Grocery Co.
6493	Louisville	April 18, 1900	Moses & Nichols
7612	Richmond	February 2, 1901	L. D. Landers
8092	Owensboro	May 13, 1901	O'Bryan & Lawson

MINCE MEATS—Not Found Adulterated.

Station No.	Where Obtained.	Date of Collection.	From Whom Obtained.
7997	Covington	May 14, 1901	B. H. Kroger

LARD AND OLIVE OILS, ETC.—Not Found Adulterated.

Station No.	Make or Brand on Label or Stated.	Where Obtained.	Price Paid.	Date of Collection.	From Whom Obtained.
7960	Table Oil	Covington	$0 08	May 13, 1901	Great China Tea Co
7994	Olive Oil	Covington	28	May 14, 1901	B. H. Kroger
7995	Salad Oil	Covington	08	.....	B. H. Kroger
8041	Olive Oil	Newport	.....	May 15, 1901	T. W. Wilson
8044	Lucca Oil	Newport	50	May 15, 1901	W. H. Homer
8046	Salad Oil	Newport	08	May 15, 1901	B. H. Kroger
8651	Olive Oil	Louisville	25	September 26, 1901	F. Schafer
8658	Olive Oil	Louisville	25	September 28, 1901	P. F. Cook
8709	Leaf Lard	.....	15	October 10, 1901	Wolff & Sons
8041	Olive Oil	Newport	.....	May 15, 1901	G. W. Wilson
8044	Olive Oil	Newport	50	May 15, 1901	W. H. Homer
7805	Olive Oil	.....	.....	March 21, 1901	.....
7806	Olive Oil	.....	.....	March 21, 1901	.....

LARD AND OLIVE OILS, ETC.—Found Adulterated.

Station No.	Make or Brand on Label or Stated.	Where Obtained.	Price Paid.	Date of Collection.	From Whom Obtained.
8707	Compound Lard	Louisville	10	October 10, 1901	Wolff & Sons

MINCE MEATS—Found Adulterated.

Manufacturer or Producer.	Sugar Per Cent.	Glucose, Per Cent.	Antiseptic.	REMARKS.
E. N. Dailey & Co.	4.6	21.	Borates	
Atmore & Son	.....	.....	Benzoic acid	
Mann Pk. Co.	.....	.....	Salicylic acid	
Atmore & Son	.....	.....	" trace	
" "	.....	.....	" "	
" "	.....	.....	" "	
" "	.....	.....	" "	
E. G. Dailey & Co.	.....	15.	Borates	
" " "	.....	14.	Boric acid	

MINCE MEATS—Not Found Adulterated.

Manufacturer or Producer.	Sugar, Per Cent.	Glucose, Per Cent.	Antiseptic.	REMARKS.
Merrill, Soule & Co.	5.74	.....	.....	

LARD AND OLIVE OILS, ETC.—Not Found Adulterated.

Manufacturer or Producer.	Analytical Data.					REMARKS.
	Sp. Grav. 15.5C.	Iodine No.	Halphin Test.	Baldwin Test.	Bechi Test.	
Bruce & West	.9220	109.7	Dark red	.....	.....	Cotton seed oil.
Benton Fils	.9168	82.5	Pink	No change	.....	
Lissard Fils	.9218	107.7	Dark red	" "	.....	Cotton seed oil.
.....	.9161	78.8	Same	" "	.....	
E. Rae & Co.	.9159	78.3	Same	" "	.....	
.....	.9221	107.1	Dark red	" "	.....	Cotton seed oil.
.....	.9160	77.7	No change.	" "	.....	
.....	.9164	79.4	No change.	" "	.....	
Swift & Co.	.....	60.0	Faint pink.	.....	.....	Bechi's, no reaction
Rugins & Co.	.9161	78.8	No change.	No change	.....	
S. Rae & Co.	.9159	78.3	No change.	" "	.....	
L. A. Price	.9166	80.2	No change.	" "	.....	Quality extra sup.
L. A. Price	.9163	81.1	No change.	" "	.....	Quality superfine.

LARD AND OLIVE OILS, ETC.—Found Adulterated.

Manufacturer or Producer.	Analytical Data.					REMARKS.
	Sp. Grav. 15 5c.	Iodine No.	Halptrin Test.	Baldwin Test.	Bechi Test.	
Swift & Co.	.....	72.5	Dark red	.....	.....	Cotton seed oil.

SODA FOUNTAIN DRINKS—Not Found Adulterated.

Station No.	Name of Syrup or Flavor.	Date of Collection.	Where Obtained.	From Whom Obtained.
8381	Rock Candy	July 26, 1901	Lexington	McGurk & Spears
8383	Coca Cola	July 26, 1901	Lexington	McGurk & Spears
8385	Banana	July 26, 1901	Lexington	McGurk & Spears
8391	Orange Cider	July 26, 1901	Lexington	J. P. Glenn
8393	Coca Cola	July 26, 1901	Lexington	J. P. Glenn
8394	Cherry Cobbler	July 26, 1901	Lexington	J. P. Glenn
8397	Peach Stock	July 26, 1901	Lexington	George Schange
8398	Claret Phosphate	July 26, 1901	Lexington	George Schange
8399	Peach	July 26, 1901	Lexington	Davis Drug Co.
8400	Grape Juice	July 26, 1901	Lexington	Childs Bros.
8401	Coca Cola	July 26, 1901	Lexington	Davis Drug Co.
8402	Orange Cider	July 26, 1901	Lexington	F. Fugazzi
8403	Cherry	July 26, 1901	Lexington	F. Fugazzi
8404	Coca Cola	July 26, 1901	Lexington	F. Fugazzi
8407	Strawberry	July 26, 1901	Lexington	C. A. Johns
8408	Cherry Phosphate	July 26, 1901	Lexington	C. A. Johns
8411	Blue Ribbon	July 26, 1901	Lexington	Childs Bros.
8412	Grape Juice	July 26, 1901	Lexington	Childs Bros.
8414	Pineapple	July 26, 1901	Lexington	R. H. Gray
8640	Pineapple	September 18, 1901	Lexington	J. P. Glenn
8641	Peach	September 18, 1901	Lexington	J. P. Glenn
8645	Claret Phosphate	September 18, 1901	Lexington	McGurk & Spears
8646	Banana	September 18, 1901	Lexington	McGurk & Spears
8660	Phospho	October 7, 1901	Lexington	R. H. Gray
8661	Strawberry	October 7, 1901	Lexington	R. H. Gray
8662	Pineapple	October 7, 1901	Lexington	R. H. Gray
8663	Raspberry	October 7, 1901	Lexington	Davis Drug Co.
8664	Strawberry	October 7, 1901	Lexington	Davis Drug Co.
8665	Pineapple	October 7, 1901	Lexington	Davis Drug Co.
8666	Claret Phosphate	October 7, 1901	Lexington	Davis Drug Co.
8668	Strawberry	October 8, 1901	Lexington	George Schange
8669	Wild Cherry Phosp.	October 8, 1901	Lexington	George Schange
8670	Banana	October 8, 1901	Lexington	George Schange
8671	Orange Phosphate	October 8, 1901	Lexington	George Schange
8672	Pineapple	October 8, 1901	Lexington	George Schange
8673	Pineapple	October 8, 1901	Lexington	F. Fugazzi
8674	Vanilla	October 8, 1901	Lexington	F. Fugazzi
8675	Claret Phosphate	October 8, 1901	Lexington	F. Fugazzi
8638	Strawberry	September 18, 1901	Lexington	J. P. Glenn
8643	Strawberry	September 18, 1901	Lexington	McGurk & Spears
8667	Orange Phosphate	October 7, 1901	Lexington	Davis Drug Co.
8635	Grape Juice	September 11, 1901	Lexington	George Schange

SODA FOUNTAIN DRINKS—Found Adulterated.

8043	Concord Grape J...	May 15, 1901	Newport	W. H. Homer
8201	Welch's Grape J..	July 16, 1901	Lexington	McAdams & Warford
8382	Cherry Cobler	July 26, 1901	Lexington	McGurk & Spears
8384	Orange Cider	July 26, 1901	Lexington	McGurk & Spears
8386	Strawberry	July 26, 1901	Lexington	McGurk & Spears
8387	Orange Syrups	July 26, 1901	Lexington	McGurk & Spears
8388	Wild Cherry Phosp.	July 26, 1901	Lexington	McGurk & Spears
8389	Pepsin Ade	July 26, 1901	Lexington	McGurk & Spears
8390	Claret Phosphate	July 26, 1901	Lexington	McGurk & Spears
8392	Strawberry Syrup	July 26, 1901	Lexington	J. P. Glenn
8395	Concentr'd Cherry J	July 26, 1901	Lexington	J. P. Glenn
8396	Vola	July 26, 1901	Lexington	George Schange
8406	Pineapple	July 26, 1901	Lexington	C. A. Johns
8410	Raspberry	July 26, 1901	Lexington	Childs Bros.
8413	Strawberry Syrup	July 26, 1901	Lexington	R. H. Gray
8425	Orange Phosphate	July 31, 1901	Louisville	R. M. Hughes & Co.
8639	Cherry Cobbler	September 18, 1901	Lexington	J. P. Glenn
8642	Claret Phosphate	September 18, 1901	Lexington	J. P. Glenn
8644	Cherry Cobbler	September 18, 1901	Lexington	McGurk & Spears
8659	Cherry Phosphate	October 7, 1901	Lexington	Childs Bros.
8405	Blood Orange	July 26, 1901	Lexington	C. A. Johns
8409	Cherry Phosphate	July 26, 1901	Lexington	Childs Bros.
8421	Cherry Phosphate	July 30, 1901	Louisville	Wolff & Sons
8006	Grape Juice	May 14, 1901	Covington	Jno. Evans
8377	Cherry Cobbler	July 17, 1901	Lexington	McGurk & Spears
8378	Cherry Cobbler	July 17, 1901	Lexington	J. P. Glenn

SODA FOUNTAIN DRINKS—Not Found Adulterated.

Manufacturer of Syrup or Flavor.	Antiseptic.	Color Artificial.	Remarks.
Burr, Paff & Co.	None found	None found	Found to be raspberry flavor.
Coca Cola Co.	None found	None found	
	None found	None found	
J. P. Glenn	None found	None found	
Coca Cola Co.	None found	None found	
Concentrated Co.	None found	None found	
Crown Cordial & Extract Co.	None found	None found	
Benton Meyers	None found	None found	
Crown Extract & Cordial Co.	None found	None found	
Childs Bros.	None found	None found	
Coca Cola Co.	None found	None found	
F. Fugazzi	None found	None found	
Benton Meyers	None found	None found	
Cocoa Cola Co.	None found	None found	
Gunthers	None found	None found	
Thompsons	None found	None found	
Benton Meyers	None found	None found	
Vinland Grape Juice Co.	None found	None found	
	None found	None found	
		None found	
		None found	
	None found	None found	
	None found	None found	
	None found	None found	
	Questionable	None found	
	None found	None found	
	None found	None found	
	Questionable	None found	
	None found	None found	
	None found	None found	
	Questionable	None found	
	None found	None found	
	None found	None found	
	None found	None found	
	None found	None found	
	None found	None found	
	None found	None found	
	None found	None found	
	None found	None found	
	Questionable	None found	
	Questionable	None found	
	None found	None found	
Welch Grape Juice Co.	None found	None found	Red label, "Without Antiseptics."

SODA FOUNTAIN DRINKS—Found Adulterated.

Freemont Grape Juice Co.	Salicylic acid	
Welch's Grape Juice Co.	Salicylic acid	
McGurk & Spears	Salicylic acid	Aniline color
McGurk & Spears	None	Aniline color
Crown Cordial Extract Co.	Salicylic acid	Aniline color
Crown Cordial Extract Co.	Salicylic acid	None found
Walker Shaw Phosphate Co.	Salicylic acid	None found
Pepsin Ade Co.	Salicylic acid	Aniline color
	Salicylic acid	None found
J. P. Glenn	Salicylic acid	Aniline color
Hance Bros. & White	Salicylic acid	None found
Chicago Concentrated Co.	Salicylic acid	Aniline color
Benton Meyers	Salicylic acid	None found
Benton Meyers	Salicylic acid	Aniline color
	Salicylic acid	Aniline color
R. M. Hughes & Co.	None found	Aniline color
	None found	Aniline color
		Aniline color
McGurk & Spears	Salicylic acid	Aniline
	None found	Aniline color
	None found	Cochineal
	Salicylic acid	None found
		Aniline
Thompson		
Freemont Grape Juice Co.	Salicylic acid	
McGurk & Spears	Salicylic acid	Aniline
Buck & Carridge	Salicylic acid	Aniline

SYRUPS, SUGARS AND HONEY—Not Found Adulterated.

Station No.	Make or Brand.	Where Obtained.	Date of Collection.	From Whom Obtained.
6148	Old Manner Canadian Maple Syrup	Lexington	December 6, 1899	Warren Bros.
6149	Pure Quebec Maple Syrup	Lexington	December 6, 1899	Warren Bros
6151	Pure Maple Syrup	Lexington	December 8, 1899	J. W. Parish
6154	White Clover Honey	Lexington	December 11, 1899	Joe Dinelli
6423	Pure Maple Sugar	Versailles	February 28, 1900	J. E. Neet
6424	Pure Maple Sugar	Versailles	February 28, 1900	J. E. Neet
6425	Granulated Sugar	Versailles	February 28, 1900	J. E. Neet
6428	Pure Maple Syrup	Versailles	February 28, 1900	J. M. Wasson
6448	Pure Maple Syrup	Garrard County	March 17, 1900	M. Simmons
6609	New Orleans Molasses	Lexington	June 12, 1900	H. P. Kinkead
7059	Sorghum Molasses	Lynnville	October 24, 1900	W. H. Scherffius
7964	Pure White Clover Honey	Covington	May 13, 1901	J. Hilker
7973	Pure Honey	Covington	May 14, 1901	E. J. Goebel
7980	Pure Honey	Covington	May 14, 1901	I. H. Seppenfield
8711	Granulated Sugar	Louisville	October 10, 1901	M. Wolff & Sons

TOMATO CATSUP, SAUCES, ETC.—Not Found Adulterated.

Station No.	Brand or Make.	Where Obtained.	Price Paid.	Date of Collection.	From Whom Obtained.
8648	Tomato Catsup	Louisville	10c	Sept. 26, 1901	Wm. Cumming
8796	Standard Catsup	Frankfort	...	Nov. 4, 1901	H. S. Wash & Co.
8795	Pepper Sauce	Frankfort	...	Nov. 4, 1901	H. S. Wash & Co.
8795 (b)	Pepper Sauce	Frankfort	...	Nov. 4, 1901	H. S. Wash & Co.

SYRUPS, SUGARS AND HONEY—Not Found Adulterated.

Manufacturer or Wholesaler.	Sugar, Per Cent.	Water, Per Cent.	Ash, Per Cent.	Acidity.	Polarization.		Temperature C.
					Direct.	Invert.	
Power Grocery Co.	62.4	....	....	....	+60.4	—22.	24°
J. F. Hertmeier & Sons	61.8	....	....	....	+60.6	—21.	24°
Pearson & Clarke	60.4	....	....	....	+59.3	—20.4	24°
Vogt & Foley	2.6	....	....	....	—12.0	—15.4	24°
Curry, Tunis & Norwood	87.2	....	....	....	+85.	—29.2	26°
Reinhardt & Newton	84.1	....	....	....	+85.	—25.2	26°
Martin & Woolfolk	99.94	....	....	....	+99.6	—21.4	26°
Curry, Tunis & Norwood	63.0	....	....	....	+61.6	—21.	26°
.....	56.3	....	....	....	+55.2	—18.6	26.6
New Orleans Coffee Co.	46.9	24.45	3.03	....			
.....	....	35.8	2.4	11.8cc			
F. W. Muth & Co.	1.9	....	....	....	—13.3	—15.5	31°
C. H. Weber	1.5	....	....	....	— 8.5	—10.5	31°
C. H. Weber	1.5	....	....	....	—10.0	—12.0	31°
.....	98.0	....	....	....	+99.6	—30.3	27°

TOMATO CATSUP, SAUCES, ETC.—Not Found Adulterated.

Manufacturer.	Antiseptic.	Color.	Label.
E. Ottenheimer & Son.	Benzoic acid	Aniline	"These goods are thus labeled adulterated to conform to the Pure Food Laws of Kentucky."
Hirsch Bros. & Co..	Benzoic acid	Aniline	"Harmless vegetable coloring and soda benzoate used; preservative used."
Hirsch Bros. & Co..	None	None	
Hirsch Bros. & Co..	None	None	

TOMATO CATSUP—Found Adulterated.

Station No.	Brand or Make.	Where Obtained.	Price Paid.	Date of Collection.	From Whom Obtained.
6162	West Virginia	Lexington	...	Dec. 8, 1899	H. Buchegnani
6170	Maple Leaf	Lexington	...	Dec. 13, 1899	W. W. Williams
6171	Anchor	Maysville	...	Dec. 15, 1899	Jno. O'Kelf
6172	Butters	Maysville	...	Dec. 15, 1899	R. B. Lovill
6173	Wild Rose	Maysville	...	Dec. 15, 1899	Jno. W. DeBald
7981	Standard High Grade.	Covington	5c	May 14, 1901	I. H. Seppingfield
7993	Ivory	Covington	5c	May 14, 1901	B. H. Kroger
8033	Pure Tomato	Newport	4c	May 15, 1901	Otto Deppenbrock.
8035	Roseberry	Newport	8c	May 15, 1901	B. H. Kroger
8042	Monogram	Newport	5c	May 15, 1901	T. W. Wilson
8082	Finest Quality	Owensboro	10c	May 11, 1901	Scherer & Hafenderfer
8085	Waldorf	Owensboro	15c	May 11, 1901	Dugan & Rogers
8987	Home Prepared	Owensboro	10c	May 13, 1901	McCann & Jones
8089	Admiral	Owensboro	10c	May 13, 1901	Mrs. Rollins
8091	High Grade	Owensboro	10c	May 13, 1901	O'Bryan & Lawson
8430	Tomato Catsup	Louisville	10c	Aug. 1, 1901	Gast & Croffts
8435	Rival	Louisville	5c	Aug. 1, 1901	Price & Lucas
8438	Sunny Side	Louisville	10c	Aug. 2, 1901	Mammoth Gro. Co.
8442	Ferndale	Louisville	15c	Aug. 3 ,1901	L. Zapp & Co.
8540	Cruikshank's Ketchup	Frankfort	15c	Aug. 23, 1901	M. Ellwanger
8541	Chili Sauce	Frankfort	20c	Aug. 23, 1901	Jno. Driscoll
8548	Chimes	Frankfort	5c	Aug. 23, 1901	Landers & Tichenor
8549	Waldorf	Frankfort	...	Aug. 23, 1901	Landers & Tichenor
8558	Tomato Catsup	Frankfort	10c	Aug. 23, 1901	George Salender
8647	Tomato Catsup	Louisville	10c	Sept. 26, 1901	Wm. Cummings
8538	Maple Leaf	Frankfort	...	Aug. 23, 1901	Langd'n Creasey Co
8545	Monarch	Frankfort	10c	Aug. 23, 1901	N. B. McKinney
8649	Heinz	Frankfort	10c	Aug. 23, 1901	N. B. McKinney
8654	High Grade	Frankfort	5c	Aug. 23, 1901	S. Goldsmith
8656	Chili Sauce	Frankfort	20c	Aug. 28, 1901	P. F. Koch
8657	Chimes	Frankfort	5c	Aug. 28, 1901	P. F. Koch
8698	Tomato Catsup	Louisville	10c	Oct. 10, 1901	Wolff & Son
8701	Price's Imp.	Louisville	10c	Oct. 10, 1901	Wolff & Son
8703	German	Louisville	10c	Oct. 10, 1901	Wolff & Son
8721	Van Camp's	Nicholasville	10c	Oct. 14, 1901	J. R. Miller
8722	Sunny Side	Nicholasville	10c	Oct. 14, 1901	J. R. Miller
8723	Heinz	Nicholasville	15c	Oct. 14, 1901	R. L. Goucher
8724	Chili Sauce	Nicholasville	10c	Oct. 14, 1901	R. L. Goucher
8727	Hoffman House	Nicholasville	10c	Oct. 14, 1901	Johnson & Co.
8731	Clover	Nicholasville	10c	Oct. 14, 1901	D. S. Waide
8734	Heinz	Nicholasville	15c	Oct. 14, 1901	Jas. M. Johnson
8735	Heinz Chutney	Nicholasville	25c	Oct. 14, 1901	Jas. M. Johnson
8737	Pure Gold	Nicholasville	10c	Oct. 14, 1901	Robt. Hare
7958	Butler's	Covington	5c	May 16, 1901	G. H. Voss
8717	Snyder's	Lexington	...	Oct. 14, 1901	Vogt & Foley
8718	Waldorf	Lexington	...	Oct. 14, 1901	Vogt & Foley
8719	Snyder's	Lexington	...	Oct. 14, 1901	Curry Tunis & Norwood
8015	Chili Sauce	Covington	15c	May 14, 1901	Geo. Reedy
8794	Worcester Sauce	.....	...	.....	.....

TOMATO CATSUP—Found Adulterated.

Manufacturer or Producer.	Antiseptic.	Color.	Label, If Any.	Remarks.
Buch & Batton	Benzoic acid		None	
Maple Leaf Packing Co.	" "		"	
	Salicylic acid		"	Trace antiseptic.
Tip Top Ketchup Co.	" "		"	
	Benzoic acid		"	Trace salicylic acid.
Exley, Watkins & Co.	" "	Aniline	"	
Ivory Canning Co.	" "	"	"	
W. M. Spencer & Son	Sulphites	"	"	
Ky. Pickling Co.	Benzoic acid	"	"	
	" "	"	"	
Wilhoyte, Barret & Co.	" "	"	"	
Williams Bros. & Charbonneau	" "	"	"	
E. G. Daily & Co.	Benz. & bor. acids.	"	"	
Knadler & Lucas	Salicylic acid	"	"	
M. Kahn & Co.	Benzoic acid	"	"	
Gast & Croffts	" "	"	"	
Price & Lucas	" "	"	"	
Tip Top Co.	None found	"	"	
Ontario Preserving Co.	Benzoic acid	"	"	
Cruikshank Co.	" "	"	"	
Lippincott & Cree	" "	"	"	
Standard Packing Co.	" "	"	"	
Williams Bros. & Charbonneau	" "	"	"	
Gast & Strosler	" "	"	"	
Lutz & Schramm	" "	"	"	
Maple Leaf Packing Co.	" "	"	"	
N. Sibal	" "	"	"	
H. J. Heinz	" "	"	"	
M. Kahn & Co.	" "	"	"	
Hyman Pickle Co.	" "	"	"	
Standard Packing Co.	" "	"	"	
	Salicylic acid		"	"In stock 8 yrs;" seller stated.
Price & Lucas	Benzoic acid		"	Sample very old.
Ed. L. Meyer	" "	Aniline	"	
Van Camp Packing Co.	" "	"	"	
Tip Top Co.	Saccharine.	"	"	
H. J. Heinz & Co.	Benzoic acid	"	"	
	" "	"	"	
J. Wells Co.	" "	"	"	
Flach Bros. Gro. Co.	" "	"	"	
H. J. Heinz & Co.	" "	"	"	
H. J. Heinz & Co.	" "	"	"	
New London Canning Co.	" "	"	"	
Tip Top Co.	None	"	"	
Snyder Co.	Benzoic acid	"	"	
Williams Bros. & Charbonneau	Benzoic acid 49%	"	"	
Snyder	" "	"	"	
Lippincott & Cree	" "	"	"	

VINEGARS—Found Adulterated.

Station No.	Represented to be.	Where Obtained.	Date of Collection.	From Whom Obtained.
6218	Extra pure vinegar...	Maysville	Dec. 15, 1899	C. C. Calhoun .....
6219	Apple vinegar	"	Dec. 15, 1899	Ed. Richeson .....
6319	P. & C. pure vinegar.	Lexington	Dec. 6, 1900	Jno. Hutchison .....
7211	Apple vinegar	Elizabethtown	Dec. 20, 1900	Davis & Williams .....
7836	Vinegar	"	March 7, 1901	Reed & Bro. .....
7986	Cider vinegar	Covington	May 14, 1901	D. Porter .....
8004	Apple vinegar	"	May 14, 1901	Jno. Dalheim .....
8012	Apple vinegar	"	May 14, 1901	M. L. Young .....
8021	Cider vinegar	Newport	May 14, 1901	H. Voss, Meyer & Bro. .....
8081	Cider vinegar	Owensboro	May 10, 1901	Frank Meis & Bro. .....
8084	Fruit vinegar	"	May 11, 1901	D. T. Haley .....
8083	Fruit vinegar	"	May 11, 1901	Winter Bros. & Birx .....
8088	Apple vinegar	"	May 13, 1901	W. L. Brown .....
8095	Cider vinegar	"	May 13, 1901	A. B. Thompson & Co. .....
8096	Cider vinegar	"	May 13, 1901	E. F. Sturgeon .....
8100	Cider vinegar	"	May 14, 1901	McCann & Jones .....
8105	Cider vinegar	"	May 14, 1901	L. A. Nunn .....
8420	Apple vinegar	Louisville	July 30, 1901	Wolff & Sons .....
8423	Fruit vinegar	"	July 31, 1900	R. M. Hughes & Co. .....
8424	Apple vinegar	"	July 31, 1900	R. M. Hughes & Co. .....
8426	Apple vinegar	"	July 31, 1900	C. W. Adams & Son .....
8427	Apple vinegar	"	July 31, 1900	C. W. Adams & Son .....
8428	Apple vinegar	"	Aug. 1, 1901	Lou. Cider & Vin. Works...
8431	Cider vinegar	"	Aug. 1, 1901	Gast & Crofts .....
8433	Apple vinegar	"	Aug. 1, 1901	Price & Lucas .....
8555	Cider vinegar	Frankfort	Aug. 24, 1901	George Salender .....
8655	Cider vinegar	Louisville	Sept. 28, 1901	P. F. Koch .....

VINEGARS—Not Found Adulterated.

6217	Cider vinegar	Maysville	Dec. 15, 1899	R. B. Lovel .....
6220	Cider vinegar	"	Dec. 15, 1899	G. W. Geisel .....
6320	Apple vinegar	Lexington	Dec. 6, 1900	J. C. Berryman .....
6321	Apple vinegar	"	Dec. 8, 1900	J. W. Parish .....
6322	Apple vinegar	"	Dec. 13, 1900	Honaker Gro. Co. .....
7962	Apple vinegar	Covington	May 13, 1901	J. J. Schular .....
7983	Apple vinegar	"	May 14, 1901	I. H. Seppenheld .....
8007	Tarragon vinegar ...	"	May 14, 1901	Jno. Evans .....
8029	Cider vinegar	Newport	May 15, 1901	Great China & Tea Co. .....
8036	Apple vinegar	"	May 15, 1901	B .H. Kroger .....
8086	Cider vinegar	Owensboro	May 11, 1901	W. F. Reinhardt .....
8090	Apple vinegar	"	May 13, 1901	O'Bryan & Lawson .....
8145	Cider vinegar	Lexington	June 24, 1901	John Hutchison .....
8429	Apple vinegar	Louisville	Aug. 1, 1901	Lou. Cider & Vin. Works ..
8432	Apple vinegar	"	Aug. 1, 1901	Price & Lucas .....
8434	Apple vinegar	"	Aug. 1, 1901	Price & Lucas .....
8536	Apple vinegar	Frankfort	Aug. 23, 1901	Howard & Noonan .....
8537	Apple vinegar	"	Aug. 23, 1901	Rupert Gro. Co. .....
8539	Apple vinegar	"	Aug. 23, 1901	M. Ellwanger .....
8542	Apple vinegar	"	Aug. 23, 1901	J. M. Saffel & Son .....
8546	Apple vinegar	"	Aug. 23, 1901	N. B. McKinney .....
8550	Apple vinegar	"	Aug. 23, 1901	J. W. Tichenor .....
8556	Vinegar	"	Aug. 24, 1901	George Salender .....
8551	Apple vinegar	"	Aug. 23, 1901	Franklin & Berryman .....
8790	Cider vinegar	Lexington	Nov. 1, 1901	Jno. Hutchison .....
8198	Cider vinegar	"	July 16, 1901	J. B. Rogers & Co.....
8047	Apple vinegar	Newport	May 13, 1901.....	G. H. Voss.....
7975	Apple vinegar	Covington	May 14, 1901	E. J. Goebel .....
7983	Apple vinegar	Covington	May 14, 1901	G. H. Voss .....
8018	Apple vinegar	.....	.....	.....

VINEGARS—Found Adulterated.

Manufacturer or Producer.	Analytical Data. Specific Gravity.	Ac. Acid, Per Cent.	Total Sol. Per Cent.	Ash Per Cent.	Color.	REMARKS.
I. F. Heibmeier & Son	1.010	3.42	0.98	0.03	Caramel.	Spirit vinegar.
B. T. Chandler & Co.	1.007	3.54	0.18	0.18	"	" "
Pearson & Clarke	1.007	4.14	0.28	....	"	" "
Sou. Molasses & Coffee Co. .	1.008	4.15	0.34	0.04	"	" "
Drexler, Heft & Co.	1.007	3.54	0.23	0.04	"	" "
H. Schmidt & Son	1.004	3.12	0.31	0.04	"	" "
.....	1.013	3.78	2.23	0.04	"	" "
Weller Austinburg	1.006	3.66	0.24	0.04	"	" "
J. Weller	1.006	4.14	1.28	0.01	"	" "
May & Schoenfeld	1.009	3.90	0.67	0.10	"	" "
H. L. Koltensky & Son	1.006	3.48	0.23	0.04	"	" "
Lou. Cider & Vin. Works ..	1.007	4.20	0.50	0.11	"	" "
Price & Lucas	1.007	3.66	0.36	0.06	"	" "
Price & Lucas	1.008	4.26	0.44	0.07	"	" "
May & Schoenfeld	1.008	3.66	0.85	0.13	"	" "
L. Fishback	1.006	3.66	0.30	0.05	"	" "
Price & Lucas	1.007	3.84	0.38	0.06	"	" "
Ed. L. Myer & Co.	1.006	3.30	0.17	0.20	"	" "
R. M. Hughes & Co.	1.007	4.26	0.34	0.06	"	" "
R. M. Hughes & Co.	1.006	3.97	0.27	0.03	"	" "
Gast & Croffts	1.004	2.04	0.27	0.04	"	" "
R. M. Hughes & Co.	1.004	3.66	0.34	0.04	"	" "
Lou. Cider & Vin. Works...	1.007	3.78	0.39	0.07	"	" "
Gast & Croffts	1.006	3.66	0.30	0.03	"	" "
Price & Lucas	1.005	3.30	0.23	0.02	"	" "
Red Cross	1.007	3.36	0.39	0.04	"	" "
R. M. Hughes	1.007	4.38	0.25	0|04	"	" "

VINEGARS—Not Found Adulterated.

Flach Bros. Gro. Co.	1.016	4.08	3.20	0.31	Natural....	.....
Flach Bros. Gro. Co.	1.018	4.02	3.09	0.29	"	.....
H. J. Heinz	1.018	4.62	2.81	0.33	"	.....
Morby, Raum & Grogreve ..	1.014	4.02	1.79	0.28	"	.....
H. J. Heinz & Co.	1.018	4.86	2.82	0.33	"	.....
Farm near Covington	1.009	3.48	2.42	0.40	"	Acetic acid, low.
Lutz & Schramm	1.017	3.73	3.08	0.31	"	Acetic acid, low.
Tarragon, bottled	1.020	5.82	2.49	0.45	"	.....
.....	1.018	4.80	2.69	0.35	Q'stionable.	.....
.....	1.016	4.14	2.80	0.26	"	.....
S. R. & J. C. Mott	1.015	3.18	2.90	0.37	"	Acetic acid, low.
Hyman Pickle Co.	1.010	4.20	1.30	0.14	"	.....
H. J. Heinz & Co.	1.017	4.74	2.51	0.31	"	.....
Lou. Cider & Vinegar Works	1.009	4.14	0.80	0.13	Natural ...	.....
Price & Lucas	1.013	9.00	0.12	0.02	"	.....
Price & Lucas	1.020	5.76	2.76	0.23	Q'stionable.	.....
Elko Co.	1.017	4.14	2.71	0.27	Natural. ...	.....
J. Weller Co.	1.016	4.14	2.63	0.19	"	.....
J. Weller Co.	1.017	4.74	2.38	0.26	"	.....
Hirsch Bros. & Co.	1.017	4.50	2.67	0.22	"	.....
Hirsch Bros. & Co.	1.016	4.20	2.38	0.32	"	.....
.....	1.017	4.74	2.58	0.36	"	.....
Own make	1.015	2.76	2.91	0.36	"	Acetic acid, low.
Heinz & Co.	1.017	4.80	2.66	0.25	"	.....
Elko Cider & Vinegar Co...	1.016	4.08	2.50	0.18	"	.....
.....	1.017	5.88	3.31	0.24	"	.....
.....	1.021	5.58	3.35	0.39	"	.....
Williams Bros.	1.017	4.26	2.80	0.22	"	.....
.....	1.018	5.16	2.54	0.30	"	.....

Vinegars marked "questionable" show some change in color with Fuller's Earth.

Chapter 13 of the Acts of 1900.

CIRCULAR OF INFORMATION AND FORM OF GUARANTY.

AN ACT to Amend an Act of the General Assembly of the Commonwealth of Kentucky, Entitled an Act Regulating the Sale of Food, which became a Law June 13, 1898.

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

First. That the statute mentioned in the title of this act and being an act regulating the sale and manufacture of food, which became a law on June 13, 1898, be, and the same is hereby repealed, and in lieu thereof, the following is enacted:

Section 1. It shall be unlawful for any person, persons, or corporation within this State to manufacture for sale, or expose for sale, or have in his or their possession for sale, or to sell any article of food which is adulterated or misbranded within the meaning of this act; and any person, persons or corporation, who shall manufacture for sale, expose for sale, or have in his or their possession for sale, or sell any article of food which is adulterated or misbranded in violation of this act, shall be fined not to exceed one hundred dollars, or be imprisoned for not more than fifty days, or both such fine and imprisonment.

Sec. 2. The term food, as used in this act, shall include every article used for, or entering into the composition of, food or drink of man or domestic animals, except spirituous, vinous or malt liquors.

The term misbranded, as used in this act, shall include every article of food, and every article which enters into the composition of food, the package or label of which shall bear any statement purporting to name any ingredient or substance as not being contained in such article which statement shall be untrue in any particular or any statement purporting to name the substance or substances of which such article is made, which statement shall not give fully the names of all substances contained in such articles in any measurable quantity.

Sec. 3. For the purpose of this Act, an article shall be deemed adulterated:

First. If any substance or substances be mixed or packed with

it so as to reduce or lower or injuriously affect its quality or strength;

Second. If any inferior substance or substances be substituted wholly or in part for the article;

Third. If any valuable constituent of the article has been wholly or in part abstracted;

Fourth. If it be an imitation, or sold under the name of another article; provided that nothing in this act shall be construed to prohibit the manufacture or sale of oleomargarine, butterine, or kindred compounds in a separate and distinct form, and in such manner as will advise the consumer of its real character, free from coloration or ingredient that causes it to look like butter;

Fifth. If it is colored, coated, polished or powdered, whereby damage is concealed, or if it is made to appear better or of greater value than it is;

Sixth. If it contains poisonous ingredients which may render such article injurious to the health of the party consuming it, or if it contains any antiseptic or preservative not evident or not known to the purchaser or consumer.

Seventh. If it consists in whole or in part of a diseased, filthy or decomposed or putrid substance, either animal or vegetable, unfit for food, whether manufactured or not, or if it is in any part the product of a diseased animal, or of any animal that has died otherwise than by slaughter.

Eighth. If it be labeled or branded so as to deceive or mislead the purchaser, or purport to be a foreign product when not so, or is an imitation either in package or label of another substance of a previously established name.

Provided, That any articles of food which are adulterated or misbranded within the meaning of this act, but which do not contain any added poisonous or deleterious ingredient, may be manufactured or sold if the same shall be plainly labeled "adulterated," or labeled, branded or tagged so as to show the exact character thereof.

Provided further, That nothing in this act shall be so construed as requiring or compelling proprietors or manufacturers or sellers of proprietary foods which contain no unwholesome substances to disclose their trade formulas, except so far as the provisions of this act require to secure freedom from adulteration or imitation, but in the case of baking powders every can or other package shall be

labeled so as to show clearly what acid salt has been used in making the same.

Provided further, That no dealer shall be convicted under the provisions of this act when he can establish a written guaranty of purity in a form approved by the Director of the Kentucky Agricultural Experiment Station, signed by the wholesaler, jobber, manufacturer, or other party from whom he purchased said articles, and provided he establishes that such guarantor or guarantors reside in the State of Kentucky. But said guaranty to afford protection shall contain the full name and address of the party or parties making the sale of such article to such dealer.

Sec. 4. The Director of the Kentucky Agricultural Experiment Station shall make or cause to be made examinations of samples of food manufactured or on sale in Kentucky at such time and place and to such extent as he may determine. He shall also make or cause to be made analyses of all food products which the State Board of Health may suspect of being injurious to health, and of any sample of food furnished by any Commonwealth's, county or city attorney of this Commonwealth. And the said Director may appoint such agent or agents as he may deem necessary, who shall have free access at all reasonable hours for the purpose of examining into places wherein it is suspected any adulterated article of food exists, and such agent or agents upon tendering the market price of such articles, may take from any person, firm or corporation, samples of any articles suspected of being adulterated or misbranded. The Director of said Station is hereby empowered to adopt and fix standards of purity, quality or strength, when such standards are not specified or fixed by statute.

Sec. 5. Whenever any sample shall have been examined and found to be adulterated or misbranded in violation of this act, the Director shall certify the facts to the Commonwealth's attorney of the District, or to the county attorney of the county, or city attorney of any city or town in which the said adulterated or misbranded food product was found; together with a statement of the results of the examination of the said article of food duly authenticated by the analyst under oath and taken before some officer of this Commonwealth authorized to administer an oath having a seal. And it shall be the duty of every prosecuting attorney, county attorney and city attorney to whom the Director of said Station shall report any violation of this act, to cause proceedings to be commenced

against the party so violating the act, and the same prosecuted in manner as required by law.

Sec. 6. Said Station shall make an annual report to the Governor upon adulterated food products, in addition to the reports required by law, which shall not exceed one hundred and fifty pages, and said report may be included in the report which said Station is already authorized by law to make, and such annual reports shall be submitted to the General Assembly at its regular session.

Sec. 7. The said experiment Station may issue at least once a year a bulletin giving the results of all analyses of samples taken under this act, together with the names of the parties from whom the samples were taken; as far as possible, the names of the manufacturers; the number of samples found to be adulterated; the number not found adulterated; and the number of adulterated samples that have been reported by the Station to the different Commonwealth's attorneys, county and city attorneys of the State. The edition of this bulletin shall not be less than ten thousand copies, to be distributed free to citizens of the State who may desire the same, and to other interested persons so long as the edition may last.

Sec. 8. Said Experiment Station shall receive five ($5.00) dollars for the analyses of each sample taken in accordance with this act, and all necessary expenses in carrying out the provisions of this act, including expenses for procuring samples, expert witnesses attending the grand juries and courts, clerk hire and attorneys' fees; provided the total expenses from all sources shall not exceed in any one year seven thousand five hundred dollars ($7,500). The Board of Control of said experiment Station shall furnish to the Auditor of Public Accounts an itemized statement of all the expenditures of money made under this act.

The amount of expenditures reported to the Auditor shall be paid by the Commonwealth to the Treasurer of said Experiment Station, upon the written request of the Board of Control of said Experiment Station, and the Auditor for the payment of the same, is directed to draw his warrant upon the Treasurer as is the manner of the payment of other claims against the Commonwealth.

Sec. 9. All fines recovered under this act shall be kept as a separate fund to pay necessary expenses in maintaining same.

Sec. 10. No civil action shall be maintained in any court in this

State on account of any sale or other contract made in violation of this act.

Sec. 11. All acts and parts of acts inconsistent herewith are hereby repealed.

Approved March 17, 1900.

Circular of Information Regarding the Kentucky Pure Food Law.

The Legislature of Kentucky, at its late session, amended the law entitled "An Act Regulating the Sale and Manufacture of Food." The amended act went into effect June 12, 1900.

The provisions are mainly those of the old law. The definitions of adulteration and misbranding remain the same, with the addition of a provision against labels that are calculated to deceive or that represent an article to be imported when it is really of domestic origin. It provides for the sale of adulterated articles or substitutes which contain nothing poisonous or deleterious, if they are labeled adulterated, or if the component parts are stated on the label. It provides that the acid salt of which baking powders are made must be made known on the label. The retailer is protected from prosecution when he has a written guaranty from the party from whom he purchased that the goods are pure, provided he establishes that the guarantor resides in this State. The penalty for violation of the law is a fine of not more than $100 or imprisonment not to exceed 50 days, or both. It is made the duty of Commonwealth's attorneys, county and city attorneys, to prosecute for violations of the law, upon information obtained by analyses made by the Experiment Station. Attention is called to the fact that the law applies to the adulteration of food of domestic animals as well as that of man.

A copy of the law is furnished herewith. This circular is intended to anticipate many inquiries in regard to the application of its provisions to particular articles of food.

ADULTERATIONS.—The law provides (Sec. 3) that articles of food which are adulterated but which do not contain any added poisonous or deleterious ingredient, may be manufactured or sold if plainly labeled "Adulterated" or labeled, branded or tagged so as to show the exact character thereof. The words "mixture," "com-

pound" or other similar expressions can not be substituted for the word "adulterated" when the components are not given.

ANTISEPTICS.—Saylicylic acid, benzoic acid, boracic acid, hydrofluoric acid, sulphurous acid and their compounds, the salicylates, benzoates, fluorides and sulphites; also formaldehyde or formalin, and various mixtures known in the trade as "freezine," "iceine," "preservalines" of various kinds, etc., are antiseptics, and it is unlawful to sell articles of food containing them unless plainly labeled "adulterated" or the presence of the antiseptic and its kind is clearly shown on the label or made known to all purchasers, where the article is not capable of being labeled.

BAKING POWDERS.—The law requires that every can or other package of baking powder shall be labeled so as to show clearly what acid salt has been used in making the same. Baking powders, in which exsiccated alum or sulphate of alumina is used, should be labeled "alum baking powder;" those in which phosphate and alum are used should be labeled "alum phosphate baking powder;" those in which phosphate alone is used should be labeled "phosphate baking powder," and those in which cream of tartar is used "cream of tartar baking powder." If the label already makes known in a conspicuous manner what acid salt has been used, the form is not essential. If the label does not give the name of the acid salt, a printed slip stating what acid salt has been used must be pasted on the label. But in any case the words "alum," "alum-phosphate," "phosphate" or "cream of tartar" must be printed in letters not smaller than brevier heavy **GOTHIC CAPS** and on white or light background so that the words can be easily seen.

BUTTER.—Butter should contain at least 80 per cent. of pure milk fats. Butter made by the use of "black pepsin" or other substance, in order to incorporate large quantities of water and casein, is adulterated.

Where other fats or oils are substituted, in part or whole, for milk fat in butter such article can not be sold as "Butter," or "Creamery Butter," or "Dairy Butter," or any combination of words embracing the word "Butter," but must be classed as "Oleomargarine" or "Butterine" and so plainly labeled.

Process butter or unmarketable butter that has been melted and made over is classed as adulterated butter.

CANDY.—The use of harmful coloring matters or other ingredients, and the admixture of terra alba, kaolin or other mineral substances to give weight and volume to the mass, are adulterations.

CHEESE.—Cheese not made wholly from milk or cream, salt, and harmless coloring matter, is considered adulterated, and must be sold as "Filled Cheese" or the name and amount of the adulterant must be made part of the label. Cheese made from milk from which part of the cream or fat has been taken, must be so labeled as to indicate the amount of cream or fat taken from the milk of which it was made. Cheese containing less than 10 per cent. of fat must be labeled "Skim milk cheese."

CIDER.—Cider is the unfermented juice of the apple. Any substitute for apple juice, or any antiseptic added constitutes an adulteration, and such adulterated cider should not be offered for sale, unless the name of the adulterant is made part of the label.

COFFEE.—Any article offered as coffee which contains any substitute for the coffee bean in any proportion is adulterated, and should not be offered for sale unless the quantity and kind of such substitute is given as part of the label.

CREAM.—Cream shall be produced wholly from pure milk and free from added coloring matter, preservatives or other additions of any kind. It must contain not less than 15 per cent. of milk fat.

FLOUR.—Flour is the fine and bolted meal of the wheat grain. When mixed with any material not derived from the wheat grain it is adulterated, and can not lawfully be sold unless plainly marked "adulterated" or the kind and amount of the admixture is made a part of the label.

Buckwheat flour or rye flour must be derived wholly from the grains designated in the name, and any admixture of other flours or materials constitutes an adulteration, and such mixtures can not be lawfully sold unless plainly marked "adulterated," or the kind and amount of the admixture is made part of the label.

FRUIT JELLIES, FRUIT BUTTERS, PRESERVES, CANNED FRUITS, FRUIT CONSERVES, CONFECTIONS, FRUIT JUICES AND SYRUPS, ETC., must consist of the fruit specified in the label, preserved only with cane sugar (sucrose), and must not contain artificial flavors, coloring matters or antiseptics. If such articles contain any substitute for the fruit, or any inferior material to make up bulk or weight, any glucose or other substitute for sugar, any artificial flavor or color, any starch or animal gelatine, any salicylic acid or other antiseptic, or any substance not naturally occurring in such fruits, except spices or other wholesome, natural flavoring materials, they are adulterated, and can not be lawfully sold unless plainly labeled

"adulterated," or the presence of all such substances is clearly indicated by the label.

Fruit preserves, jams, marmalades and butters should not contain less than 80 per cent. of total solids, 1 per cent. of acid calculated as malic, and 0.6 per cent of ash; jellies should not contain less than 65 per cent. total solids, 1 per cent. of acid calculated as malic and 0.3 per cent. of ash.

GUARANTY OF PURITY.—Attention is called to the provision of section 3, sub-section 8, "that no dealer shall be convicted under the provisions of this act when he can establish a written guaranty of purity in a form approved by the Director of the Kentucky Agricultural Experiment Station, signed by the wholesaler, jobber, manufacturer or other party from whom he purchased said article, and provided that he establishes that such guarantor or guarantors reside in the State of Kentucky. But such guaranty, to afford protection, shall contain the full name and address of the party or parties making the sale of such article to such dealer."

HONEY.—Honey is the nectar of flowers and other saccharine exudations of plants gathered by bees. Honey made by feeding bees glucose, sugar, invert sugar, or other saccharine substance, is not pure honey. Adding sugar, invert sugar or glucose to honey or substituting these materials for honey constitutes an adulteration and such adulterated honey can not lawfully be sold unless it is plainly marked "adulterated," or the quantity and name of the adulterant is made part of the label.

LABELING.—In labeling articles to comply with the law each separate package must be labeled. For example, it will not answer to attach to a case of catsup a label stating that it is preserved with benzoate of soda, but each bottle must bear such label.

LARD.—Lard is the fat of swine, the fat being melted and separated from the flesh. Adding beef fat or stearine, cotton seed oil, or other substitute for swine fat constitutes an adulteration, and such adulterated lard can not lawfully be sold unless it is plainly marked "adulterated," or the quantity and name of the adulterant is made part of the label. Lard must contain not less than 99 per cent. of fat.

MILK.—Milk must contain at least 12 per cent. of total solids and 3 per cent. of fat. Milk containing less than these proportions will be considered adulterated, unless labeled or offered as "skim milk," or milk below standard. The addition of antiseptics or preservatives or coloring matter is an adulteration.

MILK FAT is the fat contained in pure milk or derived therefrom and has a Reichert-Meissl number not less than 24 and a specific gravity not below .905 at 40°c.

MINCE MEAT containing glucose or any inferior material added for the purpose of increasing weight or bulk, or any antiseptic, is adulterated and should not be offered for sale unless plainly marked "adulterated" or its component parts given.

MOLASSES AND SYRUPS.—All molasses and syrups are assumed to be made from the juice of cane, or other sugar-producing plant, or the sap of the maple tree, and any syrup or molasses containing starch-sugar, glucose, or corn-syrup, is considered adulterated, and should not be offered for sale unless the label indicates the presence of the same.

OLEOMARGARINE.—Oleomargarine, butterine, or kindred compounds, or mixtures of these with butter, can not lawfully be sold if colored in imitation of butter. The law does not prohibit the sale of oleomargarine, as such, if not colored to look like butter.

OLIVE OIL is the expressed oil of the olive. The substitution of other oils or fats for olive oil, either in part or whole, constitutes an adulteration, and such adulterated oil can not lawfully be offered for sale unless plainly labeled "adulterated," or amount and kind of the adulterant is clearly shown on the label.

SPICES, MUSTARD, PEPPER, etc., must not contain any foreign substances or coloring matter introduced to dilute or cheapen the article, and any such admixture constitutes an adulteration and can not lawfully be sold unless plainly labeled "adulterated," or the kind and amount of admixture are indicated on the label.

TEA.—Tea consists of the dried leaves of the true tea plant, without addition of artificial coloring matter, or filler, or extraction of any essential properties, and any article offered as tea which does not conform to this definition is adulterated and can not lawfully be offered for sale unless plainly labeled "adulterated," or its true composition is given as part of the label.

VINEGAR.—Standard vinegar is a vinegar made from the juice of the apple, and contains not less than 1½ per cent. of apple solids and 4 per cent. of acetic acid. All vinegars labeled "apple," "cider," or "orchard" vinegars are assumed under the law to be standard vinegars. Vinegars not made of the juice of the apple must be labeled truly of what they are made, as "malt vinegar," "distilled vinegar," or "wine vinegar." Otherwise they are to be con-

sidered adulterated. If artificial coloring matter is used, this must be stated on each and every label. Vinegars to which other acids than acetic acid have been added are adulterated.

Vinegars containing less than 4 per cent. of acetic acid may be sold, provided the percentage of acetic acid is made part of the label.

M. A. SCOVELL,
Director Kentucky Agricultural Experiment Station,
July 19, 1900. Lexington, Ky.

Form of Pure Food Guaranty.

APPROVED BY M. A. SCOVELL, DIRECTOR.

I, (*or*, we), the undersigned, resident.. of the Commonwealth of Kentucky, whose name.. and Postoffice address.. are hereto subscribed, being the (a).....of the article.. hereinafter described, and being the person from whom (b).....of .....Kentucky, purchased said article.., hereby undertake.. and obligate.. (c).....unto (b)..... the aforesaid purchaser, that said article.. is (*or*, are) pure within the meaning of that term as used, applied and defined in the Statute law of Kentucky, known as the Pure Food Law.

The said article.. above referred to is (*or*, are) described as follows: (d).....

(Name) (e).....
(P. O. Address) (e).....
(Name) .....
(Name) .....
(P. O. Address) .....
(P. O. Address) .....

a.—Insert "Wholesaler," "Jobber," "Manufacturer" or other word or words aptly describing the party from whom the article or articles in question were purchased.

b.—Insert name and address of the dealer for whom the guaranty is given.

c.—The singular or plural forms should be used throughout according as the guarantors are one or more in number.

d.—Describe the articles clearly and explicitly.

e.—Write out name and Postoffice address *in full.*

Lexington, Ky., September 1, 1901.

KENTUCKY

Agricultural Experiment Station

OF THE

STATE COLLEGE OF KENTUCKY

BULLETIN No. 101.

A Comparison of Feeds for Pigs.

LEXINGTON, KENTUCKY,

May 20, 1902.

KENTUCKY
Agricultural Experiment Station.

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ADDRESS:

KENTUCKY AGRICULTURAL EXPERIMENT STATION,

LEXINGTON, KY.

Bulletin No. 101.

A Comparison of Feeds for Pigs.

D. W. May.

Of the various feeds for pigs available to the farmers of this country, corn ranks first. It is a crop grown to some extent in all sections, is much relished by pigs, is easily handled and lays on fat rapidly. With these qualifications it is no wonder that it has largely superseded all other feeds and is used to a great extent as the single article of diet in the fattening ration. Not only has it become in most instances the sole feed given to pigs, but it has materially influenced the character of the animal in the corn growing regions.

There is no doubt but that corn fed alone is in a great many instances unprofitable. Investigations have shown not only that pigs make a better gain per pound of feed but that the animals are more thrifty and less liable to disease when fed a combined ration.

In the work herein reported certain feeds were employed which are available to the farmers of this State and which may be used to supplement the corn ration for pigs. Twenty grade Berkshire pigs raised on the Station Farm were divided into five lots of four each. The animals were from the litters of three sows of very similar breeding and were by the same sire. They were a very uniform lot of pigs and were divided into lots of nearly equal weights. They had been wintered on corn and at the beginning of the experiment were in good flesh. The feeding was carried on in small piggeries with a covered room for sleeping and eating and a small run 8x15 feet. The animals were supplied at all times with water, ashes, coal and salt. A little copperas was occasionally added to the drinking water. The feeding was done twice daily, the animals being given all they would clean up well.

The feeds employed were corn, corn and soy bean silage, soy beans and dried distillery grains. In finishing the hogs there were used hominy meal, skim milk, tankage and cotton seed meal. The first period covered ten weeks and the finishing period three weeks.

The experiment was begun February 14. The feeds used for each lot were as follows :

Lot I. shelled corn.
Lot II. shelled corn and corn and soy bean silage.
Lot III. shelled corn $\frac{2}{3}$, shelled soy beans $\frac{1}{3}$.
Lot IV. shelled corn $\frac{1}{2}$, dried distillery grains $\frac{1}{2}$.
Lot V. shelled corn $\frac{2}{3}$, dried distillery grains $\frac{1}{3}$.

During the first period of ten weeks lot I. was fed shelled corn alone for comparison. This corn grown in the county showed the following by analysis: dry matter 86.50; protein, 10.31; fat, 4.14; carbohydrates, 68.97 per cent. Lot II. was fed as much shelled corn as would be well cleaned up and in addition 10 pounds of corn and soy bean silage. The latter was increased after three weeks to 15 lbs. daily. In several experiments made at the stations it has been found that silage could not be profitably substituted for a part of the grain ration. In the experiment here reported it was not intended to employ silage as a substitute for part of the grain, but to determine its value as an additional or corrective feed. The animals picked out the grain in the silage first and then chewed the remaining portions. The larger part was not swallowed. This silage was made of corn and soy beans, the corn cut when the ears were glazed. The composition of the silage was as follows: dry matter, 33.5; protein, 2.5; fat 1.0; carbohydrates, 18.9 per cent.

The pigs in lot III. were fed shelled corn $\frac{2}{3}$ and shelled soy beans $\frac{1}{3}$. The analysis of the latter was as follows: dry matter, 90.06; protein, 32.44; fat, 19.01; carbohydrates, 28.76 per cent. Taking the average of digestibility the nutritive ratio of this ration was 1:7.1

Lot IV. was fed for six weeks shelled corn ½ and dried distillery grains ½. The latter had the following composition: dry matter, 93.83; protein, 30.81; fat, 11.03; carbohydrates, 37.37 per cent. During the first six weeks the animals made practically no gains. They would first pick out the corn and would eat the distillery grains only as a last resort. During the last four weeks the ration was changed to shelled corn ⅘, distillery grains ⅕. The gains during this period were very satisfactory. The distillery grains employed was composed of the residue of corn and rye from whisky distilleries. The nutritive ratio of the ration fed this lot was 1:5.8 during the first period and 1:8.1 during the second period.

Lot V. was fed throughout the period of ten weeks on shelled corn ⅔. dried distillery grains ⅓. The nutritive ratio of this ration was 1:7.1, the same figure as with lot III.

The pigs were weighed weekly each Friday morning before feeding. The gains per pig are shown in the following table:

GAINS PER WEEK, FIRST PERIOD.

	Feb 14	Feb 21	Feb 28	Mar 7	Mar 14	Mar 21	Mar 28	Apr 4	Apr 11	Apr 18	Apr 25
Lot I.	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
1	173	172	187	192	202	211	222	227	234	242	253
2	133	132	138	136	139	142	145	144	146	152	157
3	97	100	106	106	111	117	123	127	135	143	149
4	154	156	164	167	169	180	185	181	190	194	195
	557	560	595	601	621	650	675	679	705	731	754
Net Gain.		3	35	6	20	29	25	4	26	26	23
Lot II.											
5	136	138	145	146	153	160	165	172	174	178	183
6	147	151	155	164	172	182	184	195	200	209	215
7	142	144	147	151	157	168	175	173	184	191	192
8	113	118	126	133	142	152	159	166	173	181	190
	538	551	573	594	624	662	683	706	731	759	780
Net Gain.		13	22	21	30	38	21	23	26	28	21
Lot III.											
9	133	135	142	147	157	170	176	185	193	202	204
10	125	124	134	138	146	161	169	172	186	192	197
11	157	162	174	187	205	215	226	232	242	252	259
12	153	155	164	172	183	197	207	210	223	233	234
	568	576	614	644	691	743	778	799	844	879	894
Net Gain.		8	38	30	47	52	35	21	45	35	15
Lot IV.											
13	179	174	179	181	184	192	193	202	209	219	228
14	138	136	138	137	138	138	137	144	150	155	158
15	150	151	153	154	156	161	159	169	175	182	188
16	96	91	94	94	98	97	97	104	111	119	125
	563	552	564	566	576	588	586	619	645	675	699
Net Gain.		-*11	12	2	10	12	-*2	33	26	30	24
Lot V.											
17	142	142	146	149	151	155	162	164	170	177	181
18	110	108	115	119	122	127	134	139	147	153	160
19	135	136	137	148	143	146	151	151	159	164	168
20	170	172	177	181	185	190	198	203	213	222	225
	557	558	575	597	601	618	645	657	689	716	734
Net Gain.		1	17	22	4	17	27	12	32	27	18

* Loss.

The following table shows the feed consumed by each lot per week; the gain per lot per week; the average gain per pig and the amount of food consumed per pound of gain.

FOOD CONSUMED AND GAIN PER WEEK.

	LOT I.			LOT II.			LOT III.			LOT IV.			LOT V.		
	Food Consumed		Gain	Food Consumed		Gain	Food Consumed		Gain	Food Consumed		Gain	Food Consumed		Gain
	Corn.			Corn.	Silage.		Corn.	Soy Beans		Corn	Distillery Grains		Corn	Distillery Grains	
1902 Feb. 21	lbs 89		lbs 3	lbs 88	lbs 70	lbs 13	lbs 56	lbs 27	lbs 8	lbs 35	lbs 35	lbs *11	lbs 49	lbs 25	lbs 1
Feb. 28.	110		35	102	70	22	71	35	38	27	27	12	59	30	17
Mar. 7.	116		6	125	105	21	87	43	30	31½	31½	2	64	32	22
Mar. 14.	126		20	128	105	30	97	49	47	33	33	10	67	34	4
Mar. 21.	120		29	132	105	38	106	53	52	37½	37½	12	59	29	17
Mar. 28.	121		25	134	105	21	99	49	35	35	35	*2	75	37	27
Apr. 4.	117		4	145	105	23	104	52	21	87	22	33	77	38	12
Apr. 11.	119		26	139	105	26	101	51	45	97	24	26	76	38	32
Apr. 18.	123		26	129	105	28	113	56	35	103	26	30	89	45	27
Apr. 25.	116		23	121	105	21	92	46	15	109	27	24	81	40	18
Total feed and gain.	1157		197	1243	980	243	926	461	326	595	298	136	696	348	177

* Loss.

AVERAGE DAILY GAIN AND POUNDS FOOD PER POUND GAIN.

	Lot I.		Lot II.		Lot III		Lot IV.		Lot V.	
	Gain per day.	Pounds food per pound gain.	Gain per day.	Pounds food per pound gain.	Gain per day.	Pounds food per pound gain.	Gain per day.	Pounds food per pound gain.	Gain per day.	Pounds food per pound gain.
First six weeks,	.70	5.78	.86	4.89*	1.25	3.68	.14	1730	.52	6.36
Total ten weeks	.70	5.87	.87	5.12*	1.16	4.25	1.00	4.38	.63	5.90

*Exclusive of silage.

The results of the experiments tend to show that corn should be supplemented with other feeds to get the best returns. This but bears out the testimony of many trials made at the various experiment stations of the country.

The increased gains made by lot II. over lot I. indicate that silage may under certain conditions be profitably fed to fattening hogs. Previous experiments show that it cannot replace a part of the grain feed, but the experiment under discussion shows its value as an additional feed to the full grain ration. In this connection the writer is under the impression that its value is more through acting as a corrective rather than as an increase of the fattening ration. Comparing the additional gain of lot II. over lot I. we find that 980 pounds of silage represented an increased gain of 46 pounds of pork with an additional consumption of 86 pounds of corn. Deducting the estimated gain from the increased amount of corn consumed a ton of silage represented a gain of 64 pounds of pork. Estimating from the figures of lot I. the amount of corn required to make 64 pounds of pork we find that a ton of silage represented in flesh producing value 375 pounds of corn in the experiment here reported. The relative value of the amounts of the two feeds will of course vary. There was not, however, much difference in the cost of the two in this experiment, but the quicker gains and the general thriftiness of the lot fed silage was of advantage.

The greatest daily gains and the greatest gains per pound of feed were made by lot III. with a ration composed of shelled corn $\frac{2}{3}$ and shelled soy beans $\frac{1}{3}$. The favorable increase in

this lot over lot I. fed corn alone shows the advantage of combining feeds in making the ration for pigs, especially the addition of substances containing more protein than corn. The thriftiness and the fineness of the hair of the pigs in this lot was especially noticeable. The latter at least was due in great measure no doubt to the large oil content of the grains fed. The use of the soy bean in our agriculture cannot be too highly commended. Not only does it prove to be a very efficient feed, but it belongs to the family of plants called legumes and is a splendid crop for improving the fertility of the soil.*

The distillery grains fed to lots IV. and V. was the dried residue from whisky distilleries. The animals did not relish this feed in any amount and would not eat it when there was any corn available. Fed for six weeks in equal amounts with corn the four animals gained only 23 pounds. With corn forming $\frac{2}{3}$ of the ration and the distillery grains $\frac{1}{3}$, the gains were lower than with the other lots. After changing lot IV. to corn $\frac{4}{5}$ and distillery grains $\frac{1}{5}$, the gains were better for the four weeks than with corn alone. This is probably the greatest per cent. in the ration with corn in which distillery grains can be profitably fed to hogs.

At the conclusion of the ten weeks period of feeding reported, the same lots of pigs were used to test the value of certain feeds in finishing for market. The feeds employed were corn, hominy meal (a residue from hominy mills consisting of the germ and husk of corn grains), skim milk, tankage (composed of dried blood, meat scraps and other packing house refuse) and cotton-seed meal. The trial was carried on three weeks. The five lots were fed similar rations except in the case of cotton-seed meal which was varied. This latter feed has been tested by several of the stations and it is well known that its continued use as a feed for pigs will result in the death of the animals. Where fed in small amounts or where alternated with other feeds some experiments have shown that death losses may be avoided. Georgeson, Burtis and Otis (Kansas Bul. 53) fed a ration of $\frac{5}{6}$ corn meal and $\frac{1}{6}$ cotton-seed meal to young pigs. They all died before six weeks had

*See Kentucky Bulletin No. 98.

passed. A ration composed of ¾ corn meal and ¼ cotton-seed meal was fed to two sows. They continued to gain for 45 days and showed no symptoms of disease. Henry (Wisconsin Report 1894) fed four sows ½ pound of cotton-seed meal daily for 35 days without any bad effects. Curtis and Carson (Texas Bul. 21) state that pigs died in from six to eight weeks when fed cotton-seed meal. Emery (North Carolina Bul. 109) fed 1¼ pounds of cotton-seed meal with 2½ pounds of bran in a pig ration for 21 days without bad effects. When the amount of cotton-seed meal was increased to 2 pounds the pigs sickened. The subject deserves further study as cotton seed is a cheap and valuable feed, and a large number of experiments will show to what extent it may be safely used as a part of the ration in feeding pigs. Further experiments are also desirable for determining the danger point of running pigs after steers fed cotton-seed meal. Cotton seed has proven a very efficient feed for cattle and is especially valuable in finishing them for market. The results obtained in the experiment herein reported indicate that it is no less valuable in finishing fattening hogs.

The first week of the finishing period the animals were fed shelled corn and skim milk, the pigs in lots I. and IV. receiving ¼ pound of cotton seed meal per head daily in addition. The second week they were fed hominy meal and tankage the pigs in lots II. and III. receiving ¼ and in lot V. ½ pound each of cotton-seed meal. The third week the ration was made up of shelled corn and tankage, the pigs in lot I. receiving ¼ and those in lot IV. ½ pound of cotton-seed meal per head.

The results are shown in the following tables:

GAINS PER WEEK, FINISHING PERIOD.

		Apr. 25.	May 2.	May 9.	May 16.
LOT I.	1	253	263	275	279
	2	157	171	182	197
	3	149	162	168	176
	4	195	211	223	232
		754	807	848	884
Net gain,			53	41	36
LOT II.	5	183	199	205	211
	6	215	219	230	237
	7	192	212	227	231
	8	190	199	212	221
		780	829	874	900
Net gain,			49	45	26
LOT III.	9	204	220	227	228
	10	197	210	217	225
	11	259	272	281	283
	12	234	245	252	262
		894	947	977	998
Net gain,			53	30	21
LOT IV.	13	228	245	249	259
	14	158	174	184	194
	15	188	209	220	233
	16	125	133	140	153
		699	761	793	839
Net gain,			62	32	46
LOT V.	17	181	197	198	207
	18	160	170	187	200
	19	168	184	199	209
	20	225	235	247	254
		734	786	831	870
Net gain,			52	45	39

Feed Consumed and Gain Per Week.

	LOT I.				LOT II.				LOT III.				LOT IV.				LOT V.			
	Feed.				Feed.				Feed.				Feed.				Feed.			
	Corn	Skim Milk.	Cotton Seed Meal.	Gain	Corn	Skim Milk.		Gain	Corn	Skim Milk.		Gain	Corn	Skim Milk.	Cotton Seed Meal.	Gain	Corn	Skim Milk.		Gain
	lbs.	gals.	lbs.	lbs.	lbs.	gals.		lbs.	lbs.	gals.		lbs.	lbs.	gals.	lbs.	lbs.	lbs.	gals.		lbs.
May 2.	108	35	7	53	120	35		49	150	35		53	134	35	7	62	142	35		52
	Feed.				Feed.				Feed.				Feed.				Feed.			
	Hominy Meal	Tankage.		Gain	Hominy Meal	Tankage.	Cotton Seed Meal.	Gain	Hominy Meal	Tankage	Cotton Seed Meal.	Gain	Hominy Meal	Tankage		Gain	Hominy Meal	Tankage	Cotton Seed Meal.	Gain
	lbs.	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs	lbs	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.
May 9.	121	28		41	122	28	7	45	127	28	7	30	116	28		32	124	28	14	45
	Feed.				Feed.				Feed.				Feed.				Feed.			
	Corn	Tankage	Cotton Seed Meal.	Gain	Corn	Tankage		Gain	Corn	Tankage		Gain	Corn	Tankage	Cotton Seed Meal.	Gain	Corn	Tankage		Gain
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		lbs.	lbs	lbs.		lbs.	lbs	lbs	lbs	lbs	lbs.	lbs.		lbs.
May 16.	144	28	7	36	140	28		26	151	28		21	139	28	14	46	155	28		39

	Total Grain and Tankage. lbs.	Total Gain, lbs.	Pounds of Food per Pound of Gain, lbs.	Daily Average Gain, lbs.
Without Cottonseed Meal in ration	1235	313	3.95	1.40
With Cottonseed Meal in ration	1101	317	3.47	1.62

It will be noticed that in the three weeks feeding the daily gains were greater and at less cost than in the ten preceeding weeks. This is due largely in the writers opinion to the use of skim milk and tankage. Wheeler has shown (N. Y. State Station Bul. 149) that with chickens and ducks much greater gains were made when a part of the ration was animal feed. Watson (N. Y. Cornell Bul. 89) found by feeding meat scraps with corn meal an increased gain of 70 per cent. and a saving in feed of 6 per cent. over corn meal alone. It would appear from these and other experiments that rations composed partly of milk and of tankage, meat scraps, kitchen slops, &c., have a more favorable influence in pork production than rations composed wholly of vegetable substances. The hog being an omnivorous animal we would naturally expect such results.

The results with the cotton-seed meal indicate a very favorable influence of this feed in finishing hogs for market. Such results are obtained by feeding cotton-seed meal to beeves and this practice is very extensively followed. The feeding of cotton-seed meal to calves and young pigs has usually resulted in the death of the animals. From the results of recent experiments it would appear that limited amounts of cotton seed meal may for short periods be profitably fed to grown pigs. The limit of safety is not yet clearly defined. The feeder is advised, from the present knowledge of the subject, not to go beyond the limits shown to be safe by experiments made at the experiment stations. Further studies will result in more closely determining the amount of cotton seed meal which may be safely fed to matured pigs.

Summary.

The results of these experiments like those of several previously made indicate that in feeding pigs corn should be combined with other feeds to get the best returns.

Experiments indicate that silage cannot be profitably substituted for a part of the grain ration with pigs. In this experiment it was fed in addition with some profit, giving quicker gains and keeping the animals in better condition.

Soy beans made an excellent pig feed mixed with corn in the proportion of 1:2. Being rich in protein it is recommended as an especially efficient addition to the ration when corn composes the larger part.

Dried distillery grains proved to be a poor pig feed except in small proportions. When fed as ⅓ or ½ of the ration with corn it was unprofitable. Where it composed ⅕ of the ration very good returns were obtained.

Cotton seed meal may be profitably used to finish hogs for market. In such cases it may be safely fed in quantities of ½ pound per pig daily and then omitted during periods of alternate weeks.

The writer is under obligations to Dr. A. M. Peter of this Station for the following report of the results of analyses of feeds used in the foregoing experiments:

No. 9785.—Shelled corn, sample taken from a lot in use at the Station Farm.

Analysis.	As Received Per Cent.	Calculated Water-Free. Per Cent.
Water	13.50	.....
Ash	1.38	1.6
Protein	10.31	11.9
Fiber	1.70	2.0
Nitrogen-free extract	68.97	79.7
Fat	4.14	4.8
	100.00	100.0

No. 9782.—Dried distiller's grains; sample taken from a lot obtained of W. A. Gaines & Co., Kentucky Distilleries & Warehouse Co., Frankfort, Ky.

Analysis.	As Received. Per Cent.	Calculated Water-Free. Per Cent.
Water	6.17	.....
Ash	1.69	1.8
Protein	30.81	32.8
Fiber	12.94	13.8
Nitrogen-free extract	37.37	39.9
Fat	11.03	11.7
	100.00	100.0

No. 9784.—Soy beans (shelled beans); sample from a lot in use at the Station Farm.

Analysis.	As Received. Per Cent.	Calculated Water-Free. Per Cent.
Water	9.94	.....
Ash	5.60	6.2
Protein	32.44	36.0
Fiber	4.25	4.7
Nitrogen-free extract	28.76	32.0
Fat	19.01	21.1
	100.00	100.0
Albuminoids, Stutzer method	31.00	34.4

No. 9538–Corn and soy bean ensilage from the Station silo; sample taken March 11th.

Analysis.	Fresh Material. Per Cent.	Calculated Water-Free. Per Cent.
Water	66.5	.....
Ash	2.1	6.3
Protein	2.5	7.6
Fiber	9.0	26.8
Nitrogen-free extract	18.9	56.2
Fat	1.0	3.1
	100.0	100.0
Potash	0.4	1.24
Phosphoric acid	0.3	1.00
Nitrogen	0.4	1.21
Albuminoids, Stutzer method	1.8	
Protein equival't of the NH_4 salts	0.2	
Amids, &c., by difference	0.5	

		In the Fresh Materfal. Per Cent.
Protein soluble in cold water	Albuminoid	0.25
	Amid, &c	1.05
Protein equivalent of the NH_4 salts		0.20
Protein insoluble in cold water		1.00
Total protein		2.50

Acidity, calculated as lactic acid 0.2 per cent,

No. 7648—Hominy meal from a lot bought of Henry Heile & Sons, Cincinnati, O.

Analysis.	As Received. Per Cent.	Calculated Water-Free. Per Cent.
Water	7.73	.....
Ash	2 46	2.67
Protein	10.72	11.62
Fiber	4.17	4.51
Nitrogen-free extract	67.50	73.16
Fat	7.42	8.04
	100.00	100.00

KENTUCKY

AGRICULTURAL EXPERIMENT STATION

OF THE

State College of Kentucky.

BULLETIN NO. 102.

COMMERCIAL FERTILIZERS.

LEXINGTON, KENTUCKY.
September, 1902.

KENTUCKY

Agricultural Experiment Station.

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Address of the Station—LEXINGTON, KY.

NOTICE.

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

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

ADDRESS:
KENTUCKY AGRICULTURAL EXPERIMENT STATION,
LEXINGTON, KY.

Bulletin No. 102.

Analyses of Commercial Fertilizers.

Number of Brands. There were 310 different brands of commercial fertilizers registered from January 1, to August 20, 1902. Of these different brands, 170 were complete fertilizers, or fertilizers containing all three of the essential ingredients, namely: phosphoric acid, nitrogen and potash; 38 were acid phosphates, or superphosphates; 8 contained a mixture of acid phosphate and nitrogen compounds only; 42 acid phosphate and potash salts only; and 52 were classed as bones or tankage.

Samples Collected and Analyzed. Two hundred and twenty-eight samples were collected by deputy inspectors, or were sent by farmers from various parts of the state; 346 samples were those sent in by firms as official samples; of these samples, 500 were analyzed by the Station.

Results of the Analyses. The results of the analyses show that of the 500 samples analyzed, 55, representing 49 brands and 23 firms, fell so far below the guaranteed analyses in phosphoric acid, nitrogen or potash, or any two, or all three of these ingredients, that the deficiencies could not be

accounted for by variations in sampling or analysis. It is probable that in most cases, variations can be accounted for by hurried or careless mixing at the factories, or gross mistakes in shipping one brand for another, but in one or two instances, the results show a desire on the part of the manufacturer to guarantee a higher percentage of the essential ingredients than the goods contain.

The great majority of the manufacturers, however, have furnished in most instances, fertilizers fully up to guarantee.

The following table gives the names of all manufacturers legally selling fertilizers in the State this year up to August 20, and the number of samples analyzed of each firm's fertilizers taken from various places in the State or furnished by the manufacturers.

The table also shows in how many of these samples there was a serious deficiency of either phosphoric acid, nitrogen or potash, and in how many the percentages of these constituents are such as to be considered acceptable, from the point of view of the buyer, either because they equal or exceed the percentage guaranteed by the manufacturer, or because a slight deficiency in one constituent is, in the Director's judgment, fully made up by an excess in one or both of the others. Under the heading "Relative Value Per Ton," is shown in how many instances the "estimated value per ton" calculated from our analysis, equals or exceeds the value calculated from the manufacturer's minimum guaranteed analysis, and in how many it is too low, reasonable allowance having been made for unavoidable variations. This table should be carefully studied. It concisely reviews each firm, showing how the samples of fertilizers taken from various places in the State compare with what was guaranteed. In order, however, to see the amount of variations from the guaranteed analyses, this table should be studied in connection with the table of results of analyses, which follows this introduction. This table can be easily referred to, as the names of the firms are arranged in alphabetical order.

NAME OF MANUFACTURER.	No. of Samples Analyzed.	Phosphoric Acid.		Nitrogen.		Potash.		Relative Value Per Ton.	
		No. Acceptable.	No. Too Low.	No. Acceptable.	No. Too Low.	No. Acceptable.	No. Too Low.	No. Acceptable.	No. Too Low.
The Abbott & Martin Rendering Co	4	4	0	2	0	3	0	4	0
Amer. Ag. Chem. Co., Cleveland Dryer Works	11	11	0	7	0	6	1	11	0
Amer. Ag. Chem. Co	2	2	0	2	0	0	0	2	0
The Armour Fertilizer Works	22	21	1	14	3	13	2	21	1
Peter Backer & Son	1	1	0	1	0	0	0	1	0
Geo. S. Bartlett	4	4	0	3	1	3	1	4	0
Bowker Fertilizer Co	6	6	0	3	0	3	0	6	0
C. S. Brent	4	4	0	4	0	1	2	4	0
The Buckeye Phosphate Co	10	9	1	6	0	5	1	10	0
The Cincinnati Phosphate Co	6	6	0	3	0	2	1	6	0
Continental Fertilizer Co	22	22	0	15	0	16	0	22	0
The Currie Fertilizer Co	18	13	5	15	0	13	0	15	3

NAME OF MANUFACTURER.	No. of Samples Analyzed.	Phosphoric Acid.		Nitrogen.		Potash.		Relative Value Per Ton.	
		No. Acceptable.	No. Too Low.	No. Acceptable.	No. Too Low.	No. Acceptable.	No. Too Low.	No. Acceptable.	No. Too Low.
Duncan & Bro	9	9	0	9	0	5	1	9	0
The Empire Guano Co	13	13	0	8	0	9	2	13	0
Fox Chemical Co	23	23	0	14	0	12	3	23	0
Furman Farm Improvement Co	4	4	0	3	0	4	0	4	0
Globe Fertilizer Co	30	30	0	24	1	19	4	30	0
The Hardy Packing Co	12	12	0	10	0	9	0	12	0
The Jarecki Chemical Co	16	15	1	10	0	10	1	15	1
J. B. Jones	6	2	4	6	0	4	0	5	1
The Jones Fertilizing Co	14	14	0	11	0	8	0	14	0
Kaufman Fertilizer Co	5	3	2	4	0	4	0	5	0
Louisville Fertilizer Co	25	25	0	18	0	17	0	25	0
P. B. Mathiason Mfg. Co	3	3	0	3	0	3	0	3	0

C. N. Meriwether	2	2	0	2	0	2	0	2	0
Michigan Carbon Works	16	15	1	13	0	11	0	16	0
Nelson Morris & Co.	9	8	1	8	0	5	0	9	0
National Fertilizer Co.	18	17	1	10	0	11	5	18	0
North-Western Fertilizing Co.	23	19	4	19	0	15	1	23	0
The Ohio Farmers Fertilizer Co.	13	13	0	11	0	10	0	13	0
Packers Fertilizer Association	14	14	0	9	0	11	0	14	0
Queen City Fertilizer Co.	4	4	0	4	0	3	1	4	0
Read Phosphate Co.	14	13	1	8	1	11	1	14	0
Ruhl & Pero	2	2	0	2	0	0	0	2	0
Standard Guano & Chemical Manufacturing Co.	1	1	0	1	0	0	0	1	0
Swift & Co.	26	26	0	21	1	17	0	25	1
Tennessee Chemical Co	24	24	0	17	0	16	2	24	0
Virginia-Carolina Chemical Co., S. W. Travers & Co., Branch	10	10	0	6	0	7	1	10	0
Virginia-Carolina Chemical Co., Memphis Division	4	4	0	3	0	4	0	4	0
Wake Fertilizer Co.	3	3	0	3	0	3	0	3	0
Wood, Stubbs & Co.	6	6	0	5	0	6	0	6	0

It is evident from the preceding table that while most of the fertilizers examined ran above the minimum guarantee, yet a thorough and careful inspection seems essential. It is hoped that farmers will generally take advantage of Section 8 of the fertilizer law, and when they purchase fertilizers, at least in quantity, that they will take a sample in accordance with Section 8 and send it to the Station for free analysis.

Essentials in Taking a Sample. 1. Take it at the time of purchase, and if possible in the presence of agent or seller. 2. Take a sample from not less than two bags, and from one additional bag for every ten purchased; mix these samples carefully and take at least a pint of this mixed sample, put it into a fruit jar, seal, box and express to M. A. Scovell, Director, Lexington, Ky. 3. Take the sample in the presence of at least one witness, and have the witness sign the required certificate. 4. The certificate for free analysis to be sent *by mail* and should be in accordance with the law as given in Section 8.

If the sample is taken in accordance with the above directions it may be sent by express and the charges will be paid by the Station.

Form of Certificate. A good form of certificate is the following, and blank certificates will be sent free to any farmer requesting the same.

CERTIFICATE FOR FREE ANALYSIS.

..... 190

M. A. SCOVELL, Director, Lexington, Ky.:

This is to certify that I am not a dealer in, or agent for the sale of any fertilizer, and that the fertilizer, a sample of which I have sent by express to you for free analysis was purchased by me ..... 190.. for my own use and not for sale.

I further certify that the sample was taken at the time of purchase from at least 10 per cent. of the sacks or other packages comprising the whole lot purchased, and that it was taken as provided in Section 8 of the fertilizer law, in the

following described manner, to wit : .....
.....
.....
.....
.....

Upon receipt of the analysis from you, I agree to furnish you with a tag taken from one of the sacks sampled, the name and address of the firm or agent of whom the fertilizer was purchased, and the amount purchased.

(Signature) .....
(P. O. Address) .....

Signature of Witnesses :

.....
.....

Should, however, any farmer desire to take a sample and not have a blank certificate at hand, he may write one in full like the form above given, or take the sample in presence of seller and witness and so mark it that he can identify it subsequently in a certificate, and send it at once to the Experiment Station with the request that the station furnish form of certificate, such certificate to be filled out upon receipt covering the sample and properly signed by sender and witnesses and sent by return mail to the Station.

Section Providing for Free Analysis. The section of the Fertilizer Law, providing for the taking of samples for free analysis is as follows:

SEC. 8. Any person not a dealer in, or agent for the sale of any fertilizer who may purchase any commercial fertilizer in this State for his own use and not for sale, may take a sample of the same for analysis, which analysis shall be made by the said Experiment Station free of charge. Such sample for free analysis shall be taken by the purchaser in presence of the person, company or agent selling the fertilizer from at least ten (10) per cent. of the sacks or other packages comprising the whole lot purchased, and shall be thoroughly mixed and at least one pound of the material after mixing must be put into a jar or can, securely sealed and marked in such a way as to surely identify the sample and show by whom it was sent, without giving the name of the fertilizer or the person from whom it was purchased, and must be forwarded to the Director of the Kentucky Agricultural Experiment Station, Lexington,

Ky. The purchaser shall also send with the sample a certificate signed by himself and witness, or by two witnesses, stating that the sender has purchased the fertilizer for his own use and not for sale, and that the sample was taken in the manner prescribed in this section. Provided, however, that if the person, company or agent shall refuse to witness the taking of the sample, then the sample may be taken at the time of the purchase in the manner already described in the presence of two witnesses who shall certify to the manner of taking the sample. The purchaser shall preserve the official label from one of the bags or other packages sampled to be sent to the Director after having received the report of analysis of the sample, and at the same time he shall furnish to the Director the name and address of the firm of whom the fertilizer was purchased and the amount purchased; and any person having sent a sample for free analysis, under the provisions of this section, who shall, after having received the report of analysis of the same, refuse to furnish the required information, shall thereafter forfeit the privilege of free analysis of fertilizers under this section. But if any sample shall have been submitted for free analysis without all the requirements of this section having been complied with, the Director shall inquire into the case and may accept the sample for free analysis if he believes that it is a fair sample of the fertilizer as it was delivered to the purchaser.

Values Used.—In calculating the relative value per ton, the following values have been used:

Soluble and reverted phosphoric acid in mixed fertilizers	6c per lb.
Soluble and reverted phosphoric acid in plain acid and unacidulated phosphates	5c per lb.
Insoluble phosphoric acid in mixed fertilizers	2c per lb.
Insoluble phosphoric acid in plain acid phosphates	Nothing.
Phosphoric acid in fine bone	4c per lb.
Phosphoric acid in medium bone	3c per lb.

Fine bone is all that passes through a sieve with meshes one-twenty-fifth inch square. Medium bone passes through a sieve with meshes one-sixth inch square, but does not include fine bone.

Nitrogen in all fertilizers	15c per lb.
Potash in all fertilizers, from sulphate	6c per lb.
Potash in all fertilizers, from muriate	5c per lb.

The term "Potash from muriate" does not indicate necessarily that the manufacturers used muriate of potash in fur-

nishing the potash; they may have used sulphate of potash, or other salts of potash, but in all fertilizers where the term "Potash from muriate" is used there is enough chlorine present to combine with the potash, either from salt in the tankage used, or the potash salts used, as muriate, kainit, carnallite, etc. As the objection to the use of muriate of potash arises from the chlorine present in this salt, it likewise follows that chlorine in a fertilizer is objectionable, whether put in with the potash or otherwise. The using of sulphate of potash where there is chlorine present in other ingredients of the fertilizer will not obviate the injurious effect of the chlorine, and therefore we take this method of showing chlorine present by designating the potash as "from muriate."

Explanation of the Table. In the table of analyses, following the name of each brand will be found the analysis of the sample furnished by the manufacturer at the time the fertilizer was entered for sale and which was accompanied by an affidavit giving the guaranteed analysis. This is the analysis that is marked "manufacturer" in the column headed "From Whom Obtained." If any other analyses of the same brand have been made, they will be found following this analysis. These samples have been collected by deputy inspectors or sent in by farmers. The manufacturer's guarantee is printed last in *italic* figures.

The figures in the table which are set in bold face type are those results which, in the judgment of the Director, were too low to be acceptable. Where the total phosphoric acid in samples of bone is marked with (*) it indicates that the bone contains soluble phosphoric acid. This soluble phosphoric acid is an indication of either the addition of acid phosphate to the bone, in which case it would not be a pure raw bone, or else that the bone containing this soluble phosphoric acid was not strictly a pure or high grade bone, but contained trashy materials, which carried with them the soluble phosphoric acid.

The names of the manufacturers are arranged in alphabetical order, and all the analyses of the same brand have been grouped together.

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	The Abbott & Martin Rendering Co , Columbus, O.	
9485	Standard Phosphate	Manufacturer
9486	Star Phosphate	Manufacturer
9487	Ideal Grain Grower	Manufacturer
9488	Harvest King	Manufacturer
	A. D. Adair & McCarty Bros., Atlanta, Ga.	See Furman Farm Improvement Co.
	Amer. Ag. Chem. Co., New York, N. Y , Clev. Dryer Wks.	
9502	Horsehead Phosphate	Manufacturer
9844		W. B. Morgan, Bedford
9503	Ohio Seed Maker	Manufacturer
9504	Ohio Seed Maker with Potash	Manufacturer
9845		Elvis Austin, Beaver Dam
9505	XXX Phosphate	Manufacturer
9846		Elvis Austin, Beaver Dam
9506	Tobacco, Potato & General Crop Fertilizer	Manufacturer
9847		R. W. Newman, Lewisburg
9507	Phospho Bone	Manufacturer
9848		R. W. Newman, Lewisburg
	American Agr'l Chem. Co., New York.	
9508	Ground Bone	Manufacturer
9849		J. H. & M. F. Winfree, Hopkinsville

TABLE OF ANALYSES.

Pounds in the Hundred													
Phosphoric Acid							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value Per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				9.76	8.66	18.42					$9.76	9485
		6.00	*3.00*	*9.00*		*10.00*					*9.00*	
				10.53	1.38	11.91			1.10	1.77	16.41	9486
		5.00	*3.00*	*8 00*		*9.00*			*2.00*		*12 00*	
				7.19	2.06	9.25	1.07	1.30	1.23		13.89	9487
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				10.44	1.16	11.60	1.39	1.69	1.82		18.98	9488
		5.00	*3.00*	*8.00*		*9.00*	*1.23*	*1.50*	*2.00*		*15.69*	
				11.45	0.26	11.71					11.45	9502
				12.26	1.13	13.39					12.26	9844
		8.00	*2.00*	*10.00*		*12 00*					*10 00*	
				10.72	1.46	12.18	1.90	2.31			19.14	9503
		7.00	*3.00*	*10 00*		*12.00*	*1.65*	*2.00*			*17.75*	
				8.84	1.79	10.63	1.81	2.20	2.30		19.06	9504
				9.20	1.94	11.14	1.65	2.00	2.01		18.78	9845
		5.00	*3.00*	*8.00*		*10 00*	*1.65*	*2.00*	*2.00*		*17.35*	
				16 17	0.23	16 40					16.17	9505
				13.92	0.33	14 25					13.92	9846
		12.00	*2.00*	*14.00*		*16 00*					*14.00*	
				8.76	1.13	9.89	1.11	1.35	4.41		18.70	9506
				9.08	1.37	10.45	0.99	1.20	3.51		17.93	9847
		5.00	*3.00*	*8 00*		*10.00*	*0.82*	*1.00*	*4.00*		*16.86*	
				12.04	1.11	13.15	1.01	1.23	**0 55**		18.47	9507
				10.71	2.20	12.91	1.34	1.63	1.22		18 97	9848
		7.00	*3.00*	*10.00*		*12.00*	*0.82*	*1.00*	*1.00*		*16.26*	
14.53	6.83					21.36	2.72	3.30			23.88	9508
17.08	5.69					22.77	2.31	2.80			24.00	9849
						20.00	*2.47*	*3.00*			*19.41*	

TABLE OF ANALYSES.

Station' Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	The Armour Fertilizer Works, Chicago, Ill.	
9362 9850	Bone Meal	Manufacturer Dunagan & Kirtley, Horse Cave
9363 9851	Raw Bone Meal	Manufacturer Ross & Duncan, Beard
9364 9852	Grain Grower	Manufacturer Henry E. Lewis, Hodgenville
9365 9853 9876	Bone, Blood & Potash	Manufacturer T. J. Turley & Co., Owensboro Jas. Pollard, Mt. Carmel
9366 9854	White Burley & Black Tobacco	Manufacturer Jno. T. Hopkins, Jr., Henderson
9367 9855	Wheat, Corn & Oats Special	Manufacturer Wesley & Singleton, Eubanks
9368 9856	Tobacco Grower	Manufacturer Dunagan & Kirtley, Horse Cave
9369 9857	Ammoniated Bone with Potash	Manufacturer T. J. Turley & Co., Owensboro
9370	Star Phosphate	Manufacturer
9371 9858	Phosphate & Potash	Manufacturer Turley & Co., Hartford
9372 9859	Cereal Phosphate	Manufacturer Christmas & Cary, Glasgow

Table of Analyses.

Pounds in the Hundred.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
21.01	3.42					24.43	2.55	3.10			$26.51	9362
21.80	3.25					25.05	2.65	3.22			27.34	9850
						24.00	*2.47*	*3.00*			*21.81*	
11.96	14.62					26.58	3.60	4.37			29.14	9363
20.54	4.82					25.36	3.71	4.50			30.45	9851
						22.00	*3.71*	*4.50*			*24.33*	
				8.38	0.41	8.79	1.94	2.36	2.36		18.40	9364
				8.99	1.01	10.00	1.39	1.69	1.97		17.33	9852
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				9.14	1.16	10.30	3.85	4.67	1.18	5.55	30.82	9365
				14.11	0.68	14.79	**3.10**	3.76		**2.97**	**30.06**	9853
				11.11	1.38	12.49	**3.51**	4.26	1.54	5.40	32.43	9876
		6.00	*2.00*	*8.00*		*10.00*	*4.12*	*5.00*		*7.00*	*31.16*	
				8.59	1.64	10.23	2.69	3.27	1.48	3.21	24.37	9366
				7.31	4.49	11.80	2.98	3.62	**3.42**		22.93	9854
		6.00	*2.00*	*8.00*		*10.00*	*2.88*	*3.50*		*4.00*	*23.84*	
				7.61	0.31	7.92	0.96	1.17	1.35		13.48	9367
				7.54	0.78	8.32	0.79	0.96	1.20		12.93	9855
		5.00	*2.00*	*7.00*		*9.00*	*0.82*	*1.00*	*1.00*		*12.66*	
				8.42	0.36	8.78	1.56	1.89	1.50	3.44	20.55	9368
				8.93	0.60	9.53	1.65	2.00	4.92		20.83	9856
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*		*5.00*	*21.35*	
				6.92	0.64	7.56	2.69	3.27	1.78	0.87	19.45	9369
				9.66	1.02	10.68	**1.99**	2.42	2.66		20.63	9857
		4.00	*2.00*	*6.00*		*8.00*	*2.47*	*3.00*		*2.00*	*17.81*	
				16.31	0.40	16.71					16.31	9370
		10.00	*4.00*	*14.00*		*16.00*					*14.00*	
				10.60	0.27	10.87			1.68	0.44	15.04	9371
				10.21	0.17	10.38			1.74		14.06	9858
		6.00	*4.00*	*10.00*					*2.00*		*14.00*	
				10.05	0.38	10.43					10.05	9372
				12.00	4.81	16.81					12.00	9859
		6.00	*4.00*	*10.00*		*12.00*					*10.00*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Peter Backer & Son, Troy, Ind.	
10058	Grower No. 9, Pure Raw Bone.	Manufacturer
	Geo. S. Bartlett, successor to Cin. Dis. Co., Cin., O.	
9743	Indian Brand Tob. & Potato Fert	Manufacturer
9744	Indian Brand Gilead Phosphate	Manufacturer
9863		Grant McDaniel, Vanceburg
9745	Indian Brand Ohio Valley Phos	Manufacturer
	Bowker Fertilizer Co., Boston, New York, Cincinnati.	
9433	Bowker's Fish Guano	Manufacturer
9434	Bowker's Harvest Bone	Manufacturer
9435	Bowker's Dis. Bone Phosphate	Manufacturer
9436	Bowker's Dissolved Bone Phosphate with Potash	Manufacturer
9437	Bowker's Soluble Bone	Manufacturer
9438	Bowker's Bone Meal	Manufacturer
	C. S. Brent, Lexington, Ky.	
9779	Brent's Tob. & Hemp Special	Manufacturer
10005		D. J. & A. G. Prewit, Thomson
9780	Brent's Raw Bone Meal	Manufacturer
9781	Brent's Grain Grower	Manufacturer

TABLE OF ANALYSES.

Pounds in the Hundred.											Relative Value per Ton.	Station Number.
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.			
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
10.38	13.77					24.15	4.21	5.11			$29.19	10058
						23 00	*3.00*	*3.64*			*22.80*	
				9.03	1.68	10.76	2.64	3.20		4.81	25.26	9743
				9.00		*12.00*	*2.47*	*3.00*		*5.00*	*25.41*	
				9.68	1.73	11.41	2.74	3.33		2 18	23.15	9744
				10.73	2.29	13.02	2.09	2.54	1.54		21.61	9863
				9.00		*12.00*	*2.47*	*3.00*	*2.00*		*21.41*	
				8.32	1.75	10.07	1.99	2.42		1.81	18 82	9745
				8.00		*11.00*	*1.65*	*2.00*	*2.00*		*17.75*	
				8.37	2.02	10 39	0.86	1.04	3.22		16.65	9433
				8.00		*9.00*	*0.75*	*0.91*	*3.00*		*15.25*	
				7.81	1.00	8.81	0.84	1.02	1.30		13.59	9434
				8.00		*10 00*	*0.75*	*0.91*	*1.00*		*13.65*	
				10 59	2.98	13.57					10.59	9435
				10.00		*11.00*					*10.00*	
				9.90	2.62	12.52			1.27		14.20	9436
				10.00		*11.00*			*1.00*		*13.40*	
				14.29	3.34	17.63					14.29	9437
				14 00		*15.00*					*14.00*	
16.85	4.21					21.06	1.87	2.27			21.62	9438
						20.00	*1.50*	*1.82*			*16 50*	
				6.81	1.79	8.60	3.86	4.69	2.60	5 29	29.42	9779
				6.60	2.09	8.69	4.2	5.16	2.46	4.53	29.41	10005
				5.00			*4.00*	*4.86*		*10.00*	*30.00*	
20.04	4.70					24.74	3.74	4.54			30.07	9780
						22.00	*3.71*	*4.50*			*24 33*	
				10 27	2.34	12.61	1.82	2.21	1.94		20.66	9781
				8 00		*10.00*	*1.65*	*2.00*	*2.00*		*17 35*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	The Buckeye Phosphate Co., Columbus, O.	
9442 9864	Buckeye Special Blood & Pot ash Mixture	Manufacturer .... A. C. Broad, Milton .....
9443 9865	Buckeye Wheat Maker.....	Manufacturer ..... A. C. Broad, Milton .....
9444 9866	Buckeye Bone Meal.....	Manufacturer ..... Henry Dutchkey, Stephensport
9445 9867	Buckeye Extra Superphosphate	Manufacturer .... A. C. Broad, Milton .....
9615 9868	Complete Fertilizer	Manufacturer .... A. C. Broad, Milton .....
	The Cincinnati Phosphate Co., Cincinnati, O.	
9458	Capital Wheat Grower	Manufacturer .....
9459	Capital Grain and Grass Grower	Manufacturer .....
9460	Capital Dissolved Bone and Pot-ash	Manufacturer .....
9461	Capital Superphosphate	Manufacturer .....
9462	Capital Ground Bone.....	Manufacturer ....
9463	Capital Tobacco Food.....	Manufacturer .....

TABLE OF ANALYSES.

POUNDS IN THE HUNDRED.												
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value Per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				8.28	1.37	9.65	1.12	1.36		4.44	$19.18	9442
				9.59	1.48	11.07	0.84	1.02	4.36		18.98	9864
				8.00			*0.82*	*1 00*		*4 00*	*16.86*	
				10.13	1.68	11.81				2.82	16 21	9443
				8.96	2.58	11.54			2.35		14.13	9865
				10.00						*2.00*	*14.40*	
18.52	5.53					24.05	3.88	4.71			29.78	9444
20.71	3.65					24.36	3.31	4.02			28.69	9866
						20 00	*1.65*	*2.00*			*16 95*	
				14.34	2.67	17.01					14 34	9445
				16.25	0.97	17.22					16 25	9867
				14.00							*14.00*	
				10.67	2.11	12.78	1.32	1.60	3.66		21.26	9615
				10.23	1.54	11.77	0.83	1.01	1.91		17.30	9868
				8.00			*0.41*	*0.50*		*2.50*	*13 83*	
				14.43	1.98	16.41					14 43	9458
				14.00		*15.00*					*14.00*	
				10.08	1.64	11.72	0.82	1.00		1.33	16.82	9459
				10.00		*11.00*	*0.82*	*1.00*	*1.00*		*15 86*	
				11.96	1.88	13.84				2.43	18.02	9460
				12.00		*13.00*			*3.00*		*17.80*	
				13.04	2.07	15.11					13.04	9461
				12.00		*13.00*					*12.00*	
20.40	7.54					27.94	2.30	2.79			27.74	9462
						20.00	*2.47*	*3.00*			*19 41*	
				8.11	1.38	9.49	0.86	1.04		3 56	17.13	9463
				8.00		*9.00*	*0.82*	*1.00*		*4.00*	*17.26*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Cleveland Dryer Works (see Continental Fertilizer Co, Nashville, Tenn.	**Amer. Ag. Chem. Co.)**
9204 9773	Bear Special Tobacco Grower...	Manufacturer ..... Geo. L. Dobyns, Mt. Gilead.....
9205 9877	Bear Special Corn Grower.....	Manufacturer ..... J. M. Gray, Tolesboro .....
9206 9878	Bear High Grade Tobacco & Potato Grower	Manufacturer .... J. M. Cary, Greenville.....
9207 9879	Bear Ammoniated Phosphate ...	Manufacturer ..... J. V. Fentress, Caneyville.....
9208 9880	Bear Special Dissolved Bone.....	Manufacturer ..... Depp & Holman, Glasgow .....
9209 9881	Bear Beef, Blood & Bone.....	Manufacturer ..... J. V. Fentress, Caneyville.....
9210 9882	Bear Tobacco Grower	Manufacturer ..... Winter & Everett, Maysville ...
9211	Bear Phosphate	Manufacturer .....
9212	Bear Potash Mixture	Manufacturer .....
9213 9883	Bear Corn & Wheat Special.....	Manufacturer ..... J. W. Kelly, Leitchfield.. .....
9214	Bear High Grade Dis. Bone.....	Manufacturer .....
9337	Bear Bone Meal.....	Manufacturer .....

Table of Analyses.

Pounds in the Hundred.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				9.37	0.70	10.07	1.07	1.30	0.64	1.01	$16.58	9204
				8.00	1.24	9.24	1.10	1.34		1.70	15.44	9773
		5.00	*3.00*	*8.00*		*9.00*	*0.82*	*1.00*		*1.50*	*14.26*	
				9.02	0.70	9.72	0.69	0.84		1.52	14.99	9205
				10.00	0.55	10.55	0.46	0.56		1.23	15.08	9877
		5.00	*3.00*	*8.00*		*9.00*	*0.41*	*0.50*		*1 50*	*13.03*	
				8.79	1.00	9.79	1.72	2.09	1.24	3.33	21.35	9206
				8.79	1.55	10.34	1.39	1.69		3.55	19 60	9878
		4.00	*3.00*	*7 00*		*8.00*	*1.65*	*2.00*		*4 00*	*18.55*	
				8.62	1.05	9.67	0.65	0.79			12.71	9207
				10.06	1.04	11.10	0.42	0.51			13.75	9879
		5.00	*3.00*	*8.00*		*9.00*	*0.41*	*0.50*			*11.23*	
				8.23	0.83	9.06				1.22	11.67	9208
				7.72	1.04	8.76	0 45	0.55		1.05	12.29	9880
		4.00	*3.00*	*7.00*		*8.00*				*1.00*	*10.00*	
				11.10	2.00	13.10	1.79	2.17		3.32	23.47	9209
				10.67	1.78	12.45	2.00	2.43		2.17	22.11	9881
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*		*2.00*	*19.75*	
				8.84	0.88	9.72	2.71	3.29	1.00	5.20	26.33	9210
				8.36	2.12	10.48	2.37	2.88		6.39	25.66	9882
		5.00	*3.00*	*8.00*		*9 00*	*2.47*	*3.00*		*6.00*	*24.61*	
				12.34	1.45	13.79					12.34	9211
		7.00	*5.00*	*12.00*		*13.00*					*12 00*	
				11.21	0.64	11.85				2.72	16.97	9212
		6.00	*4.00*	*10.00*		*11.00*				*2.00*	*14.80*	
				10.23	0.75	10.98				0.77	13.50	9213
				10.47	1.30	11.77	0.36	0.44		0.69	14.99	9883
		6.00	*4.00*	*10.00*		*11.00*				*0 50*	*13 00*	
				15.91	1.25	17.16					15.91	9214
		8.00	*6.00*	*14.00*		*15 00*					*14 00*	
22.16	1.17					23.33	0.59	0.72			20.20	9337
						20.00	*0.82*	*1.00*			*14.46*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Continental Fertilizer Co.	
9338	Bear Raw Bone	Manufacturer
9973	Bear Special Wheat Grower	Manufacturer
	The Currie Fertilizer Co., Louisville, Ky.	
9511	Currie's Acid Phosphate	Manufacturer
9895		W. H. Lillard, Danville
9512	Currie's Alkaline Bone	Manufacturer
9513	Currie's Corn & Wheat Special	Manufacturer
9896		C. W. Quiggins, Elizabethtown
9514	Currie's Soluble Bone	Manufacturer
9897		Wm. Leming, Hodgenville
9515	Currie's Corn Grower	Manufacturer
9516	Currie's Climax Tobacco & Potato Grower	Manufacturer
9517	Currie's Golden Leaf Tobacco & Potato Grower	Manufacturer
9898		Wm. Leming, Hodgenville
9518	Currie's Tob. & Potato Grower	Manufacturer
9519	Currie's Dissolved Bone	Manufacturer
9949	Currie's Raw Bone Meal	Manufacturer
9974		Kirkpatrick & Bros., Greenville
9950	Currie's Fine Ground Raw Bone Meal	Manufacturer

TABLE OF ANALYSES.

POUNDS IN THE HUNDRED.												
Phosphoric Acid.									Potash			
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble	Total.	Nitrogen.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Relative Value per Ton.	Station Number.
22.70	4.01					26.71	2.43	2.95			$27.86	9338
						20.00	*2.47*	*3.00*			*19.41*	
				8.03	0.87	8.90	0.96	1.17		1.42	14.57	9973
		4.00	*3.00*	*7.00*		*8 00*	*0.82*	*1.00*	*1.00*		*12.26*	
				14.62	3.21	17.83					14 62	9511
				11.82	3.53	15.35					11.82	9895
				13.50							*13.50*	
				9.97	3.88	13.85				2.15	16.09	9512
				10.00		*11 00*				*2.00*	*14.80*	
				8.62	3.83	12.45	1.00	1.21	1.69		16.56	9513
				9.94	3.80	13.74	0.93	1.13	1.02		17.26	9896
				10.00		*12.50*	*0.82*	*1.00*		*1.00*	*16 66*	
				7.73	6.19	13.92	0.80	0.97	1.88		16.04	9514
				9.89	3.31	13.20	1.05	1.27	1.45		17.79	9897
				10.00		*12.00*	*1.03*	*1.25*		*1.50*	*17.69*	
				8.35	6.08	14.43	0.84	1.02	1.89		16.86	9515
				10.00		*12.50*	*1.03*	*1.25*		*1.50*	*17.89*	
				8.27	6.05	14.32	0.80	0.97	1.84		16.58	9516
				9.50		*12.00*	*1.03*	*1.25*		*1.50*	*17.29*	
				9.11	4.23	13 34	1.94	2.36	3.89		22.33	9517
				9.40	5.59	14.99	1.55	1.88	3.98		22.15	9898
				8.00		*9.50*	*1.65*	*2.00*		*3.50*	*19 35*	
				8.68	2.49	11.17	1.60	1.94	4.36	4.86	26.41	9518
				7.00		*9.00*	*1.65*	*2.00*		*8.00*	*23 75*	
				8.51	5.22	13.73	2.03	2.46	2.36		20.75	9519
				8.00		*10.00*	*1.65*	*2.00*		*2.00*	*17.75*	
8.53	13.91					22.44	3.93	4.77			26.96	9949
10.87	11.31					22.18	3 90	4.73			27.19	9974
						19.00	*3.09*	*3.75*			*20.67*	
11.28	6.35					*17.63	1.89	2.29			18.50	9950
						15.00	*1.65*	*2.00*			*13 95*	

* Contains Soluble Phosphoric Acid.

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	The Currie Fertilizer Co.	
9951	Currie's Butchertown Raw Bone Meal	Manufacturer
9952	Currie's Wheat Grower	Manufacturer
	Duncan & Bro., Lagrange, Ky.	
9610	Tiger Corn and Wheat Special	Manufacturer
9899		Mfrs. Warehouse
9611	Tiger Corn and Wheat Grower	Manufacturer
9612	Tiger Tobacco & Potato Grower	Manufacturer
9900		Mfrs. Warehouse
9613	Tiger Bone Meal	Manufacturer
9901		Mfrs. Warehouse
10138	Tiger Guano	Manufacturer
10139	Tiger Raw Bone Meal	Manufacturer
	The Empire Guano Co., Nashville, Tenn.	
9320	Empire High Grade Tobacco Grower	Manufacturer
9904		Choat & Webb, Guthrie
9321	Empire Favorite	Manufacturer
9905		Durham, Blakeman & Cantrell, Greensburg
9322	Empire Wheat Grower	Manufacturer
9323	Empire Wheat & Corn Grower	Manufacturer

Table of Analyses.

Pounds in the Hundred.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value Per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
12.35	5.30					*17.65	1.71	2.08	1.40		$19.59	9951
						15.00	*1.65*	*2.00*	*0.75*		*14.70*	
				10.37	4.70	15.07	0.90	1.09	1.60		18.62	9952
				10.00		*12 50*	*1.03*	*1.25*	*1.50*		*17.59*	
				7 72	4.48	12.20	1.35	1.64		1 36	16.73	9610
				9.30	4.75	14.05	1.30	1.58	0.64	0.61	18.33	9899
		5.00	*2.00*	*7.00*		*12.00*	*0.82*	*1.00*	*1.50*		*14.36*	
				10.70	1.24	11.94	0.86	1.04		1.67	17.92	9611
		7.00	*3.00*	*10.00*		*11.00*	*0.82*	*1.00*	*2.00*		*16.86*	
				8.36	1.06	9.42	1.81	2.20	1.04	3.38	20 98	9612
				7.77	1.98	9.75	1.65	2.00	0.76	2 58	18.92	9900
		4.00	*3.00*	*7.00*		*8.00*	*1.65*	*2.00*		*4 00*	*18.55*	
19.03	4.76					23.79	2.96	3.59			26.96	9613
25.16	3.11					28.27	2.15	2.61			28.45	9901
						22.00	*2.47*	*3.00*			*20.61*	
				10.80	1.87	12.67	1.76	2.14		3.09	22.70	10138
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*	*2.00*		*19.35*	
14.69	9.00					23.69	3.44	4.18			27.47	10139
						22.00	*3.71*	*4.50*			*24.33*	
				8 50	1.18	9 68	1.79	2.17	1.16	7.22	25 86	9320
				8.79	1.00	9 79	1.87	2.27		6.63	24.52	9904
				8.00			*1.65*	*2.00*		*8.00*	*24.15*	
				11.34	2.89	14 23	1.01	1.23	3.37		21.17	9321
				13.45	1.06	14.51	0.62	0.75	2.03		20.45	9905
				10.00			*0.82*	*1.00*	*3.00*		*17.46*	
				7.98	4.81	12.79	1.71	2.08	2.48		19.11	9322
				8.00			*1.65*	*2.00*	*2.00*		*16.55*	
				11.12	2.98	14.10	0.96	1.17	1.29		18 70	9323
				10.00			*0.82*	*1.00*	*1.00*		*15.46*	

*Contains Soluble Phosphoric Acid.

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	The Empire Guano Co.	
9324 9906	Empire Tobacco Grower	Manufacturer ..... Durham, Blakeman & Cantrell, Greensburg .....
9325 9907	Empire Bone and Potash	Manufacturer ..... Durham, Blakeman & Cantrell, Greensburg..... .....
9326	Empire Potash Mixture	Manufacturer .....
9327 9903	Empire Acid Phosphate.....	Manufacturer .... Wesley & Singleton, Eubanks.
	Fox Chemica Co., Branch, Federal Chem. Co., Louisville, Ky.	
9419 9912	Fox Special Tobacco Grower ...	Manufacturer .... Adams & McChord, Winch'st'r
9420 9913	Fox Tobacco Grower.....	Manufacturer .... Gus Gibson & Son, Cloverport.
9421	Fox Wheat and Corn Grower ...	Manufacturer .....
9422	Fox Grain Grower	Manufacturer .....
9423 9914	Fox Bone and Blood	Manufacturer ..... Gus Gibson & Son, Cloverport.
9424 9915	Fox Alkaline Bone.....	Manufacturer ..... Adams & McChord, Winch'st'r
9425 9916	Fox Bone and Potash	Manufacturer ..... Dickey & Co., Glasgow.....
9426 9917	Fox A. A. Acid Phosphate..	Manufacturer .... J. M. Whitworth, Caneyville...

TABLE OF ANALYSES.

Pounds in the Hundred.												
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value Per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				8.77	3.65	12.42	1.85	2.25	1.04	3.23	$22.45	9324
				8.25	4.06	12.31	1.66	2.02	1.10	2.67	20.80	9906
				8.00			*1.65*	*2.00*		*4.00*	*19.35*	
				11.04	3.20	14.24			2.18		16.71	9325
				9.50	5.25	14.75			2.24		15.74	9907
				10.00					*2.00*		*14.00*	
				11.08	3.08	14.16			4.11		18.64	9326
				10.00					*4.00*		*16.00*	
				14.05	2.48	16.53					14.05	9327
				13.65	2.60	16.25					13.65	9908
				12.00							*12.00*	
				10.28	1.36	11.64	2.28	2.77		2.90	23.20	9419
				10.53	0.79	11.32	2.59	3.14	1.02	2.21	24.40	9912
				9.00			*2.47*	*3.00*		*3.00*	*21.81*	
				10.37	1.23	11.60	1.54	1.87		1.60	19.47	9420
				8.26	1.42	9.68	1.86	2.26		2.68	19.28	9913
				8.00			*1.65*	*2.00*		*2.00*	*16.95*	
				12.23	1.38	13.61	1.68	2.04		1.54	22.12	9421
				10.00			*1.65*	*2.00*		*2.00*	*19.35*	
				9.76	1.50	11.26	1.30	1.58		1.07	17.49	9422
				9.00			*0.82*	*1.00*		*1.00*	*14.46*	
				9.91	2.70	12.61	2.04	2.48			19.09	9423
				9.87	2.62	12.49	2.04	2.48			19.01	9914
				9.00			*1.65*	*2.00*			*15.75*	
				11.04	0.78	11.82				2.22	16.22	9424
				10.53	0.42	10.95				2.06	15.28	9915
				10.00						*2.00*	*14.40*	
				10.10	0.75	10.85				1.28	13.96	9425
				10.83	0.91	11.74				1.17	14.76	9916
				9.00						*1.00*	*12.00*	
				10.97	1.07	12.04					10.97	9426
				10.80	0.96	11.76					10.80	9917
				10.00							*10.00*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Fox Chemical Co.	
9427	Fox Formula	Manufacturer
9918		J. M. Whitworth, Caneyville
9428	Fox Grain Special	Manufacturer
9919		Elvis Austin, Beaver Dam
9598	Fox Phosphate of Potash	Manufacturer
9599	Fox Acid Phosphate	Manufacturer
9920		Elvis Austin, Beaver Dam
9762	Fox Ground Bone	Manufacturer
9774	Fox Raw Bone	Manufacturer
	Furman Farm Improvement Co., Atlanta Ga.	
9343	Furman High Grade Fertilizer	Manufacturer
9344	Buffalo Bone Fertilizer	Manufacturer
9345	Furman Soluble Bone	Manufacturer
9346	Farish Furman Formula	Manufacturer
	Globe Fertilizer Co., Branch, Federal Chemical Co., Louisville Ky.	
9408	Globe Special Tobacco Grower	Manufacturer
9922		W. B Brewer, Fairview
9409	Globe Potato Grower	Manufacturer
9410	Ky. Standard Tobacco Grower	Manufacturer
9923		Bassett & Stone, Leitchfield

TABLE OF ANALYSES.

POUNDS IN THE HUNDRED.												
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				12.40	0.74	13.14	1.18	1.43		3.28	$22.66	9427
				12 40	1.97	14.37	1.22	1.48		2.87	22.77	9918
				11.00			*0.82*	*1.00*		*3 00*	*19 26*	
				10.68	0.45	11.13	0.54	0.66		1.15	16.00	9428
				9.16	1.15	10.31	0.77	0.93		1.52	15.58	9919
				9.00			*0.41*	*0.50*		*1 50*	*13.83*	
				10.01	0.24	10.25				4.00	16.91	9598
				9.00						*4 00*	*15.60*	
				14.04	1.06	15.10					14.04	9599
				14.78	1.04	15.82					14.78	9920
				14 00							*14.00*	
19.76	5.57					25.33	2.97	3.61			28.06	9762
						22.90	*2.47*	*3.00*			*21.15*	
15.08	7.10					22.18	3.81	4.63			27.75	9774
						20.00	*3.29*	*4.00*			*21.87*	
				10.76	0.56	11.32	1.73	2.10	2.57		20.89	9343
		8.00	*2.00*	*10.00*			*1.65*	*2.00*	*2.00*		*18.95*	
				9.26	1.70	10.96	1.95	2.37	2.19		19.83	9344
		6.00	*2.00*	*8.00*			*1.65*	*2.00*	*2.00*		*16.55*	
				11.49	0.97	12.46	0.87	1.06	1.25		18.04	9345
		8.00	*2.00*	*10.00*			*0.82*	*1.00*	*1.00*		*15 46*	
				9.89	0.50	10.39			2.24		14.31	9346
		8.00	*2.00*	*10.00*					*2.00*		*14.00*	
				9.22	0.90	10.12	2.46	2.99	0.92	8.12	29.46	9408
				9.09	0.74	9 83	2.34	2.84	1.00	8.01	28.84	9922
				8.00			*2.47*	*3.00*		*10.00*	*29 01*	
				10.50	1.10	11.60	2.51	3.05	0.82	3.05	25.05	9409
				8.00			*3.29*	*4.00*		*4.00*	*24.27*	
				9 56	2.52	12.08	2.36	2.87		2.92	23.06	9410
				10.08	1.45	11.53	2.95	3.58	0.72	2.40	25.13	9923
				8.00			*2.47*	*3.00*		*3.00*	*20.61*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Globe Fertilizer Co.	
9411 9924	Big Four Tobacco Grower	Manufacturer ... . L. C. Goering, Hawesville .....
9412	Eagle Wheat & Corn Grower ..	Manufacturer .....
9413 9925	Progress Corn & Wheat Grower	Manufacturer ..... Dunagan & Kirtley, Horse Cave ....
9414 9926	Globe Bone Dust.....	Manufacturer ..... J. H. Woosley, Caneyville .....
9415 9927	Bone & Potash	Manufacturer ..... J. H. Woosley, Caneyville .....
9416	Big Four Phosphate..	Manufacturer ....
9417 9928	Braden Formula	Manufacturer ..... W. Lewis & Bro., Greensburg ..
9418	Globe Grain Grower	Manufacturer ....
9591 9929	Globe Sol. Vegetable Manure...	Manufacturer ..... W. B. Brewer, Fairview.....
9592	Phosphate of Potash	Manufacturer ....
9593 9930	Globe Bone Meal.....	Manufacturer ..... E. L. Faris, London .....
9594 9931	Golden Harvest Bone Meal	Manufacturer .... E. L. Faris, London .....
9595	Globe Wheat Grower.....	Manufacturer .....

TABLE OF ANALYSES.

Pounds in the Hundred.											Relative Value Per Ton.	Station Number.
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.			
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				10.14	1.45	11.59	1.63	1.98		1.62	$19.58	9411
				8.29	1.42	9.71	2.53	3.07		2.16	20.70	9924
				8.00			*1.65*	*2.00*		*2.00*	*16.95*	
				10.08	1.91	11.99	1.76	2.14		1.18	19.56	9412
				8.00			*1.65*	*2.00*		*2.00*	*16.95*	
				9.03	2.52	11.55	2.21	2.68		1.11	19.81	9413
				10.35	1.27	11.62	2.31	2.80		2.50	22.86	9925
				9.00			*1.65*	*2.00*		*1.00*	*16.95*	
				8.95	1.96	10.91	1.35	1.64		1.05	16.83	9414
				10.76	1.33	12.09	1.12	1.36		0.87	17.84	9926
				9.00			*0.82*	*1.00*		*1.00*	*14.46*	
				11.81	0.32	12.13	0.43	0.52		1.16	16.98	9415
				12.64	0.43	13.07	0.53	0.64		0.92	18.03	9927
				11.00			*0.41*	*0.50*		*1.00*	*15.63*	
				8.89	0.91	9.80				0.81	12.00	9416
				8.00						*1.00*	*10.80*	
				12.45	0.64	13.09	1.12	1.36		3.23	22.44	9417
				11.91	1.02	12.93	1.29	1.57		3.82	23.15	9928
				11.00			*0.82*	*1.00*		*3.00*	*19.26*	
				10.90	0.42	11.32	0.52	0.63		1.25	16.31	9418
				9.00			*0.41*	*0.50*		*1.50*	*13.83*	
				9.52	2.47	11.99	2.65	3.22		2.79	23.71	9591
				8.31	1.36	9.67	2.64	3.20	0.88	2.31	22.08	9929
				8.00			*2.47*	*3.00*		*3.00*	*20.61*	
				10.77	0.32	11.09				3.96	17.80	9592
				9.00						*4.00*	*15.60*	
14.95	7.03					21.98	3.70	4.49			27.28	9593
9.15	11.65					20.80	4.32	5.24			27.27	9930
						20.00	*3.29*	*4.00*			*21.87*	
				9.63	3.99	13.62	3.16	3.84			22.64	9594
				11.61	3.29	14.90	2.48	3.01			22.69	9931
				10.00			*2.47*	*3.00*			*19.41*	
				10.75	2.06	12.81	2.08	2.53		1.83	22.16	9595
				10.00			*1.65*	*2.00*		*2.00*	*19.35*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Globe Fertilizer Co.	
9596	Globe Acid Phosphate	Manufacturer
9597	Acorn Acid Phosphate	Manufacturer
9761	Acorn Bone Meal	Manufacturer
9819	Potash Special	Manufacturer
	The Hardy Packing Co., Chicago, Ill.	
9522	Hardy's Southern Phosphate	Manufacturer
9792		W. F. Scott, East View
9523	Hardy's Crop Producer	Manufacturer
9790		Green Wilyard, East View
9806		J. D. Harned, Sadler
9524	Hardy's Corn & Wheat Grower	Manufacturer
9789		Green Wilyard, East View
9525	Hardy's Tankage, Bone & Pot'sh	Manufacturer
9811		A. E. Nacke, East View
9526	Hardy's Tob. & Potato Special	Manufacturer
9791		W. F. Scott, East View
10014	Hardy's Packers Raw Bone	Manufacturer
	The Jarecki Chemical Co., Sandusky and Cincinnati, O.	
9448	Pure Ground Bone	Manufacturer
9937		J. M. Whitworth, Caneyville
9449	O. K. Fertilizer	Manufacturer

TABLE OF ANALYSES.

POUNDS IN THE HUNDRED.												
Phosphoric Acid.									Potash.			
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.	Nitrogen.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Relative Value per Ton.	Station Number.
				14.48	0.81	15.29					$14.48	9596
				14.00							*14.00*	
				10.50	1.27	11.77					10.50	9597
				10.00							*10.00*	
19.73	5.57					25.30	2.94	3.57			27.94	9761
						22.90	*2.47*	*3.00*			*21.15*	
				12.95	0.35	13.30				1.40	17.36	9819
				10.00						*2.00*	*14.40*	
				10.38	8.16	18.54					10.38	9522
				14.70	1.47	16.17					14.70	9792
				9.00		*10.00*					*9.00*	
				7.37	2.29	9.66	1.15	1.40	1.38		14.59	9523
				8.51	1.47	9.98	1.47	1.78	1.96		17.17	9790
				8.23	5.04	13.27	0.67	0.81		1.23	15.39	9806
				7.00		*8.00*	*0.82*	*1.00*		*1.00*	*12 46*	
				9.97	2.38	12.35	0.66	0.80	3.63		18.52	9524
				8.54	2.19	10.73	1.20	1.46	2.92		17.65	9789
				8.00		*9.00*	*0.41*	*0.50*		*2.50*	*14.23*	
				9.94	1.70	11.64	1.40	1.70	3.88		20.69	9525
				8.95	1.23	10.18	2.72	3.30	4.63		24.02	9811
				8.00		*9.00*	*1.23*	*1.50*		*2.00*	*16.09*	
				9.67	1.88	11.55	1.76	2.14	4.20		21.83	9526
				7.91	0.88	8.79	3.65	4.43	6.86		27.65	9791
				8. 00		*9.00*	*1.65*	*2.00*		*4.00*	*19.75*	
18.88	10.16					29.04	1.30	1.58			25.10	10014
						27.00	*1.23*	*1.50*			*19.89*	
20.19	7.47					27.66	2.41	2.93			27.86	9448
22.44	3.35					25.79	2.96	3.59			28.84	9937
						20.00	*2.47*	*3.00*			*19.41*	
				6.64	2.03	8.67	0.48	0.58	0.71		10.93	9449
				6.00		*7.00*	*0.41*	*0.50*	*0.50*		*9.33*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	The Jarecki Chemical Co.	
9450 9938	Phosphate and Potash.....	Manufacturer ..... Hines & Swope, Science Hill..
9451 9634	Lake Erie Fish Guano	Manufacturer ..... J. F. Hale, Brock .....
9452	Fish and Potash Grain Special..	Manufacturer .....
9453 9939	Number One Fish Guano.....	Manufacturer ..... Hines & Swope, Science Hill..
9454 9940	C. O. D. Phosphate	Manufacturer ..... Hines & Swope, Science Hill..
9455	St. Bernard Phosphate	Manufacturer .....
9456 9941	Fish & Potash, Pot. & Tob. Food	Manufacturer .... J. M. Whitworth, Caneyville...
9457	Dissolved Bone with Potash	Manufacturer .....
	J. B. Jones, Louisville, Ky.	
9306	Raw Bone Meal.....	Manufacturer ....
9307	Tobacco and Potato Grower.....	Manufacturer ....
9308 9794	Corn Grower	Manufacturer ..... M. H. Webb, Simpsonville.....
9309	Wheat Grower.....	Manufacturer ....
9310	Ammoniated Bone Meal.....	Manufacturer ....

TABLE OF ANALYSES.

Pounds in the Hundred.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value Per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				9.87	1.52	11.39				2.18	$15.07	9450
				9.99	2.16	12.15			1.91		14.76	9938
				10.00		*11.00*			*2.00*		*14.40*	
				10.16	1.87	12.03	1.63	1.98		1.41	19.52	9451
				10.45	1.79	12.24	1.56	1.89	1.34		19.28	9634
				10.00		*11.00*	*1.65*	*2.00*	*1.00*		*18.35*	
				10.00	1.59	11.59	1.36	1.65		2.49	19.71	9452
				9.00		*10.00*	*1.23*	*1.50*	*2.00*		*16.89*	
				10.17	1.64	11.81	0.93	1.13		1.29	17.20	9453
				11.80	1.66	13.46	0.93	1.13	1.29		18.90	9939
				10.00		*11.00*	*0.82*	*1.00*	*1.00*		*15.86*	
				14.07	2.29	16.36					14.07	9454
				12.83	4.98	17.81					12.83	9940
				14.00		*15.00*					*14.00*	
				12.81	2.09	14.90					12.81	9455
				12.00		*13.00*					*12.00*	
				8.01	1.50	9.51	0.88	1.07		3.56	17.12	9456
				9.44	1.79	11.23	0.90	1.09	2.04	2.15	19.37	9941
				8.00		*9.00*	*0.82*	*1.00*		*4.00*	*17.26*	
				11.61	2.00	13 61				2.52	17.75	9457
				12.00		*13.00*			*3.00*		*17.80*	
20.42	5.11					25.53	3.87	4.70			31.02	9306
						21.50	*3.50*	*4.25*			*23.40*	
				9.24	4.08	13.32	3.13	3.80		5.86	29.14	9307
				10.00		*12.00*	*2.88*	*3.50*		*5.50*	*28.04*	
				7.73	3.57	11.30	2.52	3.06		1.73	20.35	9308
				6.95	4.36	11.31	2.44	2.96		1.77	19.52	9794
				9.00		*11.00*	*2.47*	*3.00*		*1.50*	*20.81*	
				8.12	3.42	11.54	2.30	2.79		2.26	20.72	9309
				9.00		*11.00*	*1.70*	*2.06*		*2.00*	*19.10*	
11.14	1.97					*13.11	2.15	2.61			16.54	9310
						15.00	*2.06*	*2.50*			*15.18*	

*Contains Soluble Phosphoric Acid.

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	The Jones Fertilizing Co., Cincinnati, O.	
9602	Bone Meal	Manufacturer
9603	Ammoniated Bone Meal	Manufacturer
9604	Corn and Wheat Grower	Manufacturer
9605 9955	Tobacco and Potato Grower	Manufacturer J. B. Benjamin, Providence
9606 9956	Miami Valley	Manufacturer J. B. Benjamin, Providence
9607 9957	Jones' Reliable	Manufacturer Thos. E. Hedges, Rectorville
9608 9958	Jewel Phosphate	Manufacturer J. W. Webb & Son, Vanceburg
9609	Acid Phosphate	Manufacturer
10140	Potash Mixture	Manufacturer
10141	High Grade Dissolved Bone	Manufacturer
	Kaufman Fertilizer Co., Indianapolis, Ind.	
9629	Special Potato & Tob. Fertilizer	Manufacturer
9630	Harvest King	Manufacturer
9631	Banner Crop Grower	Manufacturer

TABLE OF ANALYSES.

POUNDS IN THE HUNDRED.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
											$	
13.74	9.95					*23 69	3.68	4.47			28.00	9602
						20.00	*3.29*	*4.00*			*21.87*	
				8.06	9.06	17.12	4.01	4.87			25.32	9603
				5.00		*15.00*	*4.12*	*5.00*			*22.36*	
				11.57	2.26	13.83	1.20	1.46		1.77	20.50	9604
				9.00		*10.00*	*0.82*	*1.00*		*1.00*	*14.86*	
				11.51	3.88	15.39	2.18	2.65		3.52	26.12	9605
				10.22	5.22	15.44	1.85	2.25		4.00	24.70	9955
				10.00		*12.00*	*1.65*	*2.00*		*4.00*	*22.55*	
				13.59	2.80	16 39	1.72	2.09	0.74	1.74	25.42	9606
				10.70	6.20	16.90	1.77	2.15		1.98	23.01	9956
				10.00		*12.00*	*1.65*	*2.00*		*2.00*	*20.15*	
				8.70	2.72	11.42	1.81	2.20		1.84	19.17	9607
				9.06	5.74	14.80	1.62	1.97		1.13	19.39	9957
				8.50		*10.00*	*1.23*	*1.50*		*1.25*	*15.99*	
				10.51	1.91	12.42	0.92	1.12			16.13	9608
				9.36	4.25	13.61	1.17	1.42			16.44	9958
				8.00		*10.00*	*0.82*	*1.00*			*12.86*	
				10.46	0.55	11.01					10.46	9609
				8.00		*10.00*					*8.00*	
				10.77	1.00	11.77				2.72	16.58	10140
		6.00	4.00	*10.00*		*11.00*			*2.00*		*14.40*	
				15.68	1.64	17.32					15.68	10141
		8.00	6.00	*14.00*		*15.00*					*14.00*	
				7.47	2.67	10.14	1.68	2.04	0.98	2.85	19.47	9629
				8.00			*1.65*	*2.00*		*4.00*	*19.35*	
				6.92	2.80	9.72	1.06	1.29		2.24	15.29	9630
				8.00			*1.03*	*1.25*	*2.00*		*14.69*	
				6.57	2.62	9.19	0.55	0.67		1.55	12.44	9631
				7.00			*0.82*	*1.00*	*1.00*		*11.86*	

*Contains Soluble Phosphoric Acid.

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Kaufman Fertilizer Co.	
9632	Alkaline Bone and Potash	Manufacturer
10031	Pure Bone	Manufacturer
	Louisville Fertilizer Co., Louisville, Ky.	
9171	Eagle Special Tobacco Grower	Manufacturer
9959		Jno. T. Hopkins, Henderson
9172	Eagle Special Corn Grower	Manufacturer
9793		L. H. Girky, Nancy
9173	Eagle High Grade Tobacco and Potato Grower	Manufacturer
9960		Crowell-Nunn Co., Blackford
9174	Eagle Phosphate	Manufacturer
9961		J. P. Strother, Milton
9175	Eagle Dissolved Bone	Manufacturer
9962		C. J. Rhoads, Hartford
9176	Eagle Guano	Manufacturer
9177	Eagle Corn and Wheat Grower	Manufacturer
9963		S P. Simpson, Murray
9178	Eagle Bone Meal	Manufacturer
9964		J. M. Whitworth, Caneyville
9179	Eagle Tobacco Grower	Manufacturer
9965		L. S. Brough, Bowling Green
9180	Eagle Bone and Potash	Manufacturer

TABLE OF ANALYSES.

POUNDS IN THE HUNDRED.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				8.42	2.56	10.98				2.25	$13.82	9632
				10 00					*2.00*		*14 00*	
17.39	4.08					21.47	4.73	5.74			30.55	10031
						20.00	*2.47*	*3.00*			*19.41*	
				8.91	0.86	9.77	1.03	1.25	0.56	1.03	15.92	9171
				7.97	1.11	9.08	0.95	1.15		1.43	14.57	9959
		5.00	*3.00*	*8.00*		*9 00*	*0.82*	*1.00*		*1.50*	*14.26*	
				8.55	0.83	9.38	0.63	0.76		1.40	14.16	9172
				8.58	0.41	8.99	0.52	0.63		1.36	13 65	9793
		5.00	*3.00*	*8.00*		*9.00*	*0.41*	*0.50*		*1.50*	*13.03*	
				7.79	1.65	9.44	1.69	2.05	0.98	3 26	19.97	9173
				8.60	1.92	10.52	1.64	1.99		3.92	20.71	9960
		4.00	*3.00*	*7 00*		*8.00*	*1.65*	*2.00*		*4.00*	*18.55*	
				8.01	1.11	9.12	0.63	0.76			11 94	9174
				8.33	0.74	9.07	0.34	0.41			11.32	9961
		5.00	*3.00*	*8.00*		*9.00*	*0.41*	*0.50*			*11.23*	
				7.84	0.73	8.57				1.10	11.02	9175
				8.23	0.83	9.06				1.23	11.69	9962
		4.00	*3.00*	*7.00*		*8.00*				*1.00*	*10.00*	
				10.45	1.98	12.43	1.64	1.99		3.07	21.93	9176
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*		*2.00*	*19.75*	
				10.35	0.68	11.03				0.74	13.58	9177
				11.75	1.57	13.32				0.56	15.40	9963
		6.00	*4.00*	*10.00*		*11.00*				*0 50*	*13.00*	
21.53	4.41					25.94	2.03	2.46			25.96	9178
19.44	2.90					22.34	1.25	1.52			21.04	9964
						20.00	*0.82*	*1.00*			*14.46*	
				8.89	0.81	9.70	2.44	2.96	0.90	5.20	25.45	9179
				8.59	1.93	10.52	2.53	3.07		5.60	25.39	9965
		5.00	*3.00*	*8.00*		*9.00*	*2.47*	*2.00*		*6.00*	*24 61*	
				8.77	0.86	9.63	0.66	0.80		1.51	14.65	9180
		5.00	*3.00*	*8.00*		*9 00*	*0.41*	*0.50*		*1.50*	*13.03*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Louisville Fertilizer Co.	
9181	Eagle Acid Phosphate	Manufacturer
9182	Eagle Potash Mixture	Manufacturer
9183	Eagle Soluble Bone	Manufacturer
9184	Eagle Special Wheat Grower	Manufacturer
9334	Eagle Raw Bone	Manufacturer
9966		J. W. Kelly, Leitchfield
9991	Eagle High Grade Dis. Bone	Manufacturer
	P. B. Mathiason M'f'g Co., St. Louis, Mo.	
9440	Increscent Tobacco & Potato Grower	Manufacturer
9441	Increscent Brand Acidulated Bone & Potash	Manufacturer
9601	Increscent Brand Dis. Bone	Manufacturer
	C. N. Meriwether, Clarksville, Tenn.	
9543	Clarksville Spec. Tob. Grower	Manufacturer
9544	Clarksville Grain Grower	Manufacturer
	Michigan Carbon Works, Detroit, Mich.	
9299	Homestead A Bone Black Fert.	Manufacturer
9975		D. H. Hatter, Franklin
9300	Homestead Tobacco Grower	Manufacturer
9976		D. H. Hatter, Franklin

TABLE OF ANALYSES.

POUNDS IN THE HUNDRED.												
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value Per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				10.64	0.95	11.59					$10.64	9181
		6.00	*4.00*	*10.00*		*11.00*					*10.00*	
				12.61	1.13	13.74				3.68	20 00	9182
		6.00	*4.00*	*10.00*		*11.00*				*2.00*	*14.80*	
				8.66	0.87	9.53	1.04	1.26	0.72	0.83	15.58	9183
		5.00	*3.00*	*8.00*		*9.00*	*0.82*	*1.00*		*1.50*	*14.26*	
				7.92	1.16	9.08	0.91	1.10	0.66	0.52	13.97	9184
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*		*1.00*	*12 46*	
						26.81	2.43	2.95			27.99	9334
23.06	3.75					27.45	2.24	2.72			27.80	9966
23.06	4.39					*20 00*	*2.47*	*3.00*			*19.41*	
				14.73	0.83	15.56					14.73	9991
		8.00	*6.00*	*14 00*		*15.00*					*14.00*	
				8.65	2.61	11.26	1.84	2.23	1.02	4 10	22.88	9440
				7.00		*11.00*	*1.65*	*2.00*		*4.50*	*20.35*	
				8.91	3.51	12.42	2.64	3.20	0.76	2.57	23.85	9441
				9.00		*13.00*	*2.47*	*3.00*	*2.00*		*21.81*	
				9.73	3.75	13.48	3.13	3.80		4.59	28.08	9601
				9.00		*12.00*	*3.00*	*3.64*	*4.00*		*25.00*	
				3.24	0.73	3.97	2.87	3.48		9.25	23.89	9543
		2.00	*1.00*	*3.00*		*3.25*	*2.47*	*3.00*		*8.00*	*20.71*	
				9.95	2.24	12.19	0.80	0.97		2.07	17 72	9544
		8.00	*2.00*	*10.00*		*11.00*	*0.82*	*1.00*		*2.25*	*17.56*	
				9.32	1.82	11.14	1.92	2.33	1.67		19.34	9299
				8.80	3.19	11 99	2.00	2.43	1.43		19.27	9975
				8.00		*9.00*	*2.06*	*2.50*	*1.50*		*17.68*	
				10.43	0.84	11.27	3.18	3.86	3.53		25.93	9300
				10.00	2.46	12.46	2.80	3.40	3.50		24.88	9976
				10.00			*2.88*	*3.50*	*3.50*		*24.14*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Michigan Carbon Works.	
9301 9977	Homestead Pot. & Tob. Fertiliz'r	Manufacturer Hausgen, Fulton & Co., Anchorage
9302 9978	Red Line Crop Grower	Manufacturer J. R. Davis & Bro., Campbellsville
9303 9979	Red Line Complete Manure	Manufacturer Hausgen, Fulton & Co., Anchorage
9304 9980	Red Line Phosphate	Manufacturer Cochran & Baker, Marion
9305	Red Line Phosphate with Pot'sh	Manufacturer
9446 9981	Desiccated Bone	Manufacturer D. H. Hatter, Franklin
9447	Wolverine Ground Bone	Manufacturer
	Nelson Morris & Co., Chicago, Illinois.	
9752	Big One, Pure Raw Bone	Manufacturer
9753	Big Two, Pure Bone Meal	Manufacturer
9754	Big Three, Bone Phosphate	Manufacturer
9755 9834	Big Four, Bone Phosphate	Manufacturer Ben Mylor, Gex
9756	Big Five, Bone Phosphate	Manufacturer

Table of Analyses.

Pounds in the Hundred.												
Phosphoric Acid.									Potash.			
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.	Nitrogen.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Relative Value per Ton.	Station Number.
				9 06	1.66	10.72	2 06	2.50	2.97		$20.68	9301
				8.75	3.19	11.94	2.28	2.77	3.30		21.92	9977
				8 00		*9.00*	*2.06*	*2.50*	*3.00*		*19 18*	
				9.16	1.65	10 81	1.70	2.06	2.35		19.10	9302
				7.99	2.78	10.77	1.88	2.28	2.27		18.61	9978
				8 00		*9.00*	*1.65*	*2.00*	*2.00*		*16.95*	
				8.95	0.93	9.88	0.91	1.10	0.87		14.71	9303
				5.99	3.36	9.35	1.22	1.48	1.35		13.54	9979
				7.00		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				15.42	0.37	15.79					15.42	9304
				15.91	0.31	16 22					15.91	9980
				14 00		*15.00*					*14.00*	
				11.63	0.23	11.86			2.01		16.06	9305
				10.00		*11.00*			*2.00*		*14.40*	
25.41	6.75					32.16	1.37	1.66			28.49	9446
22.07	9.91					31.98	1.52	1.85			28.17	9981
						25.00	*1.23*	*1.50*			*18.69*	
16.96	11.31					28.27	1.74	2.11			25.58	9447
						25.00	*1.65*	*2.00*			*19.95*	
13.18	11.23					24.41	3.78	4.59			28.62	9752
						24.00	*3.29*	*4.00*			*24.27*	
25.61	2.53					28.14	2.10	2.55			28.31	9753
						28.00	*2.06*	*2.50*			*22.98*	
8.27	2.07					10.34	3.63	4.41	2.13		20.88	9754
						10.00	*2.47*	*3.00*		*2.00*	*15.81*	
7.49	3.36					*10.85	4.93	5.99	1.52	3.36	28.35	9755
9.28	2.62					11.90	4.77	5.79	1.02	2.97	27.88	9834
						12.00	*4.12*	*5.00*		*4.00*	*24.36*	
9.72	1.72					*11.44	2.70	3.28	0.98		17.89	9756
						10.00	*2.47*	*3.00*		*1.00*	*14 61*	

*Contains Soluble Phosphoric Acid.

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Nelson Morris & Co.	
9757	Big Six, Special Bone Meal	Manufacturer
9758	Big Seven, High Grade Acid Phosphate	Manufacturer
9759	Big Eight, Amm. Acid Phos. with Potash added	Manufacturer
	National Fertilizer Co., Nashville, Tenn.	
9568	Acid Phosphate	Manufacturer
9569	Sadler's Formula	Manufacturer
9984		W. Lewis & Bro., Greensburg
9614	Special Tobacco Fertilizer	Manufacturer
9775	National Dissolved Bone	Manufacturer
9776	Tobacco Grower	Manufacturer
9985		W. Lewis & Bro., Greensburg
9777	M. & S. Tobacco Grower	Manufacturer
9986		Miller & Sullivan, Elkton
9783	Corn Grower	Manufacturer
9987		Shaver & Atherton, Livermore
9786	Acid Phosphate	Manufacturer
9787	Acid Phosphate & Potash	Manufacturer
9988		W. Lewis & Bro., Greensburg
9953	Pea Grower	Manufacturer
9989		Shaver & Atherton, Livermore

Table of Analyses.

Pounds in the Hundred.												
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value Per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate		
						26.43	1.37	1.66			$24 78	9757
24.05	2.38					*27.00*	*0.82*	*1.00*			*18.66*	
				10.89	1.51	12.40					10.89	9758
				10.00		*11.00*					*10 00*	
				9.45	1.50	10.95	1.12	1.36	0.94	1.03	17.48	9759
				10.00		*11.00*	*0.82*	*1.00*		*1.00*	*16.06*	
				12.27	2.69	14.96					12.27	9568
		8.00	*4.00*	*12.00*							*12.00*	
				12 00	1.29	13.29			2.20		17.12	9569
				11.41	3.66	15.07			1.59		16.74	9984
		8.00	*4.00*	*12.00*					*2.00*		*16.40*	
				9.34	1.46	10.80	2.44	2.96	10.90		30.01	9614
		6.00	*2.00*	*8.00*			*2.47*	*3.00*	*10.00*		*27.01*	
				10.11	6.42	16.53	0.99	1.20	1.42		19.09	9775
				10.00		*11.00*	*0.82*	*1.00*	*1.00*		*15.86*	
				10.57	3.63	14.20	1.43	1.74	2.19		20.61	9776
				10 13	2.15	12.28	1.86	2.26	1.23		19.83	9985
				10.00		*11.00*	*1.65*	*2.00*	*2.00*		*19.35*	
				10.49	1.78	12.27	1.37	1.66	4.17		21.58	9777
				10.71	1.55	12.26	1.65	2.00	3.42		21.84	9986
				10 00		*11.00*	*1.65*	*2.00*	*4.00*		*21.35*	
				9 82	6.29	16.11	0.97	1.18	1 33		18.54	9783
				9 91	3.42	13.33	0.88	1.07	1.17		17.07	9987
				10.00		*11.00*	*0.82*	*1.00*	*1.00*		*15.86*	
				14.64	2.55	17.19					14.64	9786
				14.00		*15.00*					*14.00*	
				10 39	1.65	12.04			1.87		15.00	9787
				10.68	4.03	14 71			1.54		15.97	9988
				10.00		*11.00*			*2.00*		*14.40*	
				9.83	2.17	12.00			1.78		14.45	9953
				11.21	1.84	13.05			3.42		17.61	9989
				10.00		*11.00*			*2.00*		*14.40*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	National Fertilizer Co.	
9954	Tobacco Fertilizer.	Manufacturer ....
9990		Reynolds & Co., Slaughterville
	North-Western Fertilizing Co., Chicago, Ill.	
9382	Horse Shoe Brand Quick Acting Phosphate	Manufacturer .....
9992		Watkins & Co., Elizabethtown
9383	H. S. B. Bone & Potash.....	Manufacturer ....
9993		Dickey & Co., Glasgow.....
9384	H. S. B. Success Corn Grower ..	Manufacturer .....
9994		H. C. Crawford, Millwood .....
9385	H. S. B. Cap Sheaf Wheat Grow	Manufacturer .....
9386	H. S. B. Dark Tob. Grower.....	Manufacturer ....
9995		E. W. Curd & Co., Cave City...
9387	H. S. B. Acidulated Bone & Potash	Manufacturer .....
9388	H. S. B. Corn & Wheat Grower..	Manufacturer .....
9996		W. A. Coffman, Vine Grove.....
9389	H. S. B. Challenge Corn Grower	Manufacturer ....
9390	H. S. B. Ky. Tobacco Grower...	Manufacturer .....
9391	H. S. B. Tobacco Grower.....	Manufacturer .....
9998		Choat & Webb, Guthrie .....
9392	H. S. B. Potato Grower.....	Manufacturer .....

TABLE OF ANALYSES.

POUNDS IN THE HUNDRED.												
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value Per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				9.65	1.83	11.48	2.69	3.27	3.42		$23.80	9954
				9.19	3.86	13.05	2.95	3.58	1.97		23.39	9990
				10.00		*11.00*	*2.06*	*2.50*	*3.00*		*21 58*	
				11.15	0.47	11.62					11.15	9382
				11.78	1.01	12.79					11.78	9992
		8.00	*2.00*	*10 00*		*12.00*					*10.00*	
				11.68	0.23	11.91			1.88		15.99	9383
				11.14	0.37	11.51			1.92		15.44	9993
		7.00	*3.00*	*10.00*		*12.00*			*2.00*		*14 80*	
				8.98	1.06	10.04	0.94	1.14	0.66		14.68	9384
				6 45	3.53	9.98	1.28	1.55	1.22		14.21	9994
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				9.37	1.02	10.39	0.92	1.12	0.67		15.08	9385
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				9.22	0.99	10.21	0.92	1.12	0.69		14.91	9386
				8.87	2.80	11.67	1.13	1.37	1.29		16.44	9995
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				12.43	1.13	13.56	1.04	1.26	0.55		19.04	9387
		7.00	*3.00*	*10.00*		*12.00*	*0.82*	*1.00*	*1.00*		*16.26*	
				9.37	1.75	11.12	1.81	2.20	2.39		19 76	9388
				10.10	2.28	12.38	2.02	2.45	2.20		21.29	9996
		5.00	*3.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17 35*	
				7.64	2.25	9.89	2.87	3.48	1.46		20.14	9389
		5.00	*3.00*	*8.00*		*10.00*	*2.47*	*3.00*	*1.50*		*19.31*	
				7.46	2.34	9.80	2.80	3.40	1.56		19.85	9390
		5.00	*3.00*	*8.00*		*10.00*	*2.47*	*3.00*	*1.50*		*19 31*	
				9.30	2.26	11.56	3.33	4.04	3.74		25.79	9391
				8.15	4.32	12.47	3.40	4.13	3.60		25.31	9998
		5.00	*3.00*	*8.00*		*10.00*	*3.29*	*4.00*	*3.50*		*23.77*	
				9.65	2.03	11.68	3.31	4.02	3.77		26.09	9392
		5.00	*3.00*	*8.00*		*10.00*	*3.29*	*4.00*	*3.50*		*23.77*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	North-Western Fertilizing Co.	
9393	H. S. B. Bone and Superphosphate Mixture	Manufacturer
9394	H. S. B. Pure Ground Bone	Manufacturer
9999		H. C. Crawford, Millwood
9395	H. S. B. Fine Raw Bone	Manufacturer
10000		H. C. Crawford, Millwood
10033		O. J. Duell, Sonora
	The Ohio Farmers Fertilizer Co., Columbus, O.	
9373	Acid Phosphate	Manufacturer
9374	Soluble Bone and Potash	Manufacturer
9375	General Crop Fish Guano	Manufacturer
10006		Handy & Reynolds, Cave City
9376	Wheat Maker & Seeding Down	Manufacturer
9377	Corn, Oats & Wheat Fish Guano	Manufacturer
10007		H. T. Peake, Vine Grove
9378	Tobacco Grower	Manufacturer
10008		Handy & Reynolds, Cave City
9379	Potato and Tobacco Special	Manufacturer
9380	Ammoniated Bone and Potash	Manufacturer
9381	Fine Ground Bone Meal.	Manufacturer
9872	Raw Bone Meal	Manufacturer

TABLE OF ANALYSES.

Pounds in the Hundred.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				5.98	7.29	13.27	2.60	3.16	0.97		$18.87	9393
		4.00	*3.00*	*7.00*		*13.00*	*2.47*	*3.00*	*0.50*		*18.71*	
17.20	7.36					24.56	2.47	3.00			25.59	9394
14.76	7.27					22.03	2.44	2.96			23.49	9999
						20.00	*2.47*	*3.00*			*19.41*	
20.29						20.29	4.21	5.11			28.86	9395
17.51	1.12					18.63	4.42	5.37			27.94	10000
20.01						20.01	3.91	4.75			27.74	10033
						22.00	*3.29*	*4.00*			*23.07*	
				9.57	8.90	18.47					9.57	9373
				9.00		*10.00*					*9.00*	
				10.68	1.27	11.95			1.00	1 65	16.31	9374
				8.00					*2.00*		*11.60*	
				7.58	2.14	9.72	1.08	1.31	1.21		14.41	9375
				7.34	2.47	9.81	1.18	1.43	1.27		14.61	10006
				7.00			*0.82*	*1.00*	*1.03*		*11.86*	
				9.17	1.74	10.91	0.75	0.91	3.23		17.18	9376
				8.00			*0.41*	*0.50*	*2.50*		*13.33*	
				9.90	1.54	11.44	1.52	1.85	1.85		18.91	9377
				9.57	1.66	11.23	1.19	1.44	2.11		17.82	10007
				8.00			*1.23*	*1.50*	*2.00*		*15.29*	
				9.50	1.92	11.42	1.45	1.76	1.84		18.36	9378
				8.52	1.62	10.14	1.29	1.57	2.01		16.75	10008
				8.00			*1.23*	*1.50*	*2.00*		*15.29*	
				9.93	1.60	11.53	1.74	2.11	4.12		21.90	9379
				8.00			*1.65*	*2..00*	*4.00*		*18.55*	
				9.55	3.01	12.56	1.13	1.37	4.29		20.34	9380
				8.00			*0.82*	*1.00*	*4.00*		*16.06*	
13.23	10.82					24.05	3.25	3.95			26.82	9381
						20.00	*1.65*	*2.00*			*16 95*	
16.62	13.06					29.68	1.08	1.31			24.38	9872
						27.00	*1.23*	*1.50*			*19.89*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Packers Fertilizer Association, Chicago, Ill.	
9489	Boars Head Brand Special Tobacco Grower	Manufacturer
10009		J. H. & M. F. Winfree, Hopkinsville
9490	B. H. B. Corn & Wheat Grower	Manufacturer
10010		G. C. Prather, Somerset
9491	B. H. B. Ky. Potash Mixture	Manufacturer
10011		Gardner Bros., Elizabethtown
9492	B. H. B. World of Good Potato and Tobacco Grower	Manufacturer
10012		J. H. & M. F. Winfree, Hopkinsville
9493	B. H. B. World of Good Superphosphate	Manufacturer
9494	B. H. B. Soluble Phosphate	Manufacturer
9495	B. H. B. Potash Phosphate	Manufacturer
10013		Gardner Bros., Elizabethtown
9496	B. H. B. Chicago Bone Meal	Manufacturer
9497	B. H. B. Raw Bone	Manufacturer
	Queen City Fertilizer Co., Cincinnati, O.	
9618	Valley Gem Phosphate	Manufacturer
10015		Thos. E. Hedges, Rectorville
9619	Tobacco and Potato Grower	Manufacturer
10016		Thos. E. Hedges, Rectorville

TABLE OF ANALYSES.

Pounds in the Hundred.												
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value Per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				9.01	1.77	10.78	1.81	2.20	2.33		$19.28	9489
				9.02	2.38	11.40	1.67	2.03	2.11		18.89	10009
		5.00	*3.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				9.22	1.77	10.99	1.83	2.22	2.32		19.58	9490
				7.80	3.15	10.95	1.86	2.26	2.24		18.44	10010
		5.00	*3.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				11.86	0.18	12 04			1.97		16.27	9491
				12.25	0.35	12.60			1.84		16.68	10011
		7.00	*3.00*	*10.00*		*12.00*			*2.00*		*14.80*	
				10.17	1.94	12.11	3.37	4.09	3.80		26.89	9492
				7.70	5.04	12 74	3.52	4.27	3.67		25.49	10012
		5.00	*3.00*	*8.00*		*10.00*	*3.29*	*4.00*	*3.50*		*23.77*	
				8.37	2.15	10.52	2.29	2.78	1.71		19.48	9493
		5.00	*3.00*	*8.00*		*10.00*	*2.06*	*2.50*	*1.50*		*18 08*	
				11.24	0.27	11.51					11.24	9494
		8.00	*2.00*	*10.00*		*12.00*					*10.00*	
				12.18	0.19	12.37			4.17		18.87	9495
				11.04	0.51	11.55			3.62		17.07	10013
		8.00	*2.00*	*10.00*		*12.00*			*4.00*		*16 80*	
16.87	7.23					24 10	2.65	3.22			25.79	9496
						20.00	*2.47*	*3.00*			*19.41*	
4.03	19.69					23.72	4.31	5.23			27.96	9497
						22.00	*3.29*	*4.00*			*23.07*	
				9.96	3.42	13.38	0.82	1.00		1.67	17.78	9618
				11.56	1.50	13.06	1.01	1.23	1.47		18.97	10015
				10.00			*0.82*	*1.00*	*1.00*		*15.46*	
				8.70	3.68	12.38	1.29	1.57		4.22	20.84	9619
				9.75	1.64	11.39	0.96	1.17	3.06		18.30	10016
				8 00			*0.82*	*1.00*	*4.00*		*16.06*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Read Phosphate Co., Nashville, Tenn.	
9311 10017	Read's High Grade Tob. Grower	Manufacturer W. S. Pierce, Bedford
9312 10018	Read's Blood & Bone No. 1	Manufacturer W. S. Pierce, Bedford
9313 10019	Read's Alkaline Bone	Manufacturer W. S. Pierce, Bedford
9314 10020	Read's Farmer's Spec. Manure	Manufacturer W. S. Pierce, Bedford
9315	Read's Corn Grower Special	Manufacturer
9316	Read's Soluble Bone	Manufacturer
9317 10021	Read's X X X Dissolved Bone	Manufacturer G.W. Plimell & Co., Science Hill
9318	Read's Special Potash Mixture.	Manufacturer
9319	Read's Tobacco Special	Manufacturer
	Ruhl & Pero, Louisville, Ky.	
9481	Pure Bone Meal	Manufacturer
9482	Pure Ammoniated Bone Meal	Manufacturer
	Standard Guano & Chem. M'f'g Co., New Orleans, La.	
10136	Pure Raw Ground Bone	Manufacturer
	Swift & Co., Chicago, Ill.	
9217 10024	Swift's Ky. Tobacco Grower	Manufacturer P. H. Haffey, Whitesville

TABLE OF ANALYSES.

Pounds in the Hundred.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				8.79	3.30	12.09	1.72	2.09	1.06	3.05	$21.75	9311
				8.31	2.72	11.03	1.76	2.14	0.80	2.94	20.67	10017
				8.00			*1.65*	*2.00*		*4.00*	*19.35*	
				8.74	4.45	13.19	1.74	2.11	2.64		20.13	9312
				8.67	3.71	12.38	0.95	1.15	2.64		17.37	10018
				8.00			*1.65*	*2.00*	*2.00*		*16.55*	
				10.67	3.33	14.00			2.17		16.30	9313
				8.82	3.45	12.27			2.53		14.49	10019
				10.00					*2.00*		*14 00*	
				11.13	3.19	14.32	1.03	1.25	3.20		20.93	9314
				11.38	2.23	13.61	1.04	1.26	2.49		20.16	10020
				10 00			*0.82*	*1.00*	*3.00*		*17.46*	
				10.64	3.24	13.88	1.07	1.30	1.18		18.46	9315
				10.00			*0.82*	*1.00*	*1.00*		*15.46*	
				9.29	4.58	13.87	1.11	1.35	2.10		18.41	9316
				8.00			*0.82*	*1.00*	*2.00*		*14.06*	
				15.17	3.30	18.47					15.17	9317
				14.78	1.94	16.72					14.78	10021
				13.00							*13.00*	
				10.83	3.02	13.85			4.16		18.37	9318
				10.00					*4.00*		*16.00*	
				8.84	1.04	9.88	1.69	2.05	1.32	7.08	25.92	9319
				8.00			*1.65*	*2.00*		*8.00*	*24.15*	
12.60	11.63					24 23	3.63	4.41			27 95	9481
						24.50	*2.38*	*2.89*			*21.84*	
6.71	4.11					10.82	4.40	5.34			21.04	9482
						8.50	*3.50*	*4.25*			*15.60*	
13.77	9.56					23.33	3.71	4.50			27.89	10136
						20.00	*3.09*	*3.75*			*21.27*	
				10.83	1.94	12.77	2.15	2.61		1.97	22.59	9217
				11.04	2.78	13.82	2.06	2.50	0.74	1.05	22.54	10024
				10.00		*14.00*	*1.65*	*2.00*		*2.00*	*20.95*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Swift & Company.	
9218 10025	Swift's Spec. Tobacco Fertilizer	Manufacturer C. P. Clark & Co., Owensboro.
9219	Swift's Garden City Phosphate..	Manufacturer
9220 10026	Swift's Superphosphate	Manufacturer Irvington Milling Co., Irvington
9221 10027	Swift's Complete Fertilizer	Manufacturer Bassett & Stone, Leitchfield
9222	Swift's Potato & Tob. Grower ..	Manufacturer
9223	Swift's Vegetable Grower	Manufacturer
9224	Swift's Phosphate & Potash	Manufacturer
9225 10028	Swift's Pure Raw Bone Meal	Manufacturer B. F. Beard & Co., Hardinsburg
9226 10029	Swift's Bone Meal	Manufacturer Bassett & Stone, Leitchfield
9227	Ammoniated Bone	Manufacturer
9228	Ammoniated Bone & Potash	Manufacturer
9229	Bone & Potash	Manufacturer
9230	Pure Acid Phosphate	Manufacturer
9231	Diamond S. Phosphate	Manufacturer

TABLE OF ANALYSES.

Pounds in the Hundred.												
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value Per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				10 32	1.92	12.24	3.25	3.95		3.45	$27.04	9218
				10.13	1.87	12 00	2.13	2.59	0.64	2.33	22.74	10025
				10.00		*13.00*	*2.47*	*3.00*		*3.00*	*24.21*	
				14.13	2.99	17.12					14.13	9219
				14.00		*15.00*					*14.00*	
				8 58	3.29	11.87	1.86	2.28	1.92		19.18	9220
				8.53	5.50	14.03	1.90	2.31	1.86		20.00	10026
				8.00		*12 00*	*1.65*	*2.00*	*2.00*		*18 15*	
				8.72	2.15	10.87	0.85	1.03	1.54		15.41	9221
				7.60	2.17	9.77	1.85	2.25	1.21		16.75	10027
				8.00		*11.00*	*1.03*	*1.25*	*1.00*		*14.89*	
				9 40	0.40	9.80	3.52	4.27		5.12	28.14	9222
				10 00		*11.00*	*3.29*	*4.00*		*5.00*	*28 27*	
				10.49	1.78	12.27	3.99	4.84		9.70	36.91	9223
				9.00		*10.00*	*3.29*	*4.00*	*10.00*		*31.07*	
				12.03	3.16	15.19				1.98	18.08	9224
				12.00		*13.00*			*2.00*		*16 80*	
16.20	9.51					25.71	3.84	4.66			30 19	9225
8.61	16.00					24.61	4.07	4.94			28.70	10028
						23.00	*3.71*	*4.50*			*24.93*	
22.18	4.22					26.40	2.51	3.05			27.80	9226
20.96	5.24					26.20	2.45	2.97			27.26	10029
						25.00	*2.47*	*3.00*			*22.41*	
15.25	2.48					17.73	5.29	6.42			29.56	9227
						17.00	*4.94*	*6.00*			*25.02*	
13.92	2.46					16.38	4.79	5.82		4.12	31.93	9228
						16.00	*4.74*	*5.75*	*3.00*		*26.82*	
16.83	6.22					23.05	3.00	3.64		2.74	29.48	9229
						23.50	*2.47*	*3.00*	*3.00*		*24.51*	
				18.17	0.87	19.04					18.17	9230
				16 00		*17 00*					*16.00*	
				11.56	2.60	14.16					11.56	9231
				10.00		*11.00*					*10.00*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Swift & Company.	
9232	Champion Wheat Grower	Manufacturer
9233	Champion Corn Grower	Manufacturer
9234	Onion & Potato Special	Manufacturer
10030		C. P. Clark & Co., Owensboro
9833	Swift's Special Bone Meal	Manufacturer
	Tennessee Chemical Co., Nashville, Tenn.	
9189	Ox Ammoniated Phosphate	Manufacturer
9190	Ox Special Tobacco Guano	Manufacturer
10041		Franklin Hardware Co., Franklin
9191	Ox High Grade Tobacco and Potato Grower	Manufacturer
9192	Ox Special Corn Grower	Manufacturer
9193	Ox Corn and Wheat Grower	Manufacturer
9194	Ox Ammoniated Bone	Manufacturer
10042		J. F. Caplinger, Milton
9195	Ox Bone, Ammonia and Potash	Manufacturer
9196	Ox Slaughter House Bone	Manufacturer
10043		J. F. Caplinger, Milton
9197	Ox Potash Mixture	Manufacturer
10044		Turley & Co , Hartford

TABLE OF ANALYSES.

POUNDS IN THE HUNDRED.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value Per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate		
				13.64	2.35	15 99	1.82	2.21	0.80	1.10	$24.89	9232
				12.00		*13.00*	*1.65*	*2.00*	*2.00*		*21.75*	
				13.24	2.06	15.30	1.81	2.20	0.82	1.35	24.58	9233
				12.00		*13.00*	*1.65*	*2.00*	*2.00*		*21.75*	
				8.79	0.20	8.99	2.11	2.56		7.12	25.50	9234
				9.25	1.38	10.63	1.77	2.15	6.77		23 73	10030
				8.00		*11.00*	*1.65*	*2.00*		*7.00*	*24 15*	
23.80	9.72					33.52	0.70	0.85			26.97	9833
						27.50	*0.82*	*1.00*			*18.96*	
				8.11	1.42	9.53	0.67	0.81			12.31	9189
		5.00	*3.00*	*8.00*		*9.00*	*0.41*	*0.50*			*11.23*	
				10.74	1.96	12.70	1.71	2.08		3.20	22.64	9190
				11.04	1.89	12.93	1.81	2.20	1.79		21.23	10041
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*		*2.00*	*19.75*	
				8.43	1.02	9.45	1.80	2.19	1.26	3.20	21.03	9191
		4.00	*3.00*	*7.00*		*8.00*	*1.65*	*2.00*		*4.00*	*18 55*	
				8.36	0.68	9.04	0.64	0.78		1.48	14.00	9192
		5.00	*3.00*	*8.00*		*9 00*	*0.41*	*0.50*		*1.50*	*13.03*	
				10.67	0.54	11.21				0.79	13.97	9193
		6.00	*4.00*	*10.00*		*11.00*				*0.50*	*13.00*	
				11.04	1.68	12.72	1.72	2.09		3.27	23.00	9194
				11.58	2.19	13.77	1.72	2.09		1.59	21.85	10042
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*		*2.00*	*19 75*	
				10.73	0.95	11.68	1.09	1.32	0.56	0.78	18.03	9195
		6.00	*4.00*	*10.00*		*11.00*	*0.82*	*1.00*		*1.00*	*16.06*	
				9.26	0.82	10.08	2.04	2.48	1.02	1.24	20.07	9196
				11.22	2.05	13.27	1.78	2.16		2.10	22.14	10043
		5.00	*3.00*	*8.00*		*9 00*	*1.65*	*2.00*		*2.00*	*17.35*	
				10.83	0.81	11.64				2.77	16.64	9197
				9 68	9.80	19.48				1.49	17.33	10044
		6.00	*4.00*	*10.00*		*11 00*				*2.00*	*14 80*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Tennessee Chemical Co.	
9198	Ox Alkaline Bone	Manufacturer
9199 10045	Ox High Grade Dissolved Bone	Manufacturer Langdon Bros., Science Hill
9200	Ox Phosphate	Manufacturer
9201 10046	Ox Alkaline Bone and Ammonia	Manufacturer Elvis Kelley, Spring Lick
9202 10047	Ox Corn and Wheat Guano	Manufacturer Depp & Holman, Glasgow
9335	Ox Bone Meal	Manufacturer
9336	Ox Raw Bone	Manufacturer
9972	Ox Special Wheat Grower	Manufacturer
	Virginia Carolina Chemical Co., S. W. Travers & Co, Branch, Richmond, Va.	
9100 10048	National Tobacco Fertilizer	Manufacturer Hook, DeHaven & Co., Hardinsburg
9101 10049	Beef, Blood & Bone Fertilizer	Manufacturer Arthur Ferrell, Owensboro
9102 10050	Champion Corn & Wheat Grow'r	Manufacturer E. F. Morris, Eubanks
9103 10051	Capital Bone Potash Compound	Manufacturer F. Mahoney, Bedford

TABLE OF ANALYSES.

POUNDS IN THE HUNDRED.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Relative Value Per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				13.12	0.99	14.11				2.80	$19.50	9198
		7.00	*5.00*	*12.00*		*13.00*				*2.00*	*17.20*	
				16 63	0.74	17.37					16 63	9199
				15.12	2.42	17.54					15.12	10045
		8.00	*6.00*	*14.90*		*15.00*					*14.00*	
				13.32	0.84	14.16					13.32	9200
		7.00	*5.00*	*12.00*		*13.00*					*12.00*	
				12 33	0.87	13.20	0.59	0.72		1.11	18 25	9201
				12.42	1.18	13.60	0.35	0.42		0.70	17 26	10046
		6.50	*4.00*	*10.50*		*11 50*	*0.41*	*0.50*		*1.00*	*15 43*	
				13.38	1.00	14.38	1.11	1.35	0.64	0.70	21.27	9202
				12.97	1.52	14.49	0.93	1.13		0.93	20.08	10047
		7.00	*5.00*	*12.00*		*13.00*	*0.82*	*1.00*		*1.00*	*18 46*	
22.38	1.18					23.56	0.57	0.69			20.32	9335
						20 00	*0.82*	*1.00*			*14.46*	
22.86	3.72					26.58	2.35	2.85			27.57	9336
						20.00	*2.47*	*3.00*			*19 41*	
				7.87	0.88	8.75	0.96	1.17		1.22	14.13	9972
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				7.56	3.45	11.01	1.82	2.21	0.78	4 08	21 59	9100
				6.63	7.94	14.57	1.86	2.26	3.33		20 05	10048
		5.00	*2.00*	*7 00*		*8.00*	*1.65*	*2.00*		*4.00*	*18.55*	
				6.81	2.67	9.48	1.94	2.36	2.28		17.34	9101
				6.93	6.95	13 88	2.13	2.59	2.27		19.76	10049
		5.00	*2.00*	*7.00*		*8.00*	*1.65*	*2.00*	*2.00*		*15.75*	
				8.47	2.10	10.57	0.91	1.10	2.28		16.01	9102
				9.78	3.68	13 46	0.91	1.10	2.17		18 11	10050
		6.00	*2.00*	*8.00*		*9.00*	*0.82*	*1.00*	*2.00*		*14.46*	
				10.16	1.71	11.87			2.27		15.14	9103
				13 59	1.15	14.74			2.15		18.92	10051
		7.00	*3.00*	*10.00*		*11.00*			*2.00*		*14.40*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	From Whom Obtained.
	Virginia-Carolina Chemical Co.	
9104 10052	Capital Dissolved S. C. Bone ..	Manufacturer ..... Grant McDaniel, Vanceburg...
	Virginia-Carolina Chemical Co., Memphis Division, Memphis, Tenn.	
9873	Royal High Grade Guano..	Manufacturer .....
9874	Royal Grain Grower	Manufacturer .....
9875	Beef, Blood & Bone Fertilizer..	Manufacturer .....
9934	Kentucky Spec. Wheat Grower	Manufacturer ....
	Wake Fert. Co., Adairville, Ky...	
9620 10053	Old Kentucky Tobacco Grower	Manufacturer ..... Mfrs. Warehouse..... .....
9621	Wake's Special.....	Manufacturer .....
	Wood, Stubbs & Co., Louisville, Ky.	
9527	Acme Brand Potato & Tobacco..	Manufacturer ....
9528	A. B. Wheat and Corn	Manufacturer .....
9529	A. B. High Grade Vegetable....	Manufacturer .....
9530	A. B. Special Truckers	Manufacturer .....
9531	A. B. Blood, Bone & Potash	Manufacturer ....
9532	A. B. Soluble Bone & Potash ...	Manufacturer ....

TABLE OF ANALYSES.

Pounds in the Hundred.													
Phosphoric Acid.									Potash.				
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.	Nitrogen.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Relative Value per Ton.	Station Number.
				12.28	2.25	14.53					$12.28	9104
				11.74	1.91	13.65					11.74	10052
		9 00	*3.00*	*12.00*		*13 00*					*12.00*	
				10.22	3.71	13.93	1.89	2.29	2.71		22.12	9873
		7.00	*3.00*	*10.00*		*12.00*	*1.65*	*2.00*	*2.00*		*19.75*	
				12.57	0.50	13.07			4.99		20.27	9874
		7.00	*3.00*	*10.00*		*12.00*			*4.00*		*16 80*	
				8 90	4.35	13.25	1.75	2.12	2.46		20.13	9875
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				10.39	4.71	15.10	1.04	1.26	4.26		21 73	9934
		7.00	*3.00*	*10.00*		*12.00*	*0.82*	*1.00*	*3.00*		*18 26*	
				7.13	2.29	9.42	3.47	4.21		8.22	29 75	9620
				6.58	2.34	8 92	3.78	4.59		8.85	30.80	10053
				6.00			*3 00*	*3.64*		*7.00*	*24.60*	
				8.42	2.24	10.66	2.56	3.11		5.25	24.98	9621
				8 00			*2.00*	*2.43*		*4.00*	*20.40*	
				10.40	3.31	13.71	2.62	3.18		5.37	28.10	9527
				8.00			*2.47*	*3.00*		*5.00*	*23 01*	
				10.63	6.81	17.44	1.75	2.12		2.13	23.29	9528
				10.00			*0.82*	*1.00*	*2.00*		*16.46*	
				11.96	0.37	12 33	3.22	3.91		4.80	29.92	9529
				10.00			*3.29*	*4.00*	*4.00*		*25.87*	
				9.94	1.39	11.33	2.24	2.72	1.24	0.97	21.61	9530
				8.00			*2.47*	*3.00*		*2.00*	*19.41*	
				11.90	4.54	16.44	2.01	2.44		2.33	24.93	9531
				10.00			*1.65*	*2.00*	*2.00*		*18.95*	
				11.68	9.36	21.04				2.21	20 41	9532
				10 00					*2.00*		*14.00*	

M. A. SCOVELL, Director and Chemist.

H. E. CURTIS, Chemist, Fertilizers.

The following is a list of Bulletins issued by the Kentucky Agricultural Experiment Station since its organization. Those marked with a star (*) are out of print:

*No. 1.—Do Fertilizers Affect the Quality of Tobacco? Dec. 23, 1885.
" 2.—Corn Fodder as Food for Stock. Jan. 4, 1886.
* " 3.—Milk.
* " 4.—Distillery Slop.
* " 5.—Analyses of Feeding-Stuffs.
" 6.—Clover.
* " 7.—Fertilizers.
* " 8.—Experiments with Wheat. Sept. 25, 1886.
" 9.—Experiments with Potatoes March 1, 1887.
* " 10.—Fertilizer Analyses. May, 1887.
" 11.—Wheat Experiments. September, 1887.
* " 12.—Fertilizer Analyses. Dec. 31, 1887.
" 13.—Commercial Fertilizers. April, 1888.
" 14.—Analyses of Commercial Fertilizers. July, 1888.
" 15.—Wheat Experiments. September, 1888.
* " 16.—Potato Experiments. December, 1888.
" 17.—Corn Experiments. February, 1889.
" 18.—1. Hemp Experiments. 2. Notes on the Treatment of an Old Apple Orchard. April, 1889.
" 19.—Experiments in Pig Feeding. May, 1889.
" 20.—Commercial Fertilizers. July, 1889.
* " 21.—Wheat Experiments. The Grain Louse. September, 1889.
" 22.—Potato Experiments. December, 1889.
" 23.—1. Experiments with Oats. 2. Tests of Fertilizers on Meadow Land. February, 1890.
" 24.—Broom-Rape of Hemp and Tobacco. March, 1890.
" 25.—Strawberries. April, 1890.
" 26.—Corn Experiments. April, 1890.
" 27.—Experiments with Commercial Fertilizers on Hemp. April, 1890.
" 28.—Tobacco Experiments. May, 1890.
" 29.—Commercial Fertilizers. July, 1890.
" 30.—Wheat Experiments. A new Wheat Insect. August, 1890.
" 31.—Some Strawberry Pests. December, 1890.
" 32.—Strawberries. Vegetables. March, 1891.
" 33.—Corn Experiments. April, 1891.
" 34.—Commercial Fertilizers. August, 1891.
" 35.—1. Experiments with Wheat. 2. Experiments with Oats. September, 1891.
* " 36.—Commercial Fertilizers. December, 1891.
" 37.—Experiments with Potatoes. December, 1891.
" 38.—1. Vegetables. 2. Strawberries. March, 1892.
" 39.—Marls. March, 1892.

No. 40.—Some Common Pests of the Farm and Garden. March, 1892
" 41.—Commercial Fertilizers. July, 1892.
" 42.—1. Experiments with Wheat. 2. Experiments with Oats. September, 1892.
" 43.—Commercial Fertilizers. December, 1892.
" 44.—Bordeaux Mixture for Apple Pests. January, 1893.
" 45.—Field Experiments with Fertilizers. 1. Corn. 2. Potatoes. 3. Tobacco. April, 1893.
" 46.—Commercial Fertilizers. August, 1893.
" 47.—1. The Pests of Shade and Ornamental Trees. 2. An Experiment on Plum Rot. December, 1893.
" 48.—Commercial Fertilizers. January, 1894.
" 49.—1. Destructive Locusts in Kentucky. 2. The Bud-Worm of Tobacco. March, 1894.
" 50.—1. Fruit Growing in Kentucky. 2. Notes upon Vegetables. April, 1894.
" 51.—Commercial Fertilizers. August, 1894.
" 52.—Commercial Fertilizers. 1. Official Analyses. 2. Analyses of Farmers' Samples and Samples Collected by Deputy Inspectors. December, 1894.
* " 53.—1. Spraying for Codling Moth. 2. The use of Arsenites on Tobacco. 3. The use of Bisulphide of Carbon and Hydrocyanic Acid Gas on Low Growing Plants. December, 1894.
" 54.—Notes on Vegetables. March, 1895.
" 55.—Field Experiments with Fertilizers. 1. Corn. 2. Potatoes. 3. Tobacco. 4. Hemp. April, 1895.
" 56.—Analyses of Commercial Fertilizers. August, 1895.
" 57.—1. Wheat Experiments. 2. Oat Experiments. September, 1895.
" 58.—Cut Worms in Kentucky. November, 1895.
" 59.—Spraying Experiments in 1895. December, 1895.
" 60.—Analyses of Commercial Fertilizers. 1. Official Analyses. 2. Analyses of Farmers' and Inspectors' Samples. December, 1895.
" 61.—Potatoes. 1 Experiments with Fertilizers. 2. Insects and Fungus Pests. 3. Tests of Varieties. March, 1896.
" 62 —Stawberries. March, 1896.
" 63.—Tobacco. May, 1896.
" 64.—Analyses of Commercial Fertilizers. July, 1896.
" 65.—Analyses of Commercial Fertilizers. 1. Official Analyses. 2. Analyses of Other Samples. December, 1896.
" 66.—Tobacco. February, 1897.
" 67.—The San Jose Scale in Kentucky. May, 1897.
" 68 —Analyses of Commercial Fertilizers. May, 1897.
" 69.—Wheat. 1. Test of Varieties. 2. Test of Fertilizers. 3. Descriptions of Varieties. 4. Treatment for Smut. September, 1897.

No. 70.—1. The Woolly Mullein. 2. The Gape Disease of Poultry. December, 1897.

" 71.—Analyses of Commercial Fertilizers. 1. Official Analyses. 2. Analyses of Other Samples. December, 1897.

" 72.—Potatoes. 1. Experiments with Fertilizers. 2. Corrosive Sublimate and Sulphur for Potato Scab in 1896. 3. Corrosive Sublimate for Potato Scab in 1897. February, 1898.

" 73.—Strawberries. February, 1898.

" 74.—1. The Chinch Bug. 2. Earthworms a Source of Gapes in Poultry. May, 1898.

" 75.—Commercial Fertilizers. June, 1898.

" 76.—Commercial Fertilizers. August, 1898.

" 77.—Wheat. 1. Test of Varieties. 2. Test of Fertilizers. 3. Notes and Descriptions. 4. Red Rust of Wheat. September, 1898.

" 78.—Ginseng, its Nature and Culture. November, 1898.

" 79.—Commercial Fertilizers. December, 1898.

" 80.—1. Some Pests Likely to be Disseminated from Nurseries. 2. The Nursery Inspection Law. March, 1899.

" 81.—1. A Method of Avoiding Lettuce Rot. 2. Potato Scab Experiments. March, 1899.

" 82.—Commercial Fertilizers. July, 1899.

" 83.—Wheat. 1. Experiments with Fertilizers. 2. Variety Tests. 3. Notes and Descriptions. August, 1899.

" 84.—The Elms and Their Diseases. November, 1899.

" 85.—Commercial Fertilizers. December, 1899.

" 86.—Inspection and Analyses of Foods. January, 1900.

" 87.—1. Kentucky Forage Plants—The Grasses. 2. Analyses of Some Kentucky Grasses. May, 1900.

* " 88.—Commercial Fertilizers. August, 1900.

" 89.—Wheat. 1. Test of Varieties. 2. Test of Fertilizers. 3. Descriptions of Varieties. September, 1900.

* " 90.—Commercial Fertilizers. December, 1900.

" 91.—1. Enemies of Cucumbers and Related Plants. 2. Experiments with Potato Scab. 3. The Food of the Toad. March, 1901.

" 92.—Grapes. April, 1901.

" 93.—1. Diseases of Nursery Stock. 2. Rabbits and Their Injuries to Young Trees June, 1901.

" 94.—Wheat. 1. Test of Varieties. 2. Descriptions of Varieties. September, 1901.

" 95.—Commercial Fertilizers. September, 1901.

" 96.—1. The Hessian Fly. 2. Dangerous Mosquitoes in Kentucky. 3. Poisonous and Edible Mushrooms. November, 1901.

" 97.—Commercial Fertilizers. December, 1901.

" 98.—1. Kentucky Forage Plants—The Clovers and Their Allies. 2. Notes on True Grasses in the Plots in 1900–1901. 3. Analyses of Forage Plants from the Plots. February, 1902.

" 99.—Oats. 1. Test of Varieties. 2. Treatment for Smut. 3. Test of Fertilizers. 4. Relative Value of the Varieties for Feeding. April, 1902.

" 100.—Inspection and Analyses of Foods. February, 1902.

" 101.—A Comparison of Feeds for Pigs. May, 1902.

" 102.—Commercial Fertilizers. September, 1902.

KENTUCKY

Agricultural Experiment Station

OF THE

State College of Kentucky.

BULLETIN NO. 103.

HESSIAN FLY EXPERIMENTS.

LEXINGTON, KENTUCKY.
December, 1902.

KENTUCKY

Agricultural Experiment Station.

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Address of the Station—LEXINGTON, KY.

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

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

ADDRESS:

KENTUCKY AGRICULTURAL EXPERIMENT STATION,

LEXINGTON, KY.

Bulletin No. 103.

HESSIAN FLY EXPERIMENTS.

By H. Garman, Entomologist and Botanist.

It is now possible to complete the report on experiments made during 1901–1902 with reference to Hessian fly injury in its relation to the time of planting wheat. Statements concerning the benefit resulting from early planting have hitherto been based very largely or entirely on the results of the general practice of farmers. Wheat growers themselves sometimes contradict the assertion that late planting is a means of avoiding injury, basing their opinion on isolated cases of good crops having been obtained from very early-sown seed. Such crops are undoubtedly sometimes obtained, but if we knew all the circumstances an explanation could, in many of the cases, be given entirely consistent with the common opinion that late planting is the better practice. The following record continues and completes the partial report published in Bulletin 96.

Eight plots of Hungarian wheat were planted in the fall of 1901, one week apart, on the following dates: September 26, October 3, 10, 17, 24, 31, November 7, 14. The plots occupied one twenty-second of an acre of ground each. The land was in barley in the spring of 1901, and was already infested with Hessian fly. While a primary object of the experiments was to ascertain the time at which wheat might be planted so as to escape the fly, it was hoped that they might also throw some light on the question as to how late wheat may be planted and yet escape injury from freezing—a question that is so in-

timately bound up with the former that it must be considered in any effort to get facts that will serve as a basis for recommendations as to practice.

Effect of the Winter on the Plantings.

Wheat planted in Kentucky in the fall of 1901 did not give as good a crop as usual. Some farmers attributed this to late planting and bad winter weather—especially to a heavy sleet storm that occurred in January—while others think the fly took it, notwithstanding the lateness with which most of it was planted. But if the winter was the chief cause of the general failure, our later plantings should have suffered most, whereas they suffered no more, as far as was visible, than the others. Furthermore, the late plantings were not injured at all in the fall by the fly. From observations made on these plots and others on the Experiment Farm, as well as on wheat growing on farms in the vicinity, it is plain that the general failure was largely the result of bad weather at the time of planting. The month of October was very dry, the rainfall being well below the average for the month. Only two fully cloudy days were recorded by the local weather station for the month. The variety plantings on the Farm have always done well whenever wheat is good in this part of the State, but in 1901 came the nearest failing they have ever done. The seed lay for a long time in the ground, owing to drought; then came a beating rain, leaving a crust on the surface, through which the plants that developed emerged with difficulty and but tardily. Such as pushed through grew very well afterward and were not harmed perceptibly by winter weather. In this case, again, the fly had nothing to do with the failure in the fall and winter, for the seed was planted after most of the adult flies had disappeared. Considering, therefore, facts of all sorts that came under my observation, it was concluded that failure to secure a good crop in the spring of 1902 was due more to conditions at the time of planting than either to the winter weather or to injury by fly.

Relative Condition of the Plantings.

During the fall there was a wide difference between the wheat

of our different plantings, due in part to the work of the fly and partly to the conditions of weather and soil at the time of, and immediately following, the planting of the seed.

Of course, in general, the early-sown wheat grew ahead of the rest, but earliness of planting was proved not to be the only factor in furthering the growth of the young plants.

Even though the soil might be very dry, the wheat came up promptly and did well afterward if rain followed the planting. But if no rain followed, the seed lay in the soil longer without germinating; and, if the drought was long-continued, the stand of plants was likely to be poor. Similarly, if the soil was very wet when the seed was sown, the stand was less perfect than if the planting was done when the soil was in better condition. The result was that some of the plots sown rather late were better than others sown earlier, in cases where neither were affected by the fly.

After the three last plantings (on October 31 and November 7 and 14) the weather was not suitable for growth. On October 31 the average temperature was 62° F., but sank to 85° on the following day. On the 7th of November the mean temperature was 46°, and on the 14th it was 38°. The average for the month was 40.2° F. The wheat in these three later plots was not visible as late as the 20th of November, but subsequently the tips of some of the plants could be discerned along the drilled rows. In the spring, to my surprise, these two latest plots showed a very good stand of plants, though they remained somewhat behind the others, and were harvested eleven days after the three earliest. The planting of October 31 never did show a good stand of plants.

As showing the condition of the plantings in the spring, the following is taken from notes made May 12, 1902:

Planting of September 26—Average height about 12 inches; stand not as good as in the next.

Planting of October 3—Average height 18 inches; better than the preceding; tallest of all the plantings.

Planting of October 10—Average height 16 inches; good, though not quite as tall as the planting of October 3.

Planting of October 17—Average height 12 inches; not

quite as tall as planting of October 10, but good; one row wanting, owing to failure of the drill.

Planting of October 24—Average height 12 inches; good, but not quite equal to the planting of October 17.

Planting of October 31—Average height 10 inches; plants scattering and small; the poorest stand of all.

Planting of November 7—Average height 10 inches; stand good, considering lateness.

Planting of November 14—Average height 9 inches; quite uniform; a rather better stand than in preceding planting.

The differences in the heights of the plantings continued well toward harvest time, as the notes following, made May 31, show:

September 26—Scattering; headed out, but uneven in height; 25 inches high.

October 3—Fully headed out; even; 36 inches high.

October 10—Headed out; even; 36 inches high.

October 17—Headed out; even; 32 inches high.

October 24—Mostly headed out; uneven; 26 inches high.

October 31—Scattering; uneven; some heads; 18 inches high.

November 7—Heading out; even; 24 inches high.

November 14—Heading out; even; 26 inches high.

When some of the plantings were nearly ready to harvest the following notes were made (June 10). Contrary to my expectation they show not only that the late plantings were slower than the others in ripening, but that the earliest of all (that of September 26) was later than October plantings. This is to be attributed to the fact that in the September planting some stalks were killed outright by the fly, and others pushed up to take their places, thus making the growth uneven and in general later than in plots where less injury of this sort was done:

September 26—Thin and not ripening.

October 3—Very good; heads becoming yellow.

October 10—Perhaps the best; maturing.

October 17—About like planting of October 3.

October 24—Not as good as preceding.
October 31—Thin and not good.
November 7—Fair; not ripening.
November 14—One of the best; not ripening.

Yield and Quality of Grain.

While the yield was not large for any of the plots, the relative yields are perhaps as significant as they would have been if they had been greater. The three earliest plots (of September 26, October 3 and October 10) were harvested June 26. The two next (October 17 and October 24) were cut July 2. The three latest (October 31, November 7 and November 14) were cut July 7. All of the wheat was threshed July 10.

Planting of September 26—16 pounds.
Planting of October 3—40 pounds.
Planting of October 10—28 pounds.
Planting of October 17—30 pounds.
Planting of October 24—20 pounds.
Planting of October 31—8 pounds.
Planting of November 7—24 pounds.
Planting of November 14—28 pounds.

The best yield was thus at the rate of but 14 bushels per acre, while the worst was at the rate of somewhat less than 3 bushels per acre. But it must be noted that the latest planting was one of the best in the matter of yield, while the earliest planting was one of the two worst.

It seems to me that, so far as mere weight of yield is concerned, the late plantings have done about as well as the others.

When the quality of the wheat from the different plots is considered, it appears that the plantings of October 3, 10, 17 and 24 stand first, while the planting of October 31 proves decidedly the poorest. The plot producing the most wheat also produced the best, though the differences between wheats from the plantings of October 3, 10 and 17 were so slight as to be scarcely worthy of consideration. Wheat from each plot was submitted to Mr. W. W. Patterson, of the Lexington Roller Mills, for rating, and his judgment is given below. My own

rating is given beside it, and was made without knowledge of Mr. Patterson's conclusions. Being based in part on data to which he did not have access, the closeness of the two is quite surprising. The weight of 10 cubic centimeters of each wheat is also given, and will be observed to verify in a general way the ratings.

Date planted.	Mr. Patterson's rating.	Author's rating.	Weight of 10 cc.
September 26	3rd	4th	7.4 grams
October 3	1st	1st	7.6 "
October 10	4th	3rd	7.5 "
October 17	2d	2d	7.6 "
October 24	5th	5th	7.3 "
October 31	8th	8th	6.8 "
November 7	7th	7th	7.5 "
November 14	6th	6th	7.3 "

That the grain from the planting of October 3 was best there could be no question. The seeds were larger, plumper, and with no defective ones. In all the other lots some shriveled seeds could be found, and were especially numerous in the wheat planted October 31, the lightest—bulk for bulk, as well as absolutely—of all. Wheat from the two latest plantings did not prove as good when closely scrutinized and weighed as was expected. It was not quite as plump as that of most of the early plantings, and did not seem as well matured. It was cut a little early, I think, and on this account, while the evidence points to the inference that very late planting will result in inferior grain, I am disposed to suspend judgment on this point until more evidence is secured. A single test is not sufficient basis for a conclusion.

Injury by Fly in the Fall.

When it was reported in Bulletin 96 of this Station that on November 6, 1901, the planting of September 26 showed 33 per cent. of its plants infested with fly; that the planting of October 3 showed 1 per cent. infested, and that none of the other plantings were infested at all, it was supposed, as then suggested, that later examinations would prove that other plots

than the two named were infested also. This seemed probable because Hessian fly eggs were found November 1 on wheat planted October 17, and as this wheat was not up on October 26, some adult fly must have been abroad after the latter date. But it seems now that the eggs laid late in the season did not hatch, and consequently the percentages of injury remained practically unchanged in the plots after the date of my first examination (November 6). A thorough examination was made March 10, 1902, while the wheat was still in a dormant hibernating condition. At this time 30 per cent. of the plants from the September 26 planting was infested with flaxseeds; 9-10 of 1 per cent. of the planting of October 3 was infested, one of the specimens found being still a larva. Neither larvæ nor flaxseeds were found in any of the later plantings.

Plots of wheat were planted again on the same ground in the fall of 1902, beginning on the 15th of September. The season has been more open than in 1901, the first touch of winter coming on the 25th and 26th of November, yet the results of examinations of the different plantings of wheat confirm, in a general way, those made in the winter of 1901–1902. The first two plots were examined on November 21 and the remainder on November 28, 1902.

Planting of September 15—37 per cent. infested.
Planting of September 22—38 per cent. infested.
Planting of September 29—12 per cent. infested.
Planting of October 6—2 per cent. infested.
Planting of October 13—None infested.
Planting of October 20—None infested.
Planting of October 27—None infested.

Injury by Fly in the Spring.

What is the influence of fall-infested wheat on non-infested plantings beside it during the spring? How far does the fly spread in a season from such infested wheat? These questions were suggested by the examinations made during the fall and winter, and have a practical interest for every grower of wheat. It should be stated that the plantings formed one continuous

block, the consecutive plots being separated by a strip scarcely wider than that separating the drilled rows, with the earliest planting at one end of the block and the latest at the other. An examination made May 12, 1902, showed that the condition of the wheat with reference to Hessian fly injury had changed after the emergence of the winter brood, and that the insects had spread from the planting of September 26 to the other plantings, the extent of the injury in them being in proportion to their nearness to the early planting. The flaxseeds found at this time were still white in the majority of cases, and represented a spring brood.

Planting of September 26—40 per cent. infested.
Planting of October 3—37 per cent. infested.
Planting of October 10—23 per cent. infested.
Planting of October 17—24 per cent. infested.
Planting of October 24—22 per cent. infested.
Planting of October 31—14 per cent. infested.
Planting of November 7—17 per cent. infested.
Planting of November 14—10 per cent. infested.

The injury, it will be observed, does not diminish regularly; but this could hardly be expected. Subsequently, on June 15, wheat from the plots was examined by an assistant, and while the percentages found were smaller than those obtained by me early in the season, they show the relative injury to be about the same. The flaxseeds found at this time appear to represent a second spring brood—the one that continues the fly during the summer.

Planting of September 26—32 per cent. infested.
Planting of October 3—25.7 per cent. infested.
Planting of October 10—15 per cent. infested.
Planting of October 17—12.8 per cent. infested.
Planting of October 24—1.6 per cent. infested.
Planting of October 31—5 per cent. infested.
Planting of November 7—4 per cent. infested.
Planting of November 14—6.6 per cent. infested.

The inference that may be drawn from these facts is that wheat that has escaped the fall injury will be injured in the spring proportionately to its nearness to fall-infested wheat.

Yet it would be unsafe to assert that an isolated field of late planted wheat will never be severely injured. Though small and fragile, the adult Hessian fly shows a surprising activity, and, aided by winds, is no doubt at times disseminated long distances from the fields in which it emerges. As an example it may be mentioned that a small isolated planting on the Experiment Farm became infested in the spring to the extent of 20 per cent. The infested wheat nearest to this planting must have been a quarter of a mile away, but it is possible that the adults that visited it came from flaxseeds in straw at a barn near by.

Dusting and Spraying for Hessian Fly.

It is sometimes claimed that applications of lime, Paris green and other materials have a beneficial effect in deterring the fly from placing its eggs on wheat. The use of lime dusted on the plants has been especially recommended. On September 22, 1902, in addition to an untreated plot, two additional plots were sown. Subsequently one-half of one of the plots was dusted with air-slaked lime, another was sprayed with lime and Paris green in water, a third with Bordeaux mixture, and a fourth with coal-oil emulsion. Each half plot contained 1-44 acre.

Dusting with Lime.—The first application was made October 4, when two pounds of lime were used. On October 13 two pounds more were sown over the plants. The third and last application was made October 20, when two pounds were used.

Twenty-five per cent, of the wheat was found to be infested with fly when it was examined November 28.

Lime and Paris Green.—The spray used consisted of one pound of Paris green, two pounds of lime and 140 gallons of water. One and a half gallons of this mixture were used on each of the dates October 4, 13 and 20.

Thirty-one per cent. was infested on November 21.

Bordeaux Mixture.—The mixture used consisted of six and a half pounds of bluestone, three and a half of lime, and 32

gallons of water. One and a half gallons were applied on each of the following dates: October 4, 13 and 20.

Nineteen per cent. was infested on November 28.

Coal-oil Emulsion.—The emulsion consisted of one-half pound of whale-oil soap in one gallon of water, churned with two gallons of coal-oil. One part of this was used with nine of water. Applications were made on the same dates as in the other treatments, one and a half gallons of the diluted emulsion being used each time.

Nine per cent. was infested November 21.

The untreated wheat planted on September 22 was infested, as will be remembered, to the extent of 38 per cent. All of the treated lots may thus be supposed to have been benefited. But in the case of the plots treated respectively with lime by dusting, and with lime and Paris green in a spray, the reduction in the per cent. of injury is so slight as to indicate that the treatment is of no practical value. The reduction from spraying with Bordeaux mixture is much more decided, and indicates that this material could profitably be used on wheat. Its chief value is, of course, as a fungicide, and it was only used on the wheat with the idea that if lime alone was beneficial, this mixture should prove still better. It remains to be seen to what extent it acts as a check on the red rust. Of all the materials used, coal-oil alone approximates a complete remedy. The reduction of the injury to 9 per cent. is most gratifying, and is quite surprising, considering the difficulty of reaching all parts of the plants with a spray. It is probable that it checks the injury in part by destroying the eggs.

Deep Plowing to Destroy the Hessian Fly.

It seems likely that an insect as small and fragile as the Hessian fly may be destroyed by burying it so deep in the soil that the adult cannot make its way out. Badly infested wheat must sometimes be plowed up to make a place for something else. May it not be possible to destroy the fly at the same time by very deep plowing? If good is to be accomplished, stubble

might be so treated in some cases. Just to see what the indications were, I had one of my assistants gather in August, 1902, a number of flaxseeds and place them at different depths in soil in the Vivarium. The fly was so badly parasitized at the time that only a few living flaxseeds could be secured. Five lots of fifteen flaxseeds each were buried, one at a depth of two inches, another at three, a third at four, a fourth at five, and the last at six inches. From the result recorded below it would appear that plowing to a depth of six inches would greatly reduce the numbers of emerging flies.

DEPTH	August								Sept.	Emerged
	15	16	17	18	19	20	21	22	24	
2 inch.	1					1		1	2	33 %
3 inch.	2	2		2				1		46⅔ %
4 inch.				1						6⅔ %
5 inch.										None
6 inch.										None

The Fly in the Vivarium.

The only difference between the fly indoors and out that attracted special attention was in rate of development. Broods kept indoors were always somewhat ahead of those in the field, the time depending on the condition of the weather out of doors.

Number of Broods Developed During the Season.

The brood that developed to the flaxseed stage in the fall emerged in the field as adults from about April 21 to April 24. This is to be styled the winter brood.

The adults laid eggs at once for the first spring brood, which developed very rapidly, and was observed to be adult from May 21 to May 24. These adults in turn laid eggs for the second spring brood, and were observed partly in the grub and partly in the flaxseed stage on June 3 and 4, and remained in the flaxseed stage when the wheat was cut. Provided no broods developed during the summer on volunteer plants, this gives but three broods for the year. I am disposed to consider

this the full number for this region, though from a pressure of other duties it has not been possible to give the subject the continuous attention during the summer that could be desired.

Hessian Fly in Barley.

The experimental wheat plots were planted in 1901 on land that had been the previous spring in infested barley. In the spring of 1902 barley was planted next the plots of wheat, and it was found that when the adult flies emerged they spread from the wheat to the barley. From my observation thus far I should say the fly attacked this grain as freely as it does wheat.

The Fly in Rye.

But the fly does not attack rye freely. It happened that some rye had been used in our drill previous to planting the first wheat plot in the fall of 1901, and a small quantity in the seed-trough was overlooked when sowing the wheat. The rye came up pretty evenly scattered among the wheat. and in the spring of 1902 was pulled up and examined for flaxseeds. Not a single one was found, although the wheat in the midst of which the rye grew was badly infested. Rye in the regular plantings on the Farm has also been examined from time to time, and in no case has fly been found on this cereal. It is my present opinion, therefore, that one need not fear the attacks of the fly on this grain.

The Joint-Worm in the Experimental Wheat.

In looking over the large numbers of wheat plants necessary to get percentages of Hessian fly injury during the spring, the larvæ, pupæ and adults of a joint-worm were frequently encountered within the swollen bases of the stems. They were not observed at all during the fall. The first larvæ observed were found May 3. The stems infested by this insect could always be distinguished from those occupied by the fly by the swollen condition of the stem itself, the worm occupying the interior of the swollen portion, instead of being crowded in

behind the sheaths of the blades. Infested stems were invariably destroyed by the attack. On May 12, 1902, the insect was found chiefly in the pupa stage, with occasional larvæ and some adults that had not yet escaped. All but one of the experimental plots were infested, but unevenly so, as will appear from the following record made at the time:

Planting of September 26—20 per cent. infested.
Planting of October 3—5 per cent. infested.
Planting of October 10—10 per cent. infested.
Planting of October 17—17 per cent. infested.
Planting of October 24—21 per cent. infested.
Planting of October 31—8 per cent. infested.
Planting of November 7—None infested.
Planting of November 14—2 per cent. infested.

The adults were found to be common on the blades May 17, when many examples were collected by sweeping. They were still to be taken from the blades on May 21. I consider the insect found here to be the *Isosoma grande*, first described by C. V. Riley, and subsequently noticed by Professor S. A. Forbes in his third annual report (1885, p. 34) as State Entomologist of Illinois. In color my material agrees with the descriptions of these authors, but my specimens, preserved dry and in fluid, are smaller, in no case reaching a length of four millimeters, averaging about 3.7mm. With one exception all of the many specimens collected are winged. The single wingless example measures but 2 millimeters in length, and appears to pertain to the species long known under the name *Isosoma tritici*.

Summary.

The observations and experiments thus far made in the field and in the Vivarium point to the following conclusions, though they are not considered final results:

1. To escape severe fall injury from the fly wheat should not be planted in this part of Kentucky before the 6th of October. The 8th or 10th of this month will probably prove safer dates during very mild falls.

2. Wheat that, from late planting, has escaped fall injury

entirely may, the following spring, be badly damaged if it stands near infested wheat.

3. Very deep plowing will destroy many of the flies in infested stubble.

4. Spraying with dilute coal-oil emulsion reduces injury from the fly.

5. Spraying with Bordeaux mixture reduces injury, but not as decidedly as the emulsion.

6. Lime and Paris green in water, and dry lime alone, are of no practical benefit.

7. Barley is as susceptible to attack as wheat.

8. Rye is but little, if at all, injured by Hessian fly.

9. Three annual broods of the fly develop in Eastern Kentucky.

KENTUCKY

AGRICULTURAL EXPERIMENT STATION

OF THE

STATE COLLEGE OF KENTUCKY.

BULLETIN NO. 104.

COMMERCIAL FERTILIZERS.

LEXINGTON, KENTUCKY,
DECEMBER 31, 1902.
245

KENTUCKY

Agricultural Experiment Station.

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Address of the Station—LEXINGTON, KY.

NOTICE.

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

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

ADDRESS:

KENTUCKY AGRICULTURAL EXPERIMENT STATION,

LEXINGTON, KY.

Bulletin No. 104.

Analyses of Commercial Fertilizers.

Number of Brands. There were 334 different brands of commercial fertilizers registered during the year 1902. Of these, 184 were complete fertilizers, or fertilizers containing all three of the essential ingredients, namely: phosphoric acid, nitrogen and potash; 41 were acid phosphates; 8 contained a mixture of acid phosphate and nitrogen compounds only; 45 acid phosphates and potash salts only; and 56 were classed as bones or tankage.

Samples Collected and Analyzed. Four hundred and fifty-nine samples were collected by deputy inspectors or sent by farmers from various parts of the State and 370 were sent in by firms as official samples; of these samples, 673 have been analyzed by the Station. Many of these analyses have already been published in Bulletin No. 102 and are not repeated here. The 156 samples not analyzed were duplicates collected by different deputy inspectors working in different places at the same time. In some instances as many as 4 or 5 samples of the same brand were collected.

Results of the Analyses. The results of the analyses show that of the 173 samples analyzed since the publication of Bulletin No. 102, 28, representing 27 brands and 17 firms, fell so far below the guaranteed analyses in phosphoric acid, nitrogen or potash, or any two, or all three of these ingredients, that this could not be accounted for by variations in sampling or analysis. Adding to these the 55 samples reported in Bulletin No. 102, we have 83 samples which fell so far below the

guaranteed analyses that attention should be called to this fact. It is probable that in most cases variations can be accounted for by hurried or careless mixing at the factories, or gross mistakes in shipping one brand for another, but in several instances the results show apparently a desire on the part of the manufacturer to guarantee more than the goods contain.

The great majority of the manufacturers, however, have furnished in most instances fertilizers fully up to, and often better than the guarantee.

The following table gives the manufacturers who have registered fertilizers in this State since August 20, or whose fertilizers have been sampled and analyzed since that date. It shows also the number of samples analyzed of each firm's fertilizers, and in how many of these samples there was a serious deficiency of either phosphoric acid, nitrogen or potash, and in how many the percentages of these constituents are such as to be acceptable, from the point of view of the buyer, either because they equal or exceed the percentage guaranteed by the manufacturer, or because a slight deficiency in one constituent is, in the Director's judgment, fully made up by an excess in one or both of the others. Under the heading, "Relative Value Per Ton," is shown in how many instances the "estimated value per ton," calculated from our analysis, equals or exceeds the value calculated from the manufacturer's minimum guaranteed analysis, and in how many it is too low, reasonable allowance having been made for unavoidable variations. This table should be carefully studied. It concisely reviews each firm, showing how the samples of fertilizers taken from various places in the State compare with what was guaranteed. In order, however, to see the amount of variations from the guaranteed analyses, this table should be studied in connection with the table of results of analyses. This table can be easily referred to, as the names of the firms are arranged in alphabetical order.

NAME OF MANUFACTURER.	No. of Samples Analyzed.	Phosphoric Acid.		Nitrogen.		Potash.		Relative Vaue per Ton.	
		No. Acceptable.	No. Too Low.	No. Acceptable.	No. Too Low.	No. Acceptable.	No. Too Low.	No. Acceptable.	No. Too Low.
American Agricultural Chemical Co., Cleveland Dryer Works	4	4	0	3	0	2	1	4	0
American Agricultural Chemical Co.	1	1	0	1	0	0	0	1	0
The Armour Fertilizer Works	6	6	0	4	0	2	1	6	0
Peter Backer & Son	1	1	0	1	0	0	0	1	0
The Buckeye Phosphate Co.	5	5	0	4	0	5	0	5	0
The Chicago Fertilizer Co	4	4	0	4	0	3	1	4	0
The Cincinnati Phosphate Co.	2	2	0	1	0	1	1	2	0
Continental Fertilizer Co.	6	6	0	4	0	3	1	6	0
The Currie Fertilizer Co.	3	3	0	3	0	2	0	3	0
Duncan & Bro.	4	4	0	4	0	1	1	4	0
The Empire Guano Co.	4	4	0	1	0	2	0	4	0

NAME OF MANUFACTURER.	No. of Samples Analyzed.	Phosphoric Acid		Nitrogen.		Potash.		Relative Value Per Ton.	
		No. Acceptable.	No. Too Low.	No. Acceptable.	No. Too Low.	No. Acceptable.	No. Too Low.	No. Acceptable.	No. Too Low.
Fox Chemical Co	10	10	0	6	0	5	2	10	0
Furman Farm Improvement Co	1	1	0	0	0	0	0	1	0
Globe Fertilizer Co	10	8	2	8	0	5	2	10	0
The Hardy Packing Co	2	2	0	2	0	1	0	2	0
The Jarecki Chemical Co	7	7	0	4	0	3	2	7	0
J. B. Jones	1	1	0	1	0	0	0	1	0
The Jones Fertilizing Co	7	5	2	6	0	4	0	7	0
Kaufman Fertilizer Co	4	4	0	3	0	3	0	4	0
Louisville Fertilizer Co	10	10	0	7	0	5	0	10	0
Michigan Carbon Works	6	6	0	5	0	3	0	6	0
Nelson Morris & Co.	5	4	1	5	0	3	0	5	0

National Fertilizer Co	11	8	3	6	0	6	3	9	2
North-Western Fertilizing Co	6	6	0	4	0	3	0	6	0
The Ohio Farmers Fertilizer Co.	5	5	0	2	1	3	0	5	0
Packers Fertilizer Association	2	2	0	1	0	1	1	1	1
Queen City Fertilizer Co	2	2	0	1	0	2	0	2	0
Read Phosphate Co	12	12	0	9	0	8	1	12	0
Singer & Johnson Fertilizer Co	3	3	0	1	2	3	0	3	0
Standard Guano and Chemical Mfg. Co	1	1	0	1	0	0	0	1	0
Swift & Co	9	9	0	8	0	5	0	9	0
Tennessee Chemical Co	8	8	0	4	0	4	0	8	0
Virginia-Carolina Chemical Co. (S. W. Travers & Co., Branch)	2	2	0	0	0	1	0	2	0
Virginia-Carolina Chemical Co. (Memphis Division)	5	4	1	3	0	2	0	5	0

It is evident from the preceding table that while most of the fertilizers examined ran above the minimum guarantee, yet a thorough and careful inspection seems essential. It is hoped that farmers will generally take advantage of Section 8 of the fertilizer law, and when they purchase fertilizers, at least in quantity, that they will take a sample in accordance with Section 8 and send it to the Station for free analysis.

Essentials in taking a Sample. 1. Take it at the time of purchase, and if possible in the presence of agent or seller. 2. Take a sample from not less than two bags, and from one additional bag for every ten purchased; mix these samples carefully and take at least a pint of this mixed sample, put it into a fruit jar, seal, box and express to M. A. Scovell, Director, Lexington, Ky. 3. Take the sample in the presence of at least one witness, and have the witness sign the required certificate. 4. The certificate for free analysis to be sent *by mail* and should be in accordance with the law as given in Section 8.

If the sample is taken in accordance with the above directions it may be sent by express and the charges will be paid by the Station.

Form of Certificate. A good form of certificate is the following, and blank certificates will be sent free to any farmer requesting the same.

CERTIFICATE FOR FREE ANALYSIS.

.....190

M. A. SCOVELL, Director, Lexington, Ky.:

This is to certify that I am not a dealer in, or agent for the sale of any fertilizer, and that the fertilizer, a sample of which I have sent by express to you for free analysis, was purchased by me.....190 for my own use and not for sale.

I further certify that the sample was taken at the time of purchase from at least 10 per cent. of the sacks or other packages, comprising the whole lot purchased, and that it was taken

as provided in Section 8 of the fertilizer law, in the following described manner, to-wit: .....

.....

.....

.....

.....

.....

Upon receipt of the analysis from you, I agree to furnish you with a tag taken from one of the sacks sampled, the name and address of the firm or agent of whom the fertilizer was purchased, and the amount purchased.

(Signature) .....

(P. O. Address) .....

Signature of Witnesses :

.....

.....

Should, however, any farmer desire to take a sample and not have a blank certificate at hand, he may write one in full like the form above given, or take the sample in presence of seller and witness and so mark it that he can identify it subsequently in a certificate, and send it at once to the Experiment Station with the request that the Station furnish form of certificate, such certificate to be filled out upon receipt covering the sample and properly signed by sender and witnesses and sent by return mail to the Station.

Section Providing for Free Analysis. The Section of the Fertilizer Law, providing for the taking of samples for free analysis is as follows :

SEC. 8. Any person not a dealer in, or agent for the sale of any fertilizer who may purchase any commercial fertilizer in this State for his own use and not for sale, may take a sample of the same for analysis, which analysis shall be made by the said Experiment Station free of charge. Such sample for free analysis shall be taken by the purchaser in the presence of the person, company or agent selling the fertilizer from at least ten (10) per cent. of the sacks or other packages comprising the

whole lot purchased, and shall be thoroughly mixed and at least one pound of the material after mixing must be put into a jar or can, securely sealed and marked in such a way as to surely identify the sample and show by whom it was sent, without giving the name of the fertilizer or the person from whom it was purchased, and must be forwarded to the Director of the Kentucky Agricultural Experiment Station, Lexington, Ky. The purchaser shall also send with the sample a certificate signed by himself and witness, or by two witnesses, stating that the sender has purchased the fertilizer for his own use and not for sale, and that the sample was taken in the manner prescribed in this section. Provided, however, that if the person, company or agent shall refuse to witness the taking of the sample, then the sample may be taken at the time of the purchase in the manner already described in the presence of two witnesses who shall certify to the manner of taking the sample. The purchaser shall preserve the official label from one of the bags or other packages sampled to be sent to the Director after having received the report of analysis of the sample, and at the same time he shall furnish to the Director the name and address of the firm of whom the fertilizer was purchased and the amount purchased; and any person having sent a sample for free analysis, under the provisions of this section, who shall, after having received the report of analysis of the same, refuse to furnish the required information, shall thereafter forfeit the privilege of free analysis of fertilizers under this section. But if any sample shall have been submitted for free analysis without all the requirements of this section having been complied with, the Director shall inquire into the case and may accept the sample for free analysis if he believes that it is a fair sample of the fertilizer as it was delivered to the purchaser.

Values Used.—In calculating the relative value per ton, the following values have been used:

Soluble and reverted phosphoric acid in mixed fertilizers	6c per lb.
Soluble and reverted phosphoric acid in plain acid and unacidulated phosphates	5c per lb.
Insoluble phosphoric acid in mixed fertilizers	2c per lb.
Insoluble phosphoric acid in plain acid phosphates	Nothing.
Phosphoric acid in fine bone	4c per lb.
Phosphoric acid in medium bone	3c per lb.

Fine bone is all that passes through a sieve with meshes one-twenty-fifth-inch square. Medium bone passes through a

sieve with meshes one-sixth inch square, but does not include fine bone.

Nitrogen in all fertilizers..... 15c per lb.
Potash in all fertilizers, from sulphate..... 6c per lb.
Potash in all fertilizers, from muriate..... 5c per lb.

The term "Potash from Muriate" does not indicate necessarily that the manufacturers used muriate of potash in furnishing the potash; they may have used sulphate of potash, or other salts of potash, but in all fertilizers where the term "Potash from Muriate" is used there is enough chlorine present to combine with the potash, either from salt in the tankage used, or the potash salts used, as muriate, kainit, carnalite, etc. As the objection to the use of muriate of potash arises from the chlorine present in this salt, it likewise follows that chlorine in a fertilizer is objectionable, whether put in with the potash or otherwise. The using of sulphate of potash where there is chlorine present in other ingredients of the fertilizer will not obviate the injurious effects of the chlorine, and therefore we take this method of showing chlorine present by designating the potash as "from muriate."

Explanation of the Table. In the table of analyses under the column headed "From Whom Obtained," all samples marked "Manufacturer" are those furnished by the manufacturer at the time the fertilizer was entered for sale. All other samples were collected by deputy inspectors or sent by farmers, The analysis guaranteed by the manufacturer follows the analyses of these other samples and is printed in *italic* figures.

The figures in the table which are set in bold face type are those results which, in the judgment of the Director, were too low to be acceptable. Where the total phosphoric acid in samples of bone is marked with (*) it indicates that the bone contains soluble phosphoric acid. This soluble phosphoric acid is an indication of either the addition of acid phosphate to the bone, in which case it would not be a pure raw bone, or else that the bone containing this soluble phosphoric acid was not strictly a pure or high grade bone, but contained trashy materials, which carried with them the soluble phosphoric acid.

The names of the manufacturers are arranged in alphabetical order, and all the analyses of the same brand have been grouped together.

TABLE OF ANALYSES.

Station Number	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	FROM WHOM OBTAINED.
	A. D. Adair and McCarty Bros., Atlanta, Ga. (See Furman Farm Improvement Co.)	
	Amer. Ag. Chem. Co., New York.	
	Clev. Dryer Works.	
10226	Horsehead Phosphate	O. A. Lutes & Co., Shepherdsv
10227	Ohio Seed Maker with Potash	H. L. Kirkpatrick, Penrod...
10228	Tobacco, Potato and General Crop Fertilizer	H. L. Kirkpatrick, Penrod...
10229	Phospho Bone	W. B. Jones, Stithton
	Amer Ag. Chem. Co., New York	
10230	Ground Bone	H. L. Kirkpatrick, Penrod...
	The Armour Fertilizer Works, Chicago, Ill.	
10232	Bone Meal	Peter Shearon, Kirk
10233	Raw Bone Meal	Ross & Duncan, Beard
10234	Grain Grower	Ross & Duncan, Beard
10235	Wheat, Corn and Oat Special	Grigsby & Co., Bardstown...
10236	Phosphate and Potash	Christmas & Cary, Glasgow
10237	Cereal Phosphate	O. A. Lutes & Co., Shepherdsv
	Peter Backer & Son, Troy, Ind.	
10243	Grower No. 9, Pure Raw Bone	John Snyder, Stithton

TABLE OF ANALYSES.

Pounds in the Hundred.													
Phosphoric Acid.										Potash.			
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.	Nitrogen.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
				10 92	0.31	11 23					$10.92	10226
		8.00	*2 00*	*10 00*		*12 00*					*10.00*	
				7 74	2 94	10 68	1 84	2.23	2 11		18 10	10227
		5 00	*3 00*	*8 00*		*10 00*	*1 65*	*2 00*	*2.00*		*17 35*	
				8 92	1.34	10 26	0.96	1 17	**2 92**		17 04	10228
		5.00	*3 00*	*8 00*		*10 00*	*0 82*	*1 00*	*4 00*		*16 86*	
				10 68	2 32	13 00	1 22	1 48	1.21		18 62	10229
		7 00	*3 00*	*10.00*		*12 00*	*0 82*	*1.00*	*1 00*		*16 26*	
15 03	7.74					22.77	2 65	3 22			24 61	10230
						20.00	*2 47*	*3 00*			*19 41*	
21.69	4.13					25 82	2.94	3.57			28 65	10232
						24 00	*2.47*	*3 00*			*21.81*	
17 33	9.33					26.66	3 55	4 31			30 11	10233
						22 00	*3.71*	*4 50*			*24 33*	
				7 41	2 26	9.67	1 60	1.94	2 06		16 65	10234
		6.00	*2 00*	*8.00*		*10 00*	*1 65*	*2 00*	*2 00*		*17 35*	
				7 84	0 41	8 25	0 84	1 02	1 16		13 25	10235
		5 00	*2.00*	*7.00*		*9 00*	*0 82*	*1.00*	*1 00*		*12 66*	
				12 66	4.64	17 30			**1 49**		18 54	10236
		6 00	*4 00*	*10 00*					*2 00*		*14.00*	
				11 98	2.14	14 12					11 98	10237
		6 00	*4 00*	*10.00*		*12 00*					*10.00*	
14.19	10.27					24 46	4 01	4 87			29 54	10243
						23.00	*3.00*	*3.64*			*22 80*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	FROM WHOM OBTAINED.
	The Buckeye Phosphate Co., Columbus, O.	
10244	Buckeye Special Blood and Potash Mixture	J. Worth & Bro., Gibson
10245	Buckeye Wheat Maker	Henry Dutchkey, Stephenspt
10246	Complete Fertilizer	J. Worth & Bro., Gibson
10157	Special Corn and Wheat Grow'r	Manufacturer
10247		Henry Dutchkey, Stephenspt
	The Chicago Fertilizer Co., Chicago, Ill.	
10282	Wheat and Corn Special	Manufacturer
10283	Western Bone Black and Pot'h	Manufacturer
10284	Bone, Blood and Potash	Manufacturer
10285	Potato, Truck and Tobacco Fertilizer	Manufacturer
	The Cincinnati Phosphate Co., Cincinnati, O.	
10251	Capital Grain and Grass Grower	Frank Hook, McQuady
10252	Capital Dissolved Bone and Potash	Winfree Bros., Hopkinsville.
	Clev. Dryer Works (See Amer. Ag. Chem. Co.)	
	Continental Fertilizer Co., Nashville, Tenn	
10177	Bear Beef, Blood and Bone	R. H. Brown, Madisonville

TABLE OF ANALYSES.

Pounds in the Hundred													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash		Estimated Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				7 79	1 83	9 62	0 93	1 13	1.06	2 98	$17.51	10244
				8.00			*0 82*	*1 00*		*4 00*	*16.86*	
				12 20	3.48	15 68				2.29	18.78	10245
				10 00						*2.00*	*14.40*	
				8 09	1 94	10 03	0 32	0 39		2 91	14.94	10246
				8.00			*0 41*	*0 50*		*2 50*	*13.83*	
				11.95	1 96	13 91	1 10	1 34		3 66	22.81	10157
				10 74	2 64	13 38	0 62	0 75		0 81	16.78	10247
				10 00		*11 00*	*0 82*	*1 00*		*1 00*	*16.06*	
				10.83	2 53	13 36	1 06	1 29	1 38		18.57	10282
				7 00		*9 00*	*0 82*	*1 00*	*1 00*		*12.66*	
				11 21	1 20	12 41	0.60	0 73	2 90		18.63	10283
				8 00		*10 00*	*0 41*	*0 50*	*2 50*		*14.13*	
				11 82	2 11	13 93	1 46	1 77	2 23		21.63	10284
				8 00		*10 00*	*1 23*	*1 50*	*2 00*		*16.09*	
				12 07	1.87	13.94	2 02	2 45	**3 04**		24.33	10285
				8 00		*10 00*	*1 65*	*2 00*	*4 00*		*19.35*	
				11 23	2 37	13 60	0 62	0 75		0 78	17.23	10251
				10 00		*11.00*	*0 82*	*1 00*	*1.00*		*15.86*	
				12 53	4 06	16 59				**1 67**	18.66	10252
				12 00		*13.00*			*3 00*		*17.80*	
				10 62	1.83	12 45	1.44	1 75		1.74	19.88	10177
		6.00	*4 00*	*10 00*		*11 00*	*1.65*	*2 00*		*2 00*	*19.75*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	FROM WHOM OBTAINED.
	Continental Fertilizer Co.,	
10253	Bear Potash Mixture.	S. Terry & Co., Grayson Spgs
10254	Bear Corn and Wheat Special.	Watkins & Co., Elizabetht'n
10204	Bear Bone Meal.....	Tom Casidy, Woodburn.....
10255	Bear Raw Bone.....	Crews & Lewis, McQuady....
10256	Bear Special Wheat Grower...	Bading & Patterson, Sonora
	The Currie Fertilizer Co., Louisville, Ky.	
10260	Currie's Corn and Wheat Spec.	Bassett & Stone, Leitchfield.
10261	Currie's Soluble Bone	Grigsby & Co., Bardstown...
10262	Currie's Raw Bone Meal.....	Browning Bros., Lewisburg
	Duncan & Bro., Lagrange, Ky.	
10264	Tiger Corn and Wheat Grower	Manufacturers' Warehouse..
10265	Tiger Bone Meal.....	Manufacturers' Warehouse..
10266	Tiger Guano.....	Manufacturers' Warehouse..
10267	Tiger Raw Bone Meal.....	Manufacturers' Warehouse..
	The Empire Guano Co., Nashville, Tenn.	
10268	Empire Bone and Potash.....	Durham, Blakeman & Cantrell, Greensburg.....

TABLE OF ANALYSES.

Pounds in the Hundred.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Estimated Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				10.48	0.84	11.32				1.36	$14.55	10253
		6.00	*4.00*	*10.00*		*11.00*				*2.00*	*14.80*	
				10.16	0.78	10.94				0.33	12.90	10254
		6.00	*4.00*	*10.00*		*11.00*				*0.50*	*13.00*	
19.64	2.18					21.82	1.02	1.24			20.08	10204
						20.00	*0.82*	*1.00*			*14.46*	
18.51	6.51					25.02	2.50	3.04			26.22	10255
						20.00	*2.47*	*3.00*			*19.41*	
				8.43	1.10	9.53	0.87	1.06		0.95	14.31	10256
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				10.41	4.03	14.44	1.07	1.30	1.20		18.51	10260
				10.00		*12.50*	*0.82*	*1.00*		*1.00*	*16.66*	
				11.63	2.99	14.62	1.09	1.32	1.83		20.26	10261
				10.00		*12.00*	*1.03*	*1.25*		*1.50*	*17.69*	
5.07	17.96					23.03	4.03	4.89			26.93	10262
						19.00	*3.09*	*3.75*			*20.67*	
				11.28	0.52	11.80	0.72	0.87		1.52	17.73	10264
		7.00	*3.00*	*10.00*		*11.00*	*0.82*	*1.00*	*2.00*		*16.86*	
22.80	5.01					27.81	2.24	2.72			27.97	10265
						22.00	*2.47*	*3.00*			*20.61*	
				11.47	1.77	13.24	1.36	1.65		1.75	20.65	10266
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*	*2.00*		*19.35*	
15.25	8.21					23.46	3.52	4.27			27.69	10267
						22.00	*3.71*	*4.50*			*24.33*	
				10.81	2.33	13.14			2.01		15.91	10268
				10.00					*2.00*		*14.00*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	FROM WHOM OBTAINED.
	The Empire Guano Co.	
10269	Empire Potash Mixture	Durham, Blakeman & Cantrell, Greensburg
10192	Empire Fine Ground Bone	Manufacturer
10193	Empire Dissolved Bone	Manufacturer
	Fox Chemical Co., Branch, Federal Chemical Company, Louisville, Ky.	
10273	Fox Wheat and Corn Grower	Overstreet & Snyder, Lagrange
10274	Fox Bone and Blood	W. A. Coffman, Vine Grove
10275	Fox Alkaline Bone	Gray & Trent, Garfield
10276	Fox Bone and Potash	C. R. Maynard, Elkton
10277	Fox Formula	Overstreet & Snyder, Lagrange
10278	Fox Grain Special	W. A. Coffman, Vine Grove
10279	Fox Phosphate of Potash	J. H. Lennon, Hardinsburg.
10280	Fox Acid Phosphate	P. L. Doss, Franklin
10281	Fox Raw Bone	P. L. Doss, Franklin
10155	Fox Wheat Grower	Manufacturer

TABLE OF ANALYSES.

Pounds in the Hundred.												
Phosphoric Acid.									Potash.			
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.	Nitrogen.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
				11.19	2.09	13.28				3.58	$18.57	10269
				10.00					*4.00*		*16.00*	
12.30	7.86					20.16	3.57	4.33			25.27	10192
						20.61	*2.47*	*3.00*			*19.78*	
				10.97	3.74	14.71					10.97	10193
				10.00							*10.00*	
				11.15	1.50	12.65	1.83	2.22		2.02	21.89	10273
				10.00			*1.65*	*2.00*		*2.00*	*19.35*	
				10.93	9.30	20.23	1.66	2.02			21.82	10274
				9.00			*1.65*	*2.00*			*15.75*	
				9.80	4.77	14.57				2.28	16.41	10275
				10.00						*2.00*	*14.40*	
				10.94	13.23	24.17				**0.54**	19.07	10276
				9.00						*1.00*	*12.00*	
				11.80	0.69	12.49	0.99	1.20		2.82	20.79	10277
				11.00			*0.82*	*1.00*		*3.00*	*19.26*	
				9.92	8.41	18.33	0.52	0.63		1.62	18.76	10278
				9.00			*0.41*	*0.50*		*1.50*	*13.83*	
				10.86	0.72	11.58				**2.70**	16.56	10279
				9.00						*4.00*	*15.60*	
				14.53	0.64	15.17					14.53	10280
				14.00							*14.00*	
13.39	7.87					21.26	3.95	4.80			27.28	10281
						20.00	*3.29*	*4.00*			*21.87*	
				7.59	1.38	8.97	2.17	2.63		2.04	18.62	10155
				8.00			*1.65*	*2.00*		*2.00*	*16.95*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	FROM WHOM OBTAINED.
	Furman Farm Improvement Co., Atlanta, Ga.	
10199	Furman High Grade Dissolved Bone	Manufacturer
	Globe Fertilizer Co., Branch, Federal Chemical Company, Louisville, Ky.	
10290	Eagle Wheat and Corn Grower	Goodwin & Carr, Somerset..
10291	Progress Corn & Wh't Grower.	Cash Bros., Princeton
10219	Globe Bone Dust	Jeff. Wright, Garrett
10292	Bone and Potash	Bassett & Stone, Leitchfield.
10293	Globe Grain Grower	C. R. Barnes, Bardstown
10294	Globe Bone Meal	Ellis Bros., Beard
10222	Golden Harvest Bone Meal	W. B. Meers, Hammonville..
10295	Globe Wheat Grower	Cash Bros., Princeton
10296	Globe Acid Phosphate	Langdon Bros., Science Hill.
10297	Potash Special	Goodwin & Carr, Somerset..
	The Hardy Packing Co., Chicago, Ill.	
10299	Hardy's Crop Producer	E. A. Noffsinger, Central City
10300	Hardy's Packers Raw Bone	W. W. Durbin, Grayson Spgs

TABLE OF ANALYSES.

Pounds in the Hundred.												
Phosphoric Acid.									Potash.			
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble	Total.	Nitrogen.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
				13.11	0.82	13.93					$13.11	10199
		10.00	2.00	*12.00*							*12.00*	
				10.73	2.33	13.06	1.74	2.11		1.85	21.25	10290
				8.00			*1.65*	*2.00*		*2.00*	*16.95*	
				9.92	2.07	11.99	1.84	2.23		1.14	19.62	10291
				9.00			*1.65*	*2.00*		*1.00*	*16.95*	
				7.99	3.83	11.82	2.40	2.91		1.57	20.20	10219
				9.00			*0.82*	*1.00*		*1.00*	*14.46*	
				12.32	4.66	16.98	0.41	0.50		1.36	19.50	10292
				11.00			*0.41*	*0.50*		*1.00*	*15.63*	
				9.72	0.86	10.58	0.55	0.67		1.19	15.08	10293
				9.00			*0.41*	*0.50*		*1.50*	*13.83*	
12.17	9.96					22.13	3.85	4.67			27.27	10294
						20.00	*3.29*	*4.00*			*21.87*	
				9.09	6.49	15.58	3.23	3.92			23.20	10222
				10.00			*2.47*	*3.00*			*19.41*	
				12.68	1.09	13.77	1.46	1.77		**1.29**	21.59	10295
				10.00			*1.65*	*2.00*		*2.00*	*19.35*	
				15.35	0.96	16.31					15.35	10296
				14.00							*14.00*	
				11.37	1.47	12.84				**0.92**	15.33	10297
				10.00						*2.00*	*14.40*	
				9.29	2.52	11.81	1.01	1.23	0.76	0.51	16.56	10299
				7.00		*8.00*	*0.82*	*1.00*		*1.00*	*12.46*	
16.19	11.72					27.91	1.06	1.29			23.16	10300
						27.00	*1.23*	*1.50*			*19.89*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	FROM WHOM OBTAINED.
	The Jarecki Chemical Co., Sandusky and Cincinnati, O.	
10301	Pure Ground Bone	Durham, Blakeman & Cantrell, Greensburg
10302	O. K. Fertilizer	W. P. Ray, Stithton
10303	Phosphate and Potash	Durham, Blakeman & Cantrell, Greensburg
10304	Lake Erie Fish Guano	W. P. Ray, Stithton
10305	Number One Fish Guano	W. P. Ray, Stithton
10307	C. O. D. Phosphate	Hines & Swope, Science Hill.
10240	Dissolved Bone with Potash	L. D. Stringer, Pulaski
	J. B. Jones, Louisville, Ky.	
10308	Raw Bone Meal	D. H. Highbaugh, Sonora
	The Jones Fertilizing Co., Cincinnati, O.	
10309	Bone Meal	W. P. Ray, Stithton
10310	Ammoniated Bone Meal	Dr. J. H. Heart, Glendean
10311	Corn and Wheat Grower	W. P. Ray, Stithton
10312	Miami Valley	Troutman Bros., Shepherdsv
10313	Jones Reliable	Troutman Bros., Shepherdsv

TABLE OF ANALYSES.

Pounds in the Hundred.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Estimated Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
18.84	5.31					24.15	3.04	3.69			$27.38	10301
						20.00	*2.47*	*3.00*			*19.41*	
				7.47	1.43	8.90	0.47	0.57		0.50	11.54	10302
				6.00		*7.00*	*0.41*	*0.50*	*0.50*		*9.33*	
				11.56	4.85	16.41				**1.40**	17.49	10303
				10.00		*11.00*			*2.00*		*14.40*	
				10.39	3.39	13.78	1.32	1.60		0.92	18.89	10304
				10.00		*11.00*	*1.65*	*2.00*	*1.00*		*18.35*	
				10.25	2.24	12.49	0.71	0.86		0.86	16.36	10305
				10.00		*11.00*	*0.82*	*1.00*	*1.00*		*15.86*	
				14.15	3.02	17.17					14.15	10307
				14.00		*15.00*					*14.00*	
				12.97	2.41	15.38			**2.21**		18.73	10240
				12.00		*13.00*			*3.00*		*17.80*	
13.50	9.78					23.28	3.72	4.52			27.83	10308
						21.50	*3.50*	*4.25*			*23.40*	
10.43	13.83					24.26	3.77	4.58			27.95	10309
						20.00	*3.29*	*4.00*			*21.87*	
				9.43	7.61	17.04	3.99	4.84			26.33	10310
				5.00		*15.00*	*4.12*	*5.00*			*22.36*	
				8.33	2.15	10.48	0.79	0.96		0.86	14.26	10311
				9.00		*10.00*	*0.82*	*1.00*		*1.00*	*14.86*	
				9.99	1.68	11.67	1.53	1.86		1.68	19.27	10312
				10.00		*12.00*	*1.65*	*2.00*		*2.00*	*20.15*	
				9.86	2.51	12.37	1.11	1.35		1.46	17.91	10313
				8.50		*10.00*	*1.23*	*1.50*		*1.25*	*15.99*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	FROM WHOM OBTAINED.
	The Jones Fertilizing Co.,	
10314	Jewel Phosphate	J. W. Webb & Son, Vanceb'rg
10315	Potash Mixture	W. P. Ray, Stithton
	Kaufman Fertilizer Company, Indianapolis, Ind.	
10209	Harvest King	E. G. Beauchamp, Falls of Rough
10210	Banner Crop Grower	E. G. Beauchamp, Falls of Rough
10211	Alkaline Bone and Potash	E. G. Beauchamp, Falls of Rough
10212	Pure Bone	E. G. Beauchamp, Falls of Rough
	Louisville Fertilizer Company, Louisville, Ky.	
10316	Eagle Phosphate	S. P. Simpson, Murray
10317	Eagle Guano	W. J. Martin, Wallonia
10318	Eagle Corn & Wheat Grower	S. B. Froman, Sonora
10319	Eagle Bone Meal	J. B. Taylor Co., Lewisport
10320	Eagle Bone and Potash	Forbes & Bro., Hopkinsville.
10321	Eagle Acid Phosphate	D.L.D. Sandifur, Beaver Dam

TABLE OF ANALYSES.

Pounds in the Hundred.											Estimated Value per Ton.	Station Number.
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.			
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				9.46	5.88	15.34	1.12	1.36			$17.06	10314
				8.00		*10.00*	*0.82*	*1.00*			*12.86*	
				9.05	0.43	9.48				2.46	13.98	10315
		6.00	*4.00*	*10.00*		*11.00*			*2.00*		*14.40*	
				11.28	2.49	13.77	1.03	1.25	2.05		19.68	10209
				8.00			*1.03*	*1.25*	*2.00*		*14.69*	
				7.75	2.19	9.94	1.19	1.44	1.51		15.26	10210
				7.00			*0.82*	*1.00*	*1.00*		*11.86*	
				9.50	1.05	10.55			2.14		13.96	10211
				10.00					*2.00*		*14.00*	
16.15	3.55					19.70	4.34	5.27			28.07	10212
						20.00	*2.47*	*3.00*			*19.41*	
				10.83	0.72	11.55	0.46	0.56			14.67	10316
		5.00	*3.00*	*8.00*		*9.00*	*0.41*	*0.50*			*11.23*	
				10.36	1.42	11.78	1.40	1.70		1.78	19.34	10317
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*		*2.00*	*19.75*	
				11.20	0.58	11.78				0.58	14.37	10318
		6.00	*4.00*	*10.00*		*11.00*				*0.50*	*13.00*	
17.90	2.44					20.34	1.05	1.27			18.93	10319
						20.00	*0.82*	*1.00*			*14.46*	
				8.51	0.46	8.97	0.55	0.67		1.58	13.94	10320
		5.00	*3.00*	*8.00*		*9.00*	*0.41*	*0.50*		*1.50*	*13.03*	
				12.01	0.97	12.98					12.01	10321
		6.00	*4.00*	*10.00*		*11.00*					*10.00*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	FROM WHOM OBTAINED.
	Louisville Fertilizer Company,	
10322	Eagle Soluble Bone	S. B. Froman, Sonora
10323	Eagle Special Wheat Grower	S. P. Simpson, Murray.
10324	Eagle Raw Bone	S. B. Froman, Sonora
10215	Eagle High Gr. Diss. Bone	L. L. Harned, Boston
	Michigan Carbon Works, Detroit, Michigan.	
10413	Homestead A Bone Black Fertilizer	J. D. Jackson, Scottsburg...
10414	Red Line Crop Grower	O. A. Lutes & Co., Shepherdsv
10415	Red Line Complete Manure	J. S. Depoyster, Dunmor
10416	Red Line Phosphate	E. W. Curd & Co., Cave City..
10417	Desiccated Bone	Covington, Arnold & Bros., Richmond.
10418	Wolverine Ground Bone	Woodson Lewis & Bro., Greensburg
	Nelson Morris & Co., Chicago, Ill.	
10203	Big One Pure Raw Bone	Whitsitt Hall, Auburn
10421	Big Three Bone Phosphate	Ovesen Burba Co., Hodgenv
10422	Big Five Bone Phosphate	I. K. Miller & Son, Burdick...

TABLE OF ANALYSES.

Pounds in the Hundred.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Estimated Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				9.42	0.65	10.07	0.96	1.17		1.68	$16 46	10322
		5.00	*3.00*	*8.00*		*9.00*	*0.82*	*1.00*		*1.50*	*14 26*	
				9.32	0.95	10.27	0.65	0.79		1.08	14.81	10323
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*		*1 00*	*12 46*	
17.10	5.39					22.49	2.48	3.01			24.35	10324
						20.00	*2.47*	*3 00*			*19 41*	
				13.95	0.84	14.79					13.95	10215
		8.00	*6.00*	*14.00*		*15.00*					*14 00*	
				7.81	3.72	11.53	2.29	2.78	1.78		9.51	10413
				8.00		*9.00*	*2.06*	*2.50*	*1 50*		*17 68*	
				8.38	2.60	10.98	1.77	2.15	2.08		18.49	10414
				8.00		*9.00*	*1.65*	*2 00*	*2.00*		*16 95*	
				7.63	0.83	8.46	0.92	1.12	1.08		13.33	10415
				7.00		*8.00*	*0.82*	*1 00*	*1 00*		*12 26*	
				15.36	0.12	15.48					15.36	10416
				14.00		*15.00*					*14 00*	
24.92	6.63					31.55	1.34	1.63			27.94	10417
						25.00	*1.23*	*1.50*			*18 69*	
19.38	9.12					28.50	1.88	2.28			26.61	10418
						25.00	*1.65*	*2 00*			*19 95*	
14.23	10 31					24.54	4.10	4.98			29.87	10203
						24.00	*3.29*	*4 00*			*24 27*	
7.04	2.87					9.91	3.81	4.63	1.48	0.70	21.10	10421
						10.00	*2.47*	*3 00*		*2 00*	*15 81*	
7.67	1.25					8.92	3.14	3.81		1.21	17.76	10422
						10.00	*2.47*	*3 00*		*1.00*	*14.61*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	FROM WHOM OBTAINED.
	Nelson Morris & Co.,	
10423	Big Six Special Bone Meal.....	I. K. Miller & Son, Burdick..
10424	Big Eight Amm. Acid Phos. with Potash added.....	I. K. Miller & Son, Burdick..
	National Fertilizer Company, Nashville, Tenn.	
10425	Acid Phosphate.....	J. S. Depoyster, Dunmor.....
10426	Sadler's Formula.....	H. C. Miller & Co., Elkton ..
10427	National Dissolved Bone.....	Wilson & Clark, Russellville.
10428	Acid Phosphate and Potash...	J. S. Depoyster, Dunmor.....
10154	Rock City Guano.....	Manufacturer.....
10171	Bone Meal.....	Manufacturer.....
10194	Acid Phosphate and Potash...	Manufacturer.....
10195	Tennessee Guano.....	Manufacturer.....
10429		J. S. Depoyster, Dunmor.....
10196	Twentieth Century Guano.....	Manufacturer.....
10197	National Wheat Grower.....	Manufacturer.....
	North-Western Fertilizing Co., Chicago, Ill.	
10430	Horse Shoe Brand Quick Acting Phosphate.....	E. W. Curd & Co., Cave City,

TABLE OF ANALYSES.

Pounds in the Hundred.											Estimated Value per Ton.	Station Number.
Phosphoric Acid.									Potash.			
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.	Nitrogen.	Equivalent to Ammonia.	From Muriate.	From Sulphate.		
23.06	4 39					27 45	1 46	1.77			$25 46	10423
						27.00	*0.82*	*1.00*			*18 66*	
				11.20	1.59	12.79	1 10	1.34	1 39		18.77	10424
				10.00		*11.00*	*0 82*	*1.00*		*1.00*	*16 06*	
				12.56	1.10	13.66					12 56	10425
		8.00	*4.00*	*12.00*							*12.00*	
				14.58	0.31	14.89			2.09		19 71	10426
		8 00	*4.00*	*12.00*					*2 00*		*16 40*	
				11.10	1 97	13.07	0.78	0 95	1.83		18.28	10427
				10.00		*11.00*	*0 82*	*1.00*	*1.00*		*15.86*	
				7.51	2.84	10.35			2 96		**13.11**	10428
				10 00		*11.00*			*2.00*		*14 40*	
				10.11	3.04	13 15	1.56	1 89	**1 55**		19.58	10154
				8.00		*9 00*	*1.65*	*2.00*	*2.00*		*16.95*	
13 25	5.15					**18.40**	2 88	3.50			22 33	10171
						20 00	*2.47*	*3.00*			*19 41*	
				13.32	0.29	13 61			**3.54**		**19 64**	10194
		11 00	*3.00*	*14.00*		*15.00*			*4.00*		*21.20*	
				8.51	3 81	12.32	1.95	2 37	2.33		19 91	10195
				9.78	3.72	13.50	1.68	2.04	**1 50**		19.77	10429
				8.00		*9.00*	*1 65*	*2.00*	*2.00*		*16.95*	
				12.49	1 94	14.43			4 10		19.87	10196
				12.00		*13.00*			*4 00*		*18.80*	
				10.60	2.28	12.88	2 30	2.79	2 30		22 83	10197
				10.00		*11.00*	*1.65*	*2 00*	*2.00*		*19 35*	
				10 61	0.28	10.89					10 61	10430
		8.00	*2 00*	*10.00*		*12.00*					*10.00*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	FROM WHOM OBTAINED.
	North-Western Fertilizing Co.,	
10431	H. S. B. Bone and Potash.....	R. W. Lovely, Big Clifty .....
10432	H.S. B. Cap Sheaf Wh't Grow'r	S. L. Morgan, Brandenburg.
10433	H. S. B. Corn & Wheat Grower	J. R. Beazley, Stanford.....
10434	H. S. B. Pure Ground Bone....	R. W. Lovely, Big Clifty .....
10161	H. S. B. Fine Raw Bone	C. E. Dutschke, Stephensburg
	The Ohio Farmers Fertilizer Co., Columbus, O.	
10435	Acid Phosphate.....	W. H. Elgin, Hopkinsville...
10436	Soluble Bone and Potash.....	W. H. Elgin, Hopkinsville...
10437	General Crop Fish Guano	Shaw & Smith, Hodgenville.
10438	Corn, Oats & Wh't Fish Guano	W. H. Elgin, Hopkinsville ..
10439	Raw Bone Meal.....	W. H. Elgin, Hopkinsville ..
	Packers Fertilizer Association, Chicago, Ill.	
10441	Boars Head Brand Corn and Wheat Grower	Thos. McDonahugh, Vine Grv
10442	B. H. B. Potash Phosphate....	Thos. McDonahugh, Vine Grv
	Queen City Fertilizer Company. Cincinnati, O.	
10187	Ammoniated Superphosphate and Potash.....	Manufacturer.....

TABLE OF ANALYSES.

Pounds in the Hundred.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Estimated Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				10.99	0.41	11.40			1.68		$15.03	10431
		7.00	*3.00*	*10.00*		*12.00*			*2 00*		*14 80*	
				6.94	2.65	9.59	0 94	1.14	1.14		13.35	10432
		4.00	*3 00*	*7.00*		*8.00*	*0 82*	*1.00*	*1.00*		*12 26*	
				8.21	2.57	10.78	1.79	2.17	2.15		18.40	10433
		5.00	*3 00*	*8.00*		*10 00*	*1.65*	*2.00*	*2.00*		*17 35*	
14.06	8.25					22.31	2.71	3.29			24.33	10434
						20 00	*2.47*	*3.00*			*19.41*	
9.19	13.22					22.41	3.80	4.61			26.68	10161
						22 00	*3.29*	*4.00*			*23.07*	
				11.90	2.53	14.43					11.90	10435
				9.00		*10.00*					*9 00*	
				9.08	1.30	10.38			1.86		13.28	10436
				8.00					*2 00*		*11 60*	
				8.02	1.68	9.70	0.82	1.00	1.54		14.29	10437
				7 00			*0.82*	*1.00*	*1.00*		*11 86*	
				8.23	2.87	11.10	1.33	1.61	2.11		17.13	10438
				8 00			*1.23*	*1.50*	*2.00*		*15.29*	
19.01	10.70					29.71	**0.84**	1.02			24.15	10439
						27.00	*1.23*	*1 50*			*19.89*	
				8.24	2.66	10.90	1.74	2.11	2.26		18.43	10441
		5.00	*3.00*	*8 00*		*10.00*	*1.65*	*2 00*	*2.00*		*17.35*	
				10.08	0.54	10.62			**2.93**		**15.25**	10442
		8.00	*2.00*	*10.00*		*12.00*			*4 00*		*16.80*	
				11.67	2.53	14.20	2.40	2 91		2.79	25.56	10187
				10.00		*12.00*	*1.65*	*2.00*		*2.00*	*20.15*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	FROM WHOM OBTAINED.
	Queen City Fertilizer Company,	
10188	High Grade Corn and Wheat Grower with Potash.....	Manufacturer ....
	Read Phosphate Co., Nashville, Tenn.	
10443	Read's Blood and Bone No. 1.	Moore & Gilbert, Adairville.
10444	Read's Alkaline Bone	Moore & Gilbert, Adairville.
10445	Read's Farmers Spec'l Manure	J. W. Bearce&Co., Bowl'g Gr'n
10446	Read's XXX Dissolved Bone.	Moore & Gilbert, Adairville.
10447	Read's Special Potash Mixture	W. T. Kirkman, Elkton.....
10158	Read's Wheat Special.....	Manufacturer.....
10214		J. R. Pendleton, Trenton...
10170	Read's Fine Ground Bone.....	Manufacturer.....
10448		G. S. Farwood, Beard .....
10190	Read's Wheat Grower.....	Manufacturer.....
10449		Henry Lewis, Hodgenville..
10191	Read's Wh't & Clover Grower.	Manufacturer.....
	Singer & Johnson Fertilizer Co., Nashville, Tenn.	
10178	Singer's Wheat Grower.....	Manufacturer.....
10202		S. W. Herring, Oakville.....
10217		L. H. Dawson, Russellville..

TABLE OF ANALYSES.

Pounds in the Hundred.													
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Estimated Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate.		
				12.74	2.16	14.90				3.01	$19.76	10188
				10.00		*12.00*				*2.00*	*15.20*	
				8.60	3.13	11.73	1.30	1.58	2.42		17 89	10443
				8.00			*1.65*	*2.00*	*2.00*		*16.55*	
				10.50	1.83	12.33			1.85		15.18	10444
				10.00					*2.00*		*14.00*	
				10.85	0.86	11.71	0.79	0.96		2.65	18.91	10445
				10.00			*0.82*	*1.00*	*3.00*		*17.46*	
				13.95	2.55	16.50					13.95	10446
				13.00							*13.00*	
				10.68	2.93	13.61			1.12	1.98	17.49	10447
				10.00					*4.00*		*16.00*	
				9.98	2.92	12 90	0.99	1.20		4.50	21.52	10158
				10.51	0.79	11.30	1.13	1.37	4.12		20 44	10214
				10.00			*0 82*	*1 00*	*4.00*		*18.46*	
13.63	6.71					20.34	3.62	4.39			25 79	10170
10.81	9.20					20.01	3.39	4.12			24.34	10448
						20.61	*2.47*	*3.00*			*19.78*	
				10.08	1.66	11.74	2.07	2.51	2.58		21.55	10190
				11.27	1.48	12.75	1.37	1.66	0.64	1.39	20.53	10449
				10.00			*1.65*	*2.00*	*2.00*		*18.95*	
				10.14	1.32	11.46	1.18	1 43	2.99		19 23	10191
				10.00			*0.82*	*1.00*	*2 00*		*16.46*	
				9 96	4.07	14.03	1.74	2.11		1 63	20.76	10178
				11.00	3.12	14.12	1.13	1.37		1.76	19.95	10202
				9.77	2.84	12.61	1.17	1.42		2.23	19.05	10217
				10.00			*1.65*	*2.00*		*2.00*	*19.35*	

TABLE OF ANALYSES.

Station Number	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	FROM WHOM OBTAINED.
	Standard Guano & Chem. Mfg. Company, New Orleans, La.	
10450	Pure Raw Ground Bone.....	Long House & Co., Adairville
	Swift & Company, Chicago, Ill.	
10453	Swift's Garden City Phosphate	E.F. Austin&Bro., Beav'r D'm
10454	Swift's Superphosphate.....	A. G. Lewis & Co., Glendale.
10455	Swift's Complete Fertilizer.....	Turner Bros., Cerulean Sp'ngs
10223	Swift's Pure Raw Bone Meal	C. A. Cosby, Cub Run .....
10456	Swift's Bone Meal.....	C. P. Clark & Co., Owensboro
10457	Ammoniated Bone.....	A. G. Lewis & Co., Glendale.
10198	Ammoniated Bone and Potash	S. M. Vinson, Sonora.....
10458	Bone and Potash	D. G. Hunt, Vine Grove.....
10459	Champion Wheat Grower	Ky. Supply Co., Danville.....
	Tennessee Chemical Company, Nashville, Tenn.	
10464	Ox Slaughter House Bone	Norris & Lockett, Henderson
10465	Ox Potash Mixture.....	Depp, Hugh's&Holm'n, Glasg
10466	Ox High Grade Diss. Bone.....	E. P. Austin, Beaver Dam ..
10467	Ox Phosphate	Depp, Hugh's&Holm'n, Glasg

TABLE OF ANALYSES.

Pounds in the Hundred.												
Phosphoric Acid.							Nitrogen.	Equivalent to Ammonia.	Potash.		Estimated Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.			From Muriate.	From Sulphate		
11.39	11.38					22.77	3.51	4.26			$26.47	10450
						20.00	*3.09*	*3.75*			*21 27*	
				15.03	2.21	17.24					15.03	10453
				14.00		*15.00*					*14.00*	
				8.30	5.81	14.11	1.64	1.99	1.93		19.13	10454
				8.00		*12.00*	*1.65*	*2.00*	*2.00*		*18.15*	
				9.57	2.93	12.50	1.49	1.81	0.93		18.05	10455
				8.00		*11.00*	*1.03*	*1.25*	*1.00*		*14.89*	
11.83	13.35					25.18	3.92	4.76			29.23	10223
						23.00	*3.71*	*4.50*			*24.93*	
19.86	6.62					26.48	2.48	3.01			27.30	10456
						25.00	*2.47*	*3.00*			*22.41*	
12.31	5.27					17.58	5.10	6.19			28.31	10457
						17.00	*4.94*	*6.00*			*25.02*	
13.67	2.60					16.27	5.15	6.25	2.77		30.72	10198
						16.00	*4.74*	*5.75*	*3.00*		*26.82*	
18.59	7.97					26.56	2.39	2.79	2.64		29.19	10458
						23.50	*2.47*	*3.00*	*3.00*		*24.51*	
				12.72	6.23	18.95	1.49	1.81	2.60		24.82	10459
				12.00		*13.00*	*1.65*	*2.00*	*2.00*		*21.75*	
				8.68	1.27	9.95	1.39	1.69		1.68	17.12	10464
		5.00	*3.00*	*8.00*		*9.00*	*1.65*	*2.00*		*2.00*	*17.35*	
				11.70	0.61	12.31				2.26	16.99	10465
		6.00	*4.00*	*10.00*		*11.00*				*2.00*	*14.80*	
				14.56	1.07	15.63					14.56	10466
		8.00	*6.00*	*14.00*		*15.00*					*14.00*	
				12.80	0.79	13.59					12.80	10467
		7.00	*5.00*	*12.00*		*13.00*					*12.00*	

TABLE OF ANALYSES.

Station Number.	NAME AND ADDRESS OF MANUFACTURER AND NAME OF BRAND.	FROM WHOM OBTAINED.
	Tennessee Chemical Company.	
10468	Ox Corn and Wheat Guano	Depp, Hugh's & Holm'n, Glasg
10469	Ox Bone Meal	T. N. McGlothlan, Irvington
10470	Ox Raw Bone	Franklin Hardware Co., Franklin.
10471	Ox Special Wheat Grower	T. N. McGlothlan, Irvington
	Virginia-Carolina Chemical Co., S. W. Travers & Co., Branch, Richmond, Va.	
10479	Capital Bone Potash Comp'nd	E. S. Duiguid, Murray,
10480	Capital Dissolved S. C. Bone	Dick Wigginton, Fredonia
	Virginia-Carolina Chemical Co., Memphis Division, Memphis, Tenn.	
10481	Royal Grain Grower	T. W. Buchanan & Co., Campbellsville
10225	Beef, Blood & Bone Fertilizer	Chas. M. Miller, Hardinsburg
10174	Royal Dissolved Bone	Manufacturer
10175	Ground Bone Meal	Manufacturer
10482		O. P. Eldred & Co., Princeton

TABLE OF ANALYSES.

Pounds in the Hundred.													
Phosphoric Acid.									Potash.				
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.	Nitrogen.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
				13.25	0.92	14.17	0.82	1.00		1.01	$19.94	10468
		7.00	*5.00*	*12.00*		*13.00*	*0.82*	*1.00*		*1.00*	*18.46*	
17.63	1.53					19.16	1.12	1.36			18.38	10469
						20.00	*0.82*	*1.00*			*14.46*	
13.34	6.57					19.91	2.60	3.16			22.41	10470
						20.00	*2.47*	*3.00*			*19.41*	
				7.89	1.64	9.53	0.84	1.02		0.93	13.77	10471
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				11.40	0.91	12 31			1.98		16.02	10479
		7.00	*3.00*	*10.00*		*11.00*			*2 00*		*14.40*	
				15.27	1.51	16.78					15.27	10480
		9.00	*3.00*	*12.00*		*13.00*					*12.00*	
				11.60	1.14	12.74			3.64		18.02	10481
		7.00	*3.00*	*10.00*		*12.00*			*4.00*		*16.80*	
				8.99	4.67	13.66	1.73	2.10	2.09		19.94	10225
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				15.92	0.51	16.43					15.92	10174
		10 00	*4.00*	*14.00*		*16.00*					*14.00*	
15.03	8.10					23.13	3.35	4.07			26.93	10175
18.96	3.61					*22.57	2.73	3.31			25.53	10482
						24.00	*2.47*	*3.00*			*21.81*	

*Contains Soluble Phosphoric Acid.

M. A. SCOVELL, Director and Chemist.
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December 31, 1902.

DIVISION OF CHEMISTRY

MISCELLANEOUS CHEMICAL ANALYSES MADE IN 1902.

BY A. M. PETER, L. O. BEATTY AND S. D. AVERITT.

Sorghum Cane.

The experiment was continued in 1902 by planting seed from No. 8983, 14th Annual Report, page 264, to represent the pedigreed cane. The data pertaining to this stalk were: Weight, 1 lb. 4 ozs.; per cent. of juice yielded in the mill, 40; specific gravity of the juice 1.091, equal to 21.7° Brix; reducing sugar 1.16, cane sugar 17.99 and purity 82.9, all calculated upon the juice as expressed by the mill. To represent the cane selected to combine a large stalk with high percentage of juice and purity we planted seed of No. 9015, same Report, page 265, the data for which were: Weight of stalk, 2 lbs. 6 ozs.; per cent. of juice by the mill, 55; specific gravity of the juice, 1.078, equivalent to 18.8° Brix; reducing sugar and cane sugar in the juice 2.27 and 12.74 per cent., respectively; purity 67.8. The analyses of selected canes from these two selections of seed have been tabulated under the respective headings "Pedigreed Seed" and "Seed Selected for Juciness."

Sorghum Juice—Pedigreed Seed—1902.

Laboratory Number	When Cut	Weight of Stalk	Per cent of Juice	Specific Gravity of the juice	Degrees Brix	Reducing Sugar, per cent	Cane Sugar, per cent	Purity, per cent
10645	Oct. 7	1 lb 1 ozs	43.	1 080	19 3	0.55	14.40	74.6
10646	" "	1 " 2 "	44.	1.083	19.9	62	15 22	76 5
10647	" "	1 " 3 "	45.	1 085	20 4	.81	15 25	74 8
10648	" "	1 " 6 "	44.	1.082	19.7	.57	14.89	75.6
10649	" "	1 " 5 "	40.	1 086	20 6	.78	15 52	75.3
10651	" "	1 " 4 "	43.	1 081	19 5	.68	14.55	74 6
10652	" "	1 " 4 "	40	1.082	19 7	.64	15 30	77 7
10658	" "	1 " 1 "	41.	1.080	19.3	.61	14 44	74.8
10683	" 14	1 " 0 "	40.	1.087	19.5	.85	14.77	75 7
10685	" "	1 " 1 "	39.	1.083	19.9	.57	15.23	76.5

Sorghum Juice—Seed Selected for Juciness—1902.

Laboratory Number	When Cut	Weight of Stalk	Per Cent of Juice	Specific Gravity of the Juice	Degrees Brix	Reducing Sugar, per cent	Cane Sugar, per cent	Coefficient of Purity
10686	Oct. 14	1 lb 2 ozs	40.	1 086	20 6	1.00	14.23	69.5
10689	" "	1 " 4½ "	45	1.085	20.4	1.02	14 77	72 4
10690	" "	1 " 6 "	44.	1.078	18.9	1 18	12 26	64 9
10693	" "	1 " 3 "	40.	1.085	20.4	1.07	14.32	70.2
10694	" "	1 " 0 "	40.	1.080	18.8	1.28	12.89	68.6
10695	" "	1 " 6 "	44.	1.081	19.5	1.16	13.38	68 6

Sugar Beets.

From the experiment at the Station farm in co-operation with the U. S. Department of Agriculture, 1902.

Laboratory Number.	Date of Sampling	Number of beets taken.	Weight topped. ozs.	Weight trimmed. ozs.	Analyses of the Juice.			
					Specific Gravity. 20° C	Brix.	Sugar. %	Purity %
9889	June 24	7	4¾	3¾	1.050	12.4	8.15	65.7
10696	Aug. 6	1	18¼	13	1.050	12.25	8.8	71 8
97	" "	1	12¾	9¼	1.055	13.5	10 55	78 1
98	" "	1	10	8½	1 056	13.75	10.5	76.4
99	" "	9	12	9	1.052	12.75	9.4	73.3
10700	" 19	1	23	16¼	1.045	11.2	7.05	63.
1	" "	1	17	11¼	1.045	11 6	8.75	75.4
2	" "	1	16½	14	1.055	13.5	10.70	72.
3	" "	2	10½	8	1.053	13.1	9.85	75.2
4	" "	1	11½	9	1.046	12.4	8.00	64.5
5	" "	1	10½	7¾	1 053	13.1	10.00	76.3
6	" "	1	10½	7¾	1.054	13.3	9.90	74.5
7	" "	1	13	10	1.052	12.8	9.60	75.
8	Oct. 4	1	11½	8¾	1.041	10.2	6.75	66.1
9	" "	1	8¾	6	1.042	10.5	6.55	62.4
18710	" "	1	7¾	6	1.046	11.4	7.85	68.9
11	" "	1	8¾	7½	1.045	11 2	7.45	66.5
12	" 13	5	8¾	7	1.033	8.3	4.75	57.2
13	" 22	5	8¾	6¾	1.041	10.2	6 6	64 7
14	" "	1	16¾	14¼	1.047	11 6	8.5	73 3
15	Dec. 4	1	16½	13½	1.060	14.7	12.0	81.6
16	" "	1	14½	12½	1.052	12 8	8.25	64 4
17	" "	1	17	13	1.046	11.4	6.2	54.4
18	" "	1	18¾	13½	1 045	11 2	6 8	60.7
19	" "	1	17	13¾	1.055	13.5	10.25	75.9
10720	" "	1	19	14	1.057	14.0	9.1	65.0
21	" 8	1	18½	14½	1.051	12 6	9.65	76.6
22	" "	1	15	12	1 046	11.4	6.95	61.0
23	" "	1	16½	13	1.052	12.8	8 55	66.8
24	" "	1	11¾	8	1.053	13.1	9.0	68.7
25	" "	1	11¼	8¼	1.048	11.9	7.75	65.1

Butter.

The butter analyzed was made at the Station Dairy in churn tests of several Jersey cows in 1902.

Name of Cow	No. of Sample.	From Milkings of	Fat per cent	Water per cent	Salt per cent	Curd per cent
Oonan's Silverlocks.	9536	March 1-5.	83.07	12.22	3.66	1.05
	9537	" 6-8.	84.52	11.15	3.33	1.00
	9586	" 9-12.	82.78	12.93	3.34	0.95
	9587	" 13-15.	83.11	12.81	3.29	0.79
Daisy Goff.....	9746	April 3-6.	82.98	12.91	3.45	0.66
	9747	" 7-9.	81.04	13.46	3.74	0.76
Orle's Vexer's Gem	9808	May 12-15.	83.62	11.83	3.58	0.97
	9809	" 16-18.	82.00	12.97	4 30	0.73
	9817	" 19-22.	83.30	12.54	3.50	0.66
	9818	" 23-25.	82.56	12 88	3.89	0.67

Soils.

BRECKINRIDGE COUNTY.

9477—Sediment from a barn-lot pond, farm of J. H. Harris, near Webster, Breckinridge County, Ky. The material is being hauled out and spread upon corn land. The sample was a reddish and grayish silt, apparently containing very little organic matter. All passed through the ½ mm. sieve except a trace of gravel.

9541—From farm of Geo. Gilfin, Custer, Breckinridge County, Ky. A small sample sent by mail August 21, 1901.

9802—Average sample of the top soil to depth of 6 inches from the farm of Geo. N. Harris, 2½ miles south of Cloverport, Breckinridge County., Ky., on Caney Creek, a tributary of Clover Creek. The land has been idle a number of years and is thought to be of little account. Sample sent April 27, 1902. It is a dark-colored, rather clayey soil, much like "crawfishy" or badly drained land. The ½ mm. sieve removed 3.04 per cent. of gravel from the air-dried sample.

9803—Subsoil of 9802, representing the 2d 6 inches, taken from one place only. It is much like the top soil, but of a decided chocolate brown color. The ½ mm. sieve removed 0.93 per cent. of gravel.

Analyses of the Moisture-Free Samples—Per Cent.

Number	9477	9541	9802	9803
Organic and volatile matter	5 02	4 54	6.34	2 92
Nitrogen	.113	.126	.150	.048
Sand, etc. insoluble in HCl, 1.115 sp. gr.	83.30	88.54	81.96	.....
Phosphoric acid dissolved by same	.0132	.07	.158	.....
Potash dissolved by same	.417	.26	.160	.....
Phosphoric acid dissolved by ⅕ N. HNO_3	006	.0009	.0014	.0008
Potash dissolved by ⅕ N. HNO_3	.0401	.0223	.0128	.0046
Lime dissolved by ⅕ N. HNO_3	.132	.14	.317	.113
Magnesia dissolved by ⅕ N. HNO_3			029	.021

These soils are all low in phosphoric acid, lime and nitrogen, all except the first being especially deficient in available phosphates. They would be benefited by the application of phosphatic fertilizers, especially if used upon leguminous crops or with manure to increase the organic matter and nitrogen compounds.

CASEY COUNTY.

9800—Average sample of top soil to depth of 6 inches from the farm of W. M. Riley, 4 miles west of King's Mountain, in Casey County, Ky. The land has been in cultivation three years, part longer, in corn only, and averaged 20 to 25 bushels per acre. A 1-5 acre piece, sparingly manured with stable manure, produced last year at the rate of 1,330 lbs. of White Burley tobacco per acre. Sample received April 24, 1902. It is a rather light brown, fine grained soil. The ½ mm. sieve removed 10.9 per cent. of gravel.

9801—Subsoil of the same, representing the 2d 6 inches, from one spot only. The sample is yellowish in color and more clayey looking than the top soil.

Analyses of the Moisture-Free Samples—Per Cent.

Number.	9800	9801
Organic and volatile matter	5.70	2 62
Nitrogen	.119	0.33
Sand, etc., insoluble in HCl, 1.115 sp. gr	87.71	....
Phosphoric acid dissolved by same	.069	
Potash dissolved by same	.159	
Phosphoric acid dissolved by ⅕ N. HNO_3	.0014	.0006
Potash dissolved by ⅕ N. HNO_3	.0229	0088
Lime dissolved by ⅕ N. HNO_3	.182	.050
Magnesia dissolved by ⅕ N. HNO_3	.009	.001

This soil is very deficient in phosphoric acid and low in lime and nitrogen. The remarks made upon the Breckinridge County soils apply here.

FAYETTE COUNTY.

10249—Average sample of top soil, taken 9 inches deep, from a field on the Experiment Station farm where sugar beets were grown in Dr. Wiley's co-operative experiment. This field is on Rose Street extended, Lexington, near its intersection with the Nicholasville road and near the bottom of a hill. The sample was taken from 3 places in the sugar beet plot.

10250—Subsoil of the same, representing the 2d 9 inches, taken from one spot only.

Analyses of the Moisture-Free Samples—Per Cent.

Number.	10249	10250
Organic and volatile matter	6.710	3.940
Sand, etc., insoluble in HCl, 1.115 sp. gr	83.810	87.47
Ferric oxide dissolved by same	1.562	.639
Alumina dissolved by same	5.183	6.269
Lime dissolved by same	.520	.400
Magnesia dissolved by same	.320	300
Phosphoric acid dissolved by same	475	332
Potash dissolved by same	318	.312
Titanium dioxide dissolved by same	Trace	150
Total	98.898	99.662
Humus, official method	3.12	1.97
Total nitrogen	.251	097
Total potash	1.75	1.48
Total Soda	.55	49
Phosphoric acid dissolved by $\frac{1}{5}$ N. HNO_3	.1315	.0685
Potash dissolved by $\frac{1}{5}$ N. HNO_3	.0165	.0096
Lime dissolved by same	390	.260
Magnesia dissolved by same	048	.036

These analyses show the composition of a typical blue grass soil in a good state of tillage. Attention is called to the large proportion of phosphates in easily soluble or available form and the comparatively low solubility of the potash compounds. Duplicates of these samples were sent to Dr. Wiley, who has published his analyses in connection with the results of the sugar beet experiment. (Bureau of Chemistry, Bulletin No. 96.)

HENRY COUNTY.

9798—Average sample of top soil, taken to depth of 6 inches, from the farm of E. G. McGinnis, ½ mile northwest of Eminence on the Eminence and Sulphur turnpike. The land was in corn last year and also 4 years ago and it is desired to put it in grass. Sample sent April 23, 1902. A light brown, fine grained soil. The ½ mm. sieve removed 2.15 per cent. of gravel from the air-dried sample.

9799—Subsoil of same, representing the 2d 6 inches, taken from only one spot. Distinctly red and rather clayey in appearance.

Analyses of the Moisture-Free Samples—Per Cent.

Number	9798	9799
Organic and volatile matter	3.72	4.11
Nitrogen	.082	0.41
Sand, etc., insoluble in HCl, 1.115 sp. gr	86.68	.....
Phosphoric acid dissolved by same	.123	.....
Potash dissolved by same	.264	.....
Phosphoric acid dissolved by ⅕ N. HNO_3	.0008	.0004
Potash dissolved by ⅕ N. HNO_3	.0104	.0054
Lime dissolved by ⅕ N. HNO_3	154	.204
Magnesia dissolved by ⅕ N. HNO_3	.030	.009

This soil is poor in the important elements in available forms. The aim in any course of treatment for its improvement should be to increase the organic matter, including nitrogen, which would help bring the phosphates into an available condition. If clovers or other leguminous crops are resorted to, it is probable their growth should be aided by applications of phosphatic materials and potash salts and moderate liming. Even with manure, liming would be advisable, as the soil is low in lime.

HOPKINS COUNTY.

9623—From the farm of Ike Osborn, Richland, Ky., situated in Hopkins County, about 6 miles west of Madisonville, on the waters of Clear Creek and Richland. The field from which the sample was taken has been in cultivation about 50 years and was in corn last year. It is about average upland and yields 20 to 35 bushels of corn, but formerly produced much larger crops. The principal forest growth is hickory, oak, poplar, ash, and some black and white walnut and sugar maple, with dogwood and other undergrowth. Collected April, 1902. The ½ mm. sieve removed 0.35 per cent. gravel from the air-dried sample.

9624—Top soil from a 20-acre field of level ridge land on the farm of J. H. Oldham, Madisonville, Hopkins County, Ky. Forest growth is oak, poplar, gum, elm, hickory, dogwood and walnut. Subsoil is clay. This land produces fair crops in a good season. The ½ mm. sieve removed 0.6 per cent. gravel.

Analyses of the Moisture-Free Samples—Per Cent.

Number.	9623	9624
Organic and volatile matter	3.12	3 52
Nitrogen	.068	.082
Sand, etc., insoluble in HCl, 1.115 sp. gr	91 34	89.72
Phosphoric acid dissolved by same	.052	0.72
Potash dissolved by same	.145	.165
Phosphoric acid dissolved by ⅕ N. HCl	0009	.0008
Potash dissolved by ⅕ N. HCl	.0093	0181
Lime dissolved with ⅕ N. HCl	.082	.124

These are poor soils, especially deficient in available phosphates, organic matter, nitrogen and lime. The suggestions already made for the renovation of such soils are applicable here.

LIVINGSTON COUNTY.

Four samples of soil from the farm of W. C. Ellis, Smithland, Ky., situated on the Tennessee River five miles southeast of Smithland. The samples were sent December 12, 1902, by Mr. C. O. Wilson, who says that three of them are of the river bottom soil and one from the ridge land and that they were taken according to our directions. As Mr. Wilson did not mention the subsoil in his letter or upon the labels, it is presumed that these are average samples of the top soil 6 inches deep and that No. 4 is the ridge land.

10493—Labeled "No. 1"—A dark brown soil.

10494—Labeled "No. 2"—Like No. 1, only a little darker.

10495—Labeled "No. 3"—Like Nos. 1 and 2, but more clayey.

10496—Labeled "No. 4"—Yellowish brown, very fine grained, sandy.

Analyses of the Water-Free Soils—Per Cent.

Samples marked	1	2	3	4
Numbers	10493	10494	10495	10496
Organic and volatile matters	6.57	5 67	5.48	3.16
Nitrogen	0.133	0.139	0.115	0.099
Sand, etc., insoluble in HCl, 1.115 sp. gr.	76.75	81 08	81.36	90.52
Phosphoric acid dissolved by same	0.263	0.230	0.170	0.030
Potash dissolved by same	0.471	0 505	0 475	0 214
Phosphoric acid dissolved by ⅕ N. HNO_3	0.0108	0.0307	0.0089	0.0006
Potash dissolved by ⅕ N. HNO_3	0.0137	0.0143	0.0082	0.0163
Lime dissolved by ⅕ N HNO_3	0.282	0.344	0.330	0.116
Magnesia dissolved by ⅕ N. HNO_3	0.046	0.050	0.046	0.032

Samples 1 and 2 are good, rich soils, containing enough available plant food for present needs. No. 3 is less well supplied and would probably be benefited by the use of a complete fertilizer for spring crops, acid phosphate alone for wheat or phosphate and potash salts for legumes. No. 4 is very deficient in phosphates and any crop grown upon this soil would be greatly benefited by a liberal application of phosphatic fertilizers. It is also low in organic matter. It could be improved by growing a leguminous crop upon the land, with the aid of phosphates and potash salts or wood ashes.

PULASKI COUNTY.

9766—Average of top soil, taken to depth of 6 inches, from farm of John E. Dickenson, in Pulaski County, Ky., one mile northeast of Science Hill. This field has been cleared 16 to 20 years and was farmed to corn 4 to 6 years at first, then a crop of wheat and then corn again until about 11 years ago, when Mr. Dickenson bought the land. He raised one not very good crop of corn and then sowed oats and grass and pastured the land for 9 years. Last year (1901) the land was put in corn and produced about a fourth of a crop, possibly on account of dry weather, as earlier planting did better. Sample sent April 14, 1902. It is a rather light colored, chocolate brown soil, somewhat sandy in texture. The ½ mm. sieve removed 7.2 per cent. gravel from the air-dried sample.

9767—Subsoil of the same, representing the 2d 6 inches, taken from only one spot. A light red, clay soil, mixed with some nearly white, sandy material.

Analysis of the Moisture-Free Samples—Per Cent.

Number	9766	9767
Organic and volatile matters	3.05	3 28
Nitrogen	.058	.045
Sand, etc., insoluble in HCl, 1.115 sp. gr.	91.41	82.98
Phosphoric acid dissolved by same	.030	.028
Potash dissolved by same	.141	.303
Phosphoric acid dissolved by ⅕ N. HNO_3	.0004	.0001
Potash dissolved by ⅕ N. HNO_3	.0140	.0132
Lime dissolved by ⅕ N. HNO_3	086	.055
Magnesia dissolved by ⅕ N. HNO_3	.010	.017

A very poor soil, especially in phosphates. It needs building up in organic matter and all the essentials along lines already suggested.

WASHINGTON COUUNTY.

Four samples of soil from the farm of J. K. Walls, Springfield, Ky. Nos. 1, 2 and 4 are used for corn and No. 3 for orchard grass. The samples were received April 22, 1902. Tested with litmus paper they did not show any acidity.

9768—Labeled "No. 1, Woodland." A very dark, almost black soil.

9769—Labeled "No. 2, Bottom Land." Dark brown. Similar in texture to No. 1, but lighter colored.

9770—Labeled "No. 3, Old Field." Still lighter in color. A chocolate brown.

9771—Labeled "No. 4, Very Old Field." Lighter colored than No. 3 and more yellowish.

Analyses of the Moisture-Free Samples—Per Cent.

Sample marked..	1	2	3	4
Number	9768	9769	9770	9771
Organic and volatile matter	13.54	6.60	4 61	4 54
Nitrogen	.455	.179	.119	.100
Phosphoric acid dissolved by ⅕ N. HNO_3	.0098	.0961	.0087	.0031
Potash dissolved by ⅕ N. HNO_3	.0351	.0084	.0172	.0106
Lime dissolved by same	.934	2 007	.151	.131
Magnesia dissolved by same	.093	.187	.014	.016

No. 1 is very rich in organic matter and nitrogen and well supplied with available lime, potash and phosphoric acid, though the quantity of the latter is less than was to be expected. This should be a very fine tobacco soil. No. 2 is very rich in available phosphoric acid, but low in potash. It would probably be benefited by potash fertilizers. In No. 3 the proportions of important constituents are fairly well balanced, though inclining to be low. The building up of this soil by means of leguminous crops and light liming is suggested, and the use of complete fertilizers on spring crops might be profitable. No. 4 is much poorer in all the important constituents than No. 3, and the same remarks apply with greater force. In this case both phosphates, potash salts and lime may be needed to make a proper growth of legumes.

WAYNE COUNTY.

Five samples of soil from a swamp about 5 miles southwest of Monticello, Wayne County, Ky., sent by John M. Dodson, December 18, 1902, to determine if the land would be of any value if drained.

10488—Surface soil from one spot, taken to about 4 inches depth. A yellowish-gray or buff colored, clayey looking soil.

10489—Surface soil from another place, taken to the same depth. Dark gray, but similar in texture to the preceding.

10490—Subsoil taken at a depth of about 3 feet in a ditch. Similar in texture to the first and second, but intermediate in color.

10491—Soil brought up by crayfish. Like the others in texture, but of a light chocolate color.

10492—Brought up by crayfish at another place. Ash colored and clayey looking.

Analyses of the Moisture-Free Samples—Per Cent.

Number.....	10488	10489	10490	10491	10492
Organic and volatile matter	2.88	7.17	7.95	14.33	5.14
Nitrogen	0 46	.235	.288	.501	.153
Sand, etc., insoluble in HCl, 1.115 sp. gr.	92.44	83.40	83.56	77 71	88.98
Phosphoric acid dissolved by same	.010	.055	.062	.085	.027
Potash dissolved by same ..	.100	.150	.157	.147	.120
Phosphoric acid dissolved by ⅕ N. HNO_3.... ..	.0012	.0031	.0083	.0063	.0041
Potash dissolved by ⅕ N. HNO_3	.0056	.0072	.0140	0105	.0056
Lime dissolved by ⅕ N. HNO_3	.018	.036	.056	.038	.076
Magnesia dissolved by ⅕ N. HNO_3	.018	.013	.017	.008	.014

These are all poor in mineral plant food, though all except 10488 are pretty well supplied with nitrogenous organic matter. If drained, the use of lime, phosphates and potash salts would be advisable.

Old Wood Ashes.

10137—Ashes from the old "Mann's Salt Lick" in Jefferson County, Ky., on the Mannslick road, south of Louisville. Sent

by C. R. Gardiner, August 15, 1902. Two or three acres are covered with these ashes from 3 inches to 3 or 4 feet deep, in the midst of a poor 100-acre farm. The wood was burned probably half a century ago. The material is black and looks like a very rich, light soil.

Analysis of the Air-Dried Material—Per Cent.

Nitrogen	0.11
Phosphoric acid dissolved by HCl, 1.115 sp. gr	.96
Lime dissolved by HCl, 1.115 sp. gr	11.19
Potash dissolved by ⅕ N. HNO_3	.08
Lime dissolved by same	10.06
Potash dissolved by boiling water	.09

This material would be very useful on an acid soil or one deficient in lime.

Grasses and Forage Plants.

Most of the grasses and forage plants analyzed were grown on the experimental plots of the Department of Entomology and Botany at the Station farm. Except when otherwise specified, the grasses, etc., were cut three or four inches above the ground, as would be done in making hay, and the samples were weighed and dried in the laboratory at the temperature of the room. After drying, the samples were weighed again, ground to pass a 1 mm. sieve and bottled. This material was subjected to analysis by the official methods and the results calculated upon the fresh samples and also upon the same water-free. Brief descriptions of the samples are given here, arranged in alphabetical order according to the botanical names of the plants. The common names are given also. The tables of analyses are arranged in the same order, but only the common names are used. Some of these analyses were published in Bulletin 98, stated on the aid-dried material; we have recalculated them all and republish them here, with additional matter. Those that have already appeared are indicated by a reference to Bulletin 98.

9263—*Agrostis alba;* red top. From plot at Station Farm, June 18, 1901.

9264—*Agrostis canina;* Rhode Island bent grass. From plot at Station farm, July 2, 1901.

9292—*Alopecurus pratensis;* meadow foxtail. From plot at Station farm, May 11, 1901. Just in bloom.

9295—*Audropogon sorghum;* yellow millo maize. From plot at Station Farm, July 5, 1901.

9520—Same, August 24, 1901.

9521—*Audropogon sorghum;* white millo maize. From plot at Station farm, August 24, 1901.

9288—*Anthoxanthum odoratum;* sweet vernal grass. From plot at Station farm, June 18, 1901.

9291—*Arrhenatherum elatius;* tall oats grass. From plot at Station farm, June 11, 1901.

9242—*Bromus erectus;* meadow brome grass, hairy brome grass. From plot at Station farm, May 24, 1901. Heads fully formed and in bloom.

9243—*Bromus inermis;* smooth brome grass. From plot at Station farm, June 11, 1901.

9270—*Bromus unioloides;* rescue grass, Schrader's brome grass. From plot at Station farm, June 11, 1901.

9269—*Dactylis glomerata;* orchard grass. From plot at Station farm, June 11, 1901.

9266—*Euchlaena luxurians;* teosinte. From plot at Station farm, July 8, 1901.

9290—Same, August 23, 1901.

9271—*Festuca elatoir;* English bluegrass. From plot at Station farm, June 11, 1901.

9293—*Festuca ovina;* sheeps fescue. From plot at Station farm, May 24, 1901. Heads fully formed and in bloom. Cut after a rain, when still wet.

9244—*Glycine hispida;* soy bean, soja bean. From plot at Station farm, July 3, 1901. From imported seed. Entire plant taken, including roots. See Bulletin 98.

9245—Same, July 3, 1901. Imported seed, No. 4912. Entire plant. See Bulletin 98.

9246—Same, July 3, 1901. Imported seed, No. 4914. Entire plant. See Bulletin 98.

9247—Same, July 3, 1901. Home-grown seed from No. 4914. Entire plant. See Bulletin 98.

9784—Same. Ripe soy beans used in feeding experiments, grown at Station farm. See Bulletin 101.

9260—*Holcus lanatus;* meadow soft grass, velvet grass. From plot at Station farm, June 18, 1901.

9274—*Ixophorus italicus,* var.; Siberian millet. From plot at Station farm, July 1, 1901.

9248—*Lathyrus sylvestris;* flat pea. From plot at Station farm, July 2, 1901. Entire plant, including roots. See Bulletin 98.

9289—*Leersia oryzoides;* rice grass. Wild growth in pond on the college campus, July 5, 1901.

9261—*Lolium italicum;* Italian rye grass. From plot at Station farm, June 18, 1901.

9287—*Lolium perenne;* perennial rye grass. From plot at Station farm. Heads fully formed. Cut after a rain when still wet.

9265—*Medicago sativa;* Samarcand alfalfa. From plot at Station farm, May 24, 1901. Just beginning to bloom. Cut after a rain when still wet. See Bulletin 98.

9262—*Muhlenbergia mexicana;* meadow muhlenbergia, Mexican muhlenbergia. From a yard, under trees, October 8, 1901.

9276—*Panicum crus-galli;* Japan barnyard millet, barnyard grass. From plot at Station farm, July 8, 1901.

9284—*Panicum sanguinale;* crab grass, finger grass. From college campus, October 9, 1901.

9275—*Pennisetum typhoideum;* Mands wonder forage plant, pearl millet, pencillaria. From plot at Station farm, July 3, 1901.

9277—Same, August 23, 1901.

9286—*Phalaris arundinacea;* reed canary grass. From plot at Station farm, June 18, 1901.

9285—*Phloeum pratense;* timothy. From plot at Station farm, June 28, 1901.

9272—*Poa compressa;* Canada bluegrass. From plot at Station farm, June 18, 1901.

9273—*Poa pratensis;* Kentucky bluegrass. From plot at Station farm, June 11, 1901.

9268—*Poterium sanguisorba;* burnet. From plot at Station farm, May 20, 1901. Cut when in bloom.

9294—*Trifolium hybridum;* alsike clover, Alsatian clover. From plot at Station farm, May 24, 1901. Just coming into bloom. Cut after a rain when still wet.

9267—*Trifolium incarnatum;* crimson clover, Italian clover. From plot at Station farm, May 24, 1901. In full bloom. Cut after a rain when still wet. See Bulletin 98.

9296—*Vicia villosa;* Russian vetch, hairy vetch. From plot at Station farm, August 24, 1901. See Bulletin 98.

9249—*Vigna catjang;* cowpea, "Wonderful." From plot at Station farm, July 2, 1901. Entire plant, including roots. This is the same variety as No. 9259. See Bulletin 98.

9259—Same; cowpea "Unknown." Same as 9249. From plot at Station farm, July 2, 1901. Entire plant. See Bulletin 98.

9250—Same; cowpea "Lady." From plot at Station farm, July 2, 1901. Entire plant. See Bulletin 98.

9251—Same; cowpea "Extra Early Blackeyed." From plot at Station farm, July 2, 1901. Entire plant. See Bulletin 98.

9252—Same; cowpea "Large Blackeyed." From Station farm, July 2, 1901. Entire plant. See Bulletin 98.

9253—Same; cowpea "Red Ripper." From plot at Station farm, July 2, 1901. Entire plant. See Bulletin 98.

9254—Same; cowpea "Whippoorwill." From plot at Station farm, July 2, 1901. Entire plant. See Bulletin 98.

9255—Same; cowpea "Calico." From plot at Station farm, July 2, 1901. Entire plant. See Bulletin 98.

9256—Same; cowpea "Clay." From plot at Station farm, July 2, 1901. Entire plant. See Bulletin 98.

9257—Same; cowpea "Taylor." From plot at Station farm, July 2, 1901. Entire plant. See Bulletin 98.

9258—Same; cowpea "Black." From plot at Station farm, July 2, 1901. Entire plant. See Bulletin 98.

9397—Same; the dry, ripe beans of No. 9251, "Extra Early Blackeyed," August 20, 1901. Cream colored beans with black eyes. See Bulletin 98.

9398—Same; dry, ripe beans of No. 9252, "Large Blackeyed," September 19, 1901. Like 9397, only much smaller. See Bulletin 98.

9399—Same; dry, ripe beans of 9253, "Red Ripper," October 22, 1901. Beans dark red-brown. See Bulletin 98.

9400—Same; dry, ripe beans of No. 9254, September 21, 1901. Beans mottled with brown. See Bulletin 98.

9401—Same; dry, ripe beans of No. 9255, October 22, 1901. Cream colored beans, brown around the eye, with occasional brown spots. A few beans entirely brown. See Bulletin 98.

9402—Same; dry, ripe beans of No. 9256, October 22, 1901. Beans mostly brown; a few nearly white. See Bulletin 98.

9403—Same; dry, ripe beans of No. 9257, October 22, 1901. Beans mottled, with an occasional red bean. See Bulletin 98.

9404—Same; dry, ripe beans of No. 9258, October 22, 1901. Beans pitch black. See Bulletin 98.

9405—Same; dry, ripe beans labeled "'Red' from plots at Station farm, October 22, 1901. Seed from C. S. Brent." The beans were of the same color at 9399, but longer and not as plump.

ANALYSES OF GRASSES

Station Number.	Common name of plant.	In the Fresh or Air-dry Material; per cent.					
		Water.	Ash.	Protein.	Fiber.	Nitrogen-free Extract	Fat.
9263	Red-top	61.47	3.35	3.91	12.30	18.19	0.78
9264	Rhode Island bent-grass	70 60	3 02	3.39	9 12	13 46	.41
9292	Meadow foxtail (hay)	6.47	10.79	12.69	23.47	43.23	3.35
9295	Yellow millo maize	87.30	1.53	2.14	3.31	5.43	.29
9220	Yellow millo maize	80.72	1.49	2.26	5.89	9.27	.37
9521	White millo maize	81.10	1.16	1.60	7 12	8.70	.32
9288	Sweet vernal-grass	65.66	3.42	3.06	10.86	16.01	.99
9291	Tall oats-grass	65 06	3.40	3.32	11.42	16.98	.82
9242	Meadow brome-grass	65.13	3.43	3.86	11.25	15.52	.81
9243	Smooth brome-grass	71 05	2.66	4 19	9.55	11.71	.84
9270	Rescue-grass	68.74	2.01	3.37	8 69	16.62	.57
9269	Orchard-grass	69.08	2.73	3 25	10.45	13.60	.89
9266	Teosinte	90.81	1.39	1 91	2.07	3.60	.22
9290	Teosinte	88.74	1.45	1.13	3.61	4.90	.17
9271	English blue-grass	72.07	2.80	3.37	9 27	11.90	.59
9293	Sheep's fescue	69 20	2.55	3.61	10.03	13 74	.87
9244	Soy bean, entire plant	84.26	2.30	4.11	3.75	5.31	.27
9245	Soy bean, entire plant	83.75	2.39	4.11	3 89	5.66	.20
9246	Soy bean, entire plant	83.40	2.35	4.86	3.36	5.75	.28
9247	Soy bean, entire plant	83.69	2 39	4.43	3.56	5.71	.22
9784	Soy bean, ripe beans	9.94	5.60	32.44	4.25	28.76	19.01
9260	Meadow soft-grass	72 75	3.18	3.16	8.35	11.84	.72
9274	Siberian millet	79.11	2 42	3 05	5.99	8.85	.58
9248	Flat pea, entire plant	76.82	1 56	5.82	6.93	8.22	.65
9289	Rice-grass	70.40	4.30	2.97	9 37	12.26	.68
9261	Italian rye-grass	67.81	2.97	3 28	9.38	15.85	.71
9287	Perennial rye-grass	78.41	2.25	2.88	5.76	10 16	.54
9265	Samarcand alfalfa	76.69	2.67	4.55	7 44	7.91	.74
9262	Meadow muhlenbergia	52.32	3.83	5 50	12.26	24.90	1.19
9276	Japan barnyard millet	84.76	1.78	2.81	4.16	5 93	0.56
9284	Crab-grass	71.40	3.32	3.60	7 47	13.48	.73
9275	Mands wonder forage plant	90.99	1.80	2.00	2 16	2.93	.12
9277	Mands wonder forage plant	83.95	1.68	2 89	5.19	6.48	.32
9286	Reed canary-grass	64.70	2 77	3.29	11 79	16 67	.78
9285	Timothy	65.47	2.16	2.77	10.81	17.76	1.03
9272	Canada blue-grass	71 02	2.39	2.83	9 68	13.40	.68
9273	Kentucky blue-grass	60.59	3.45	4.32	11.66	18 96	1.00
9268	Burnet	81 41	1.87	3.34	3.64	9.08	.66
9294	Alsike Clover	84.48	2.18	3.54	2.65	6.72	.43
9267	Crimson clover	73.35	3.48	4.16	7.07	11.11	.83

In the Water-free Material; per cent.									Station Number.
Ash.	Protein.	Fiber.	Nitrogen-free Extract.	Fat.	Albuminoids.	Phosphoric Acid.	Nitrogen	Potash.	
8.68	10 14	31.90	47.24	2.04	7.79	0.63	1.62	2.66	9263
10 26	11.52	31.04	45.77	1.41	8.08	73	1.84	2.72	9264
11.54	13.57	25.10	46.22	3.57	11.62	1.11	2.17	4 00	9292
11.86	16 85	26 09	42.91	2.29	8.49	1.13	2.70	5.42	9295
7.72	11.73	30.58	48.06	1.91	8.26	.79	1 88	3.23	9520
6.12	8.48	37 68	46.04	1.68	5.96	.70	1.36	2.40	9521
9.95	8.92	31 63	46.62	2.88	7 03	.73	1.43	1.60	9288
6.86	9 54	32 68	48.57	2.36	6 84	.62	1.52	3 25	9291
9.89	11 07	32.28	44.48	2.32	5.69	.73	1 79	3.19	9242
9.2[illegible]	14 46	33.03	40.40	2.91	11.56	.78	2 31	3.70	9243
6.42	10.77	27.80	53 19	1.82	7.18	.56	1.86	2.14	9270
8.82	10.52	33.80	43.96	2.90	8.31	.62	1 68	3.13	9269
15.17	20.72	22.60	39.05	2.46	13 58	1.59	3.81	7 45	9266
12.87	10.02	32 01	43 56	1.54	7.35	.75	1 60	7.00	9290
10.06	12.09	33.18	42.53	2.14	8.46	.75	1 93	3.24	9271
8.27	11 71	32 58	44.61	2.83	8.25	.57	1.87	2.56	9293
14.58	26.13	23.85	33.72	1 72	16 96	1.03	4.18	4.17	9244
14 70	25.28	23.92	34.88	1.22	17.18	.94	4 05	4 08	9245
14.18	29.26	20.23	34.63	1.70	19 51	.93	4.68	3.73	9246
14.67	27.17	21.84	34 96	1.36	18.46	.92	4.35	3.75	9247
6.22	3[illegible].02	4.72	31.93	21.11	34.42	1.63	5 76	2 50	9784
11.65	11.61	30.64	43 43	2.67	8.54	.71	1.86	3.44	9260
11.57	14 63	28.68	42 33	2.79	11.48	.83	2.34	5.73	9274
6 73	25.11	29.98	35.36	2.82	16.05	.87	4.02	3.20	9248
14.53	10 04	31.71	41.41	2.31	9.50	.69	1.67	1 40	9289
9.24	10.20	29.16	49 20	2.20	7 43	.72	1 63	2.76	9261
10.40	13 33	26.66	47.08	2.53	8.65	.83	2.13	3.47	9287
11.46	19.52	31.91	33.90	3.21	11.19	.72	3 12	3 33	9265
8.02	11.54	25 72	52.21	2.51	8.79	64	1.85	1.81	9262
11.71	18.48	27.30	38.84	3.67	13 14	1.16	2.96	4.11	9276
11.62	12.57	26.10	47.14	2.57	8.38	.50	2.01	4.30	9284
19.97	22 18	23.96	32.56	1.33	11 65	1.41	3.55	9.13	9275
10.47	14.85	32.33	40.33	2.02	7 22	.98	2.38	4.83	9277
7.84	9 31	33 40	47.23	2.22	7.51	.66	1 49	3.46	9286
6.25	8 02	31.29	51.45	2.99	4 27	.45	1.28	2.03	9285
8.25	9 77	33.44	46.16	2 38	6.95	.59	1.56	2.67	9272
8.76	11.02	29.58	48.09	2.55	9 43	.56	1.76	1.84	9273
10 02	17.98	19.59	48.82	3.59	13.48	.97	2.88	3.53	9268
14.06	22.82	17.06	43.32	2.75	14 12	.84	3 65	4.68	9294
13 04	15.61	26.54	41.70	3.11	12 98	.68	2.50	2.95	9267

ANALYSES OF GRASSES

Station Number	Common Name of Plant.	In the Fresh or Air-dry Material; per cent.					
		Water.	Ash.	Protein.	Fiber.	Nitrogen-free Extract	Fat.
9296	Russian vetch (hay)	6.90	12.76	22.19	27.64	26 79	3.72
9249	Cowpea, Wonderful, entire plant	88.94	2.03	3 18	2.49	3.09	.27
9259	" Unknown " "	88.91	2.26	3.29	2.36	2.74	.44
9250	" Lady " "	89.17	2.30	3.17	2.80	2.33	.23
9251	" E. E. Bl'keyed " "	88.97	2.07	3.07	2.59	3 05	.25
9252	" L'rgeBl'keyed " "	90 04	2.13	2.84	1 93	2.83	.23
9253	" Red Ripper " "	90.44	1.96	3.04	1.84	2.47	.25
9254	" Whippoorwill " "	89.49	2.18	2.97	2.53	2.59	.24
9255	" Calico " "	89.77	2.05	2 93	2.21	2.84	.20
9256	" Clay " "	90.25	1.93	2 84	2.45	2 34	19
9257	" Taylor " "	89.70	2 14	3.00	2 09	2.85	22
9258	" Black " "	89.46	2 09	3 19	2.09	2.97	.20
9397	" ripe beans of 9251	10.69	3.57	25.12	2.61	56.76	1.25
9398	" " " " 9252	9.45	3.55	25 12	3.83	57 06	.99
9399	" " " " 9253	9.18	3 19	23.19	4 48	58 92	1.04
9400	" " " " 9254	11 46	3.58	25 63	4.06	51.35	.92
9401	" " " " 9255	9.40	3.60	24.69	4.60	56.77	.94
9402	" " " " 9256	10.69	3.50	25.31	4.98	54 56	.96
9403	" " " " 9257	11.24	3.16	23.06	3 77	57 62	1.05
9404	" " " " 9258	10.80	3.25	23.44	4.16	57.32	1.03
9405	" " " " "Red"	9.40	3 38	25.50	4.57	56.27	.88

AND FORAGE PLANTS.—Continued.

In the Water free Material; per cent.									Station Number.
Ash.	Protein.	Fiber.	Nitrogen-free Extract.	Fat.	Albuminoids.	Phosphoric Acid.	Nitrogen.	Potash.	
13.70	23.83	29.69	28.78	4.00	14.63	1 12	3.81	4.48	9296
18.35	28 74	22.56	27 89	2.46	15.66	1.00	4.60	4.96	9249
20.41	29.64	21.31	24 63	4 01	16.31	1.24	4.74	5.60	9259
21.25	29.24	25.84	21 50	2.17	16 37	1.01	4.68	5 58	9250
18.81	27.88	23.49	27 57	2.55	14.58	1.07	4.46	5.11	9251
21.42	28 50	19.42	28.30	2 36	16.56	1.15	4.56	6 00	9252
20.47	31.81	19.30	25 82	2.60	16.61	1.46	5.09	6.17	9253
20.74	28.27	24 09	24.66	2.24	15.11	1.47	4.52	6.55	9254
20.05	28.64	21.60	27.76	1.95	16.07	1 18	4.59	5.24	9255
19.77	29.18	25.17	23.90	1.98	13.97	1 26	4.67	5.67	9256
20.83	29.18	20.29	27.54	2.16	15.68	1.08	4.67	4.34	9257
19.86	30.22	19.79	28.20	1 93	15.38	1.12	4.84	4.63	9258
4.00	28.13	2 92	63 55	1.40	24.91	1.46	4.50	1.79	9397
3.92	27.74	4.23	63.02	1.09	24 85	1.43	4.44	1.71	9398
3 51	25.59	4.93	64.83	1.14	23 12	1.11	4.08	1.64	9399
4.04	28.95	4 58	61.39	1.04	27.81	1.34	4.63	1.82	9400
3 97	27.25	5.08	62 66	1 04	23.18	1.29	4.36	1.73	9401
3.92	28.33	5.58	61.10	1.07	..	1 32	4.53	1.67	9402
3.56	26.01	4.25	65.01	1.18		.83	4.16	1.73	9403
3 64	26.28	4.66	64 27	1.15		1.29	4.20	1.70	9404
3 73	28 15	5.04	62.11	.97	...	1.37	4.50	1 77	9405

Soy Beans—With and Without Root Tubercles.

9360—Ripe soy beans gathered October 1, 1901, from a plot at the Station farm, planted with seed No. 4913, U. S. D. A. None of the plants in this plot bore any root tubercles. See Bulletin 98.

9361—Ripe soy beans gathered October 1, 1901, from another plot, planted with the same seed, where the plants bore abundant root tubercles. See Bulletin 98.

ANALYSES.	Air-dried.		Water-free.	
Number	9360	9361	9360	9361
Water	8.66	8.97	....	....
Ash	5.41	5.32	5.92	5.84
Protein	36.56	36.62	40.03	40.23
Phosphoric acid	1.69	1.65	1.85	1.81
Nitrogen	5.85	5.86	6.40	6.44
Potash	1.79	1.96	1.96	2.15

The presence of the tubercles appears to have had no effect upon the composition of the beans.

Soy Bean Roots and Tubercles.

8187—Root tubercles from soy beans grown at the Station farm, collected July 11, 1901, by H. Garman.

8188—Small roots of soy beans from plants that bore no tubercles, collected at the same time as the preceding. In preparing this sample the thick part of the tap root was rejected.

ANALYSES.	Frest Material		Water-free	
Number	8187	8188	8187	8188
Water	74.75	53.18	.....	.....
Nitrogen	1.26	.58	5.01	1.24
Protein	7.88	3.63	31.31	7.75

9297—Small roots of soy beans from plants having no tubercles, grown at the Station farm in 1901.

9298—Small roots bearing tubercles abundantly. In preparing these samples the thick part of the tap roots was rejected.

ANALYSES.	Air-dried.		Water-free	
Number	9297	9298	9297	9298
Water	5.40	5.56	———	———
Ash	———	11.28	———	11.94
Protein	11.31	16.87	11.96	17.86
Phosphoric acid	———	1.04	———	1.10
Nitrogen	1.81	2.70	1.91	2.86
Potash	———	1.38	———	1.46

It appears from these analyses that the root tubercles are about four times as rich in nitrogenous material as the roots without tubercles and the roots and tubercles together are about one-half richer than the roots of plants without tubercles. It would follow from this that where a crop is cut for hay and removed from the land, leaving the roots in the soil, there would be a larger amount of nitrogenous material added to the soil, for its enrichment, where nodules were present than where there were none. In the case of the two plots from which the samples came the yield of hay was sensibly the same in both, but the analyses show that the soil of the plot where the nodules were present was enriched by a quantity of nitrogenous material about one-half larger than the amount left in the soil of the plot where there were no nodules.

Mushrooms.

A sample of cultivated mushrooms, raised in the Vivarium, was brought by Prof. Garman, March 8, 1901. There were eight large specimens, fully expanded. The caps and stalks, weighed separately, showed the proportion of each in the sample to be: Caps, 82.6; stalks, 17.4 per cent. They were dried and analyzed separately, the caps having been designated as No. 9533 and the stems as No. 9534. The ash of the caps, also, was analyzed.

ANALYSES.	Fresh Material		Water-free	
	Caps.	Stems.	Caps.	Stems.
Number	9533	9534	9533	9534
Water	87.59	85.01	———	———
Ash	1.31	1.75	10.55	11.67
Protein	7.58	7.98	61.11	53.28
Fiber	.83	1.43	6.70	9.52
Nitrogen-free extract	2.50	3.67	20.14	24.47
Fat	.19	.16	1.50	1.06
	100.00	100.00	100.00	100.00
Phosphoric acid	.39	.34	3.14	2.28
Nitrogen	1.21	2.28	9.78	8.52
Potash	.68	.32	5.47	2.12
Albuminoids	3.58	3.81	29.00	25.43

ANALYSIS.	Ash of 9533
Ferric oxide	4.50
Manganous oxide	.21
Lime	.55
Magnesia	2.34
Potash	50.40
Soda	2.95
Phosphoric Acid	29.78
Silica	4.29
Loss and undetermined	4.98
Total	100.00

Cottonseed Meal.

9170—Sent by C. W. Caldwell, Danville, Ky., who suspected it was adulterated. The sample was sweet smelling and looked like good meal.

9432—Sent by J. R. Chaney, Woodburn, Ky., who suspected adulteration on account of its dark color. The sample was quite brown and smelled as if it had been roasted.

ANALYSES.	As received		Water-free	
	9170	9432	9170	9432
Water	10.57	5.16	———	———
Ash	5.83	7.53	6.52	7.94
Protein	41.75	46.25	46.68	48.77
Fiber	6.45	———	7.21	———
Nitrogen-free extract	25.92	———	28.99	———
Fat	9.48	———	10.60	———
	100.00		100.00	

The analyses do not indicate adulteration.

Blatchfords Calf Food.

9636—Sample taken by D. W. May from a lot in use at the Station farm.

ANALYSES.	As received	Water-free
Water	11.42	———
Ash	4.47	5.04
Protein	25.06	28.30
Fiber	4.49	5.06
Nitrogen-free extract	50.13	56.60
Fat	4.43	5.00
	100.00	100.00
Phosphoric acid	1.34	1.57
Nitrogen	4.01	4.53
Potash	1.85	2.09
Albuminoids	22.48	25.38

Distiller's Corn Bran.

9891—Made by the Glenmore Distilleries Co., Owensboro, Ky., June 24, 1904. Appears to be the outer coating of the corn grain, cleanly separated.

ANALYSES.	As received	Water-free
Water	12.15	———
Ash	2.12	2.41
Protein	8.87	10.10
Fiber	12.48	14.20
Nitrogen-free extract	57.96	65.98
Fat	6.42	7.31
	100.00	100.00
Phosphoric acid	0.91	1.04
Nitrogen	1.42	1.62
Potash	.70	.78
Albuminoids	8.62	9.81

Dried Distiller's Grains.

10420—From W. A. Gaines & Co., Frankfort, Ky.

ANALYSES.	As received	Water-free
Water	7.65	———
Ash	1.40	1.51
Protein	28.68	31.07
Fiber	11.75	12.72
Nitrogen-free extract	39.72	43.00
Fat	10.80	11.70
	100.00	100.00

Distillery Slop.

Through the courtesy of Mr. Geo. F. Berry and the Kentucky Distilleries and Warehouse Co. of Frankfort, the following described samples of fresh slop from several different distilleries were obtained for analysis:

9501—Straight rye slop, received March 4, 1902.

9633—Corn slop, received April 3, 1902. Rather thicker than 9501. No appearance of any other grain than corn.

9760—Rye slop, received April 19. Thicker than either 9501 or 9633.

9892—Corn slop, received June 26. Very thick and starchy looking.

9909—Corn slop from a spirit distillery in Indiana.

All the samples gave strong tests for starch by iodine solution, but distillation tests upon portions previously neutralized with potassium hydrate solution failed to show the presence of enough alcohol to be appreciable from the specific gravity of the distillate, except No. 9909, which was fermenting when received and contained a notable amount of alcohol. Before weighing out portions for analysis the samples were always well shaken and the weighing done quickly. In taking specific gravity a flask holding about a quart was used. Certain determinations were made upon portions of the original samples, directly weighed out, and, in case of total solids, ash and nitrogen, these were made in duplicate, the mean being taken. Analyses were made, also, of the residue obtained by evaporating the slop upon the water-bath to dryness and of the material obtained by straining on a 100. mesh sieve and drying, in imitation of the process by which dried distillery feed is obtained. Another set of analyses was made of the portion filtered out on paper filters, without pressure, and dried. Both these processes gave products richer in protein than those usually obtained in the manufacturing process ,probably because the laboratory process saved a larger proportion of the very fine particles. Some determinations were made, also, upon the clear filtrate from this filtration through paper. The results follow, in tabular form:

Determinations on the Original Slop—Per Cent.

Number	9501	9633	9760	9892	9909
Kind of grain used	Rye	Corn	Rye	Corn	Corn
Specific gravity @ 15.5°C	1 023	1.015	1 021	1.0155	.....
Total solids, water-free	7.00	5.00	5.86	4.81	8.26
Ash	.437	.312	.36	.307	.35
Total nitrogen	.367	.275	.321	.218	.382
Protein (N×6 25)	2.29	1.62	2.00	1.36	2 39
Albuminoids	1.44	1.29	1 08	...	.....
Nitrogen of ammonia salts	.009	.003	.003	....	....
Acidity, c.c. N. KOH, using litmus	7.4	6.6	6.2	....	....
Acidity, c.c. N. KOH, using phenolphtalein	.....	8.6	8.5	....	....
Acidity, c c. N. KOH, using cyanin	.....	....	2.2	...	.....
Fixed acid, by evaporation, litmus	5.4	....	...	...	.....
Volatile acid, by distillation, litmus	.3	....	....	....	.....
Chlorine	.03	....	..	....	.....
Starch	pres.	pres.	pres.	.54	.81
Amount recovered on the 100-mesh sieve, water-free	2.94	2.72	I.6	....	.....
Amount recovered on the paper filters, water-free	....	.....	....	3.54	6.1

Analyses of the Total Solids; Water-free—Per Cent.

Number.	9501	9633	9760	9892	9909
Grain Used	Rye	Corn	Rye	Corn	Corn
Ash	5.76	5.95	5.84	6.36	4.14
Protein	31.49	31.49	31.74	28.81	30.16
Fiber	8.30	6.19	7.33	6.34	10.57
Nitrogen-free extract	50.12	42.65	52.38	44.47	44 00
Fat	3 98	14.32	2.71	14.02	11.13
Total	100.00	100.00	100.00	100.00	100 00
Phosphoric Acid	2.28	2 45	2.59	2.00	1.62
Nitrogen	5.09	5 04	5.08	4.61	4.81
Potash	1.37	.70	1 53	1.32	1.05
Albuminoids	15.76	26.56	20.98	22.62	26 66
Total solids in the original slop	7.00	5.00	5.86	4.81	8.26

Analyses of the Material Strained Out by the 100. Mesh Sieve, Water-Free—Per Cent.

Number	9501	9633	9760
Grain Used	Rye	Corn	Rye
Ash	2.93	3.26	2.83
Protein	18.14	34.67	21.03
Fiber	15.12	9.08	14.77
Nitrogen-free extract	57.04	39.61	54.85
Fat	6.77	13.38	6.52
Total	100 00	100.00	100.00
Phosphoric acid	.87	1.36	1.10
Nitrogen	2.90	5.55	3.36
Potash	66	.63	.52
Albuminoids	14.34	33.50	17.62
Nitrogen of ammonia salts	.035	.....	.....
Amount of water-free material recovered by the sieve, per cent of the slop	2.94	2.72	1.60

Analyses of the Material Filtered Out on Paper Filters: Water-free—Per Cent.

Number	9501	9633	9760	9892	9909
Kind of grain used	Rye	Corn	Rye	Corn	Corn
Ash	3 78	2 32	2.53	3 24	2.46
Protein	27.43	36.84	33.18	29 50	35.43
Fiber	14 40	8.22	10 99	7 61	11.13
Nitrogen-free extract	49 91	35 52	45.52	48 25	38.52
Fat	4.48	17 10	7.78	11 40	12.46
Total	100.00	100.00	100.00	100 00	100.00
Phosphoric acid	....	....	....	1.14	1.02
Nitrogen	4.39	5.89	5.31	4.72	5.67
Potash	.....	.....	...	.48	.46
Albuminoids	...	...	...	27.84	31.52
Amount of water-free material recovered by the filter; per cent. of original slop	..	..	....	3.54	6.1
Amount of wet material, same	..	..	..	29.2	34 8

Determinations on the Clear Filtrate—Per Cent.

Number	9501	9633	9769	9892	9909
Specific gravity @ 15.5°C.	1 015	1.009	1.012	1.006	1.010
Total solids	3.66	1 82	3 19	1.90	3.02
Ash	37	.28	.33	.28	.32
Total nitrogen	.232	069	.171	.065	.091
Protein	1.45	.43	1.07	.41	.57
Albuminoids	.17	.12	.18		
Reducing sugars	.13	.07	.06	.07	.04
Starch					.64
Acid, cc. N. KOH, phenolphtalein			9 3	8.0	7 7
Phosphoric acid				.10	.14
Potash				.06	.08
Amount of filtrate collected, per cent. of original slop				70.8	65 2

A separate analysis of the ash of 9501 was made, the results of which, though not entirely satisfactory, will serve to show its character. The ash is very phosphatic and does not contain any carbonate.

ANALYSIS.	Ash of 9501.
Ferric oxide	1.28
Manganous oxide	.04
Lime	5.19
Magnesia	9.36
Potash	23.72
Soda	.65
Phosphoric Acid	39.58
Sulphuric acid	.47
Silica	9.05
Loss and undetermined	10.66
	100.00

The percentage of lime is probably too low.

Clays.

9830—Greenish, plastic clay, sent by Gus. G. Coulter, Frankfort, Ky., May 30, 1902. The sample contains a little finely crystalline pyrite. It is infusible in the blowpipe flame and burns white.

9983—Indianaite from Hart County, Ky., sent by M. G. McNamara, Louisville, Ky., who supposed it to be bauxite. The material was stained with manganese oxide and mixed with pieces of sandstone. The analysis is of selected white pieces.

10034—Clay from W. H. Blakeley, Bowling Green, Warren County, Ky., brought by C. J. Norwood, Inspector of Mines, August 5, 1902, to determine whether suitable for making Portland cement. Sample from the top of the pit. The material is a brown soil, not very clayey.

10035—Sample from the bottom of the same pit as 10034. The material is redder and more clayey than the preceding.

10205—Ochreous clay, brought by C. J. Norwood, Inspector of Mines, etc., for Mayor C. F. Grainger, Louisville. The sample was a porous, pale yellow clay, rather gritty and having somewhat the appearance of decomposed chert. Burns red when moderately heated and fuses only on the thinest edges in the blowpipe flame.

Analyses of the Air-dried Clays—Per Cent.

Number	9830	9983a	10034	10035	10205
Moisture @ 100°C.	0.61	11.77	2.14	2.09	2.16
Ignition (combined water, &c.)	6 41	13.76	4.37	3.58	3.30
Silica	69.88	36.18	78 97	79 50	80 22
Alumina	18.08	38.23	10 05	11.97	10.69
Ferric oxide	1.03	....	2.31	1.31	2.71
Lime	.37	....	.40	.35	.23
Magnesia	.37	...	trace	trace	24
Potash	.33	....	....	....	.20
Soda	.15	....	....	....	18
Sulphur trioxide	.09	...	....	....	....
Titanium dioxide	.50	....	....	....	....
Iron bisulphide	.36	....	....	....	.....
Total	98 18	99.94	98.24	98.80	99 93
Sand, by H_2SO_4 method	.....	....	.....	....	77.78

No. 9830 is an excellent plastic, refractory clay and its analysis closely resembles that of the German glass-pot clays. (See Reports of the Kentucky Geological Survey, Vol. A, Part I., p. 343.)

An analysis of No. 10205 by digestion in HCl of 1.115 specific gravity gave the following amounts soluble in that acid, calculated on the air-dried sample:

	Per Cent.
Alumina	4.91
Ferric oxide	1.73
Lime	.18
Magnesia	a trace
Potash	.18
Soda	.16
Total	7.16

Nitre Earth.

Two samples of nitre earth from a cave near Mullins Station, Pulaski County, Ky., were brought by J. K. Worrell, of Richmond, Ky., October 2, 1902.

10207—An ochreous, banded clay, soapy to the touch and very plastic. A qualitative test showed the presence of nitrates.

10208—A similar clay which had been broken up and leached in the old workings.

ANALYSES.	10207	10208
Total nitrogen, per cent	0.59	0.12
Phosphoric acid	trace	.38
Potash	.22	.10
Estimated value per ton	$2.03	$0.98

This material might be used locally as a fertilizer, especially upon sandy soils.

Banner Dissolved Bone.

10248—Manufactured by the Michigan Carbon Works, Detroit, Mich. Sample from a lot used in feeding experiments at the Station farm.

ANALYSIS.	Per Cent.
Moisture at 100 degrees C.	8.57
Ignition	17.41
Lime	36.46
Magnesia	.94
Potash	.27
Soda	.57
Phosphoric acid	33.82
Sulphuric acid	.75
Chlorine	1.70
Silica	.55
	101.04
Total Nitrogen	.31
Equivalent to protein	1.94

Agricultural Lime.

9772—Lime made by Dr. H. A. Lewis, Repton, Ky., sent for analysis by E. S. Nunn, Rodney, Ky., April 22, 1903. The sample looks like air-slaked lime. Qualitative tests showed very little magnesia and only traces of sulphates, phosphates and potash.

ANALYSIS.	Per Cent.
Calcium hydrate	72.5
Calcium carbonate	19.0
Undetermined	8.5
	100.0

The calcium hydrate present is equivalent to 54.9 per cent. of quicklime. This is a slaked lime, suitable for agricultural uses, but the price should be considerably less than for good quicklime.

Cow Manure.

10164—Manure from cattle fed on cotton seed meal, sent by J. C. Alexander, Bowling Green, Ky., who says it does not seem to have any beneficial effect when applied to the soil.

Analysis of the Dry Material—Per Cent.

Phosphoric acid	1.00
Nitrogen	.92
Equivalent to ammonia	1.12
Potash	.37
Estimated value per ton	$4.40

The analysis shows that the manure contains plenty of the valuable constituents.

Mineral Waters.

9814—Mineral water sent by W. J. Curtis, Piqua, Anderson County, Ky. Received May 6, 1902.

ANALYSIS.

One gallon of the water contains 35.4 grains of solid matter (0.607 gram per liter) consisting principally of carbonates of calcium and magnesium and chloride of sodium with a little sulphate

of calcium and traces of borates, potassium, lithium and strontium compounds and nitrates.

This is a weak calcic-saline water. It may have some medicinal value, though the amount of saline water is small.

9815—Mineral water from well 48 feet deep on place of W. C. Brown, Sinai, Anderson County, Ky. Slight whitish sediment. Received May 24, 1902.

ANALYSIS.

One gallon of the water contains 67.0 grains of solid matter (1.15 grams per liter) consisting principally of chloride of sodium and carbonates of calcium and magnesium. It contains also traces of potassium, lithium and strontium compounds, borates and nitrates.

This is a weak saline water. It may have some medicinal value, but the presence of a very marked trace of nitrates is an unfavorable indication.

9813—Mineral water sent by C. S. Jones, Glasgow, Barren County, Ky. When received it contained a ferruginous sediment which turned black on standing in the closed bottle. Received May 10, 1902.

ANALYSIS.

One gallon of the water contains 185.0 grains of solid matter (3.17 grams per liter) consisting of carbonates and sulphates of calcium, and magnesium, carbonate of iron and some chloride of sodium.

This is a chalybeate water, its most important constituent being the carbonate of iron which would give it the usual tonic properties.

10270—Mineral water sent by Hon. Geo. W. Reeves, Wickliffe, Ballard County, Ky. Water clear, no sediment. Received October 31, 1902.

ANALYSIS.

One gallon of the water contains 14.7 grains of solid matter (0.252 gram per liter) consisting mainly of the carbonates of calcium and magnesium, chloride of sodium, a little sulphate of potassium, carbonate of sodium and traces of carbonate of iron, and lithium and strontium compounds.

This is a calcic water, slightly alkaline in character. Such waters, though not containing much mineral matter, have been found to possess considerable medicinal value. If charged artificially with carbonic acid gas, this would be a very pleasant and wholesome table water.

10069—Mineral water from well of E. P. Stewart, Gilstrap, Butler County, Ky. Received July 15, 1902.

ANALYSIS.

One gallon of the water contains 24.5 grains of solid matter (0.42 gram per liter) nearly half of which is organic matter. The mineral matter is mainly carbonate of calcium, with some carbonate of magnesium and carbonate of iron, small quantities of sulphates and chlorides of calcium, magnesium, sodium and potassium and traces of iodides, bromides, borates and lithium and strontium compounds. The sediment in the jug contained a little sulphide of zinc.

This water may have some medicinal value, especially as it contains a notable amount of iron.

10067—Mineral water sent by Mr. L. H. McKee, Hopkinsville, Christian County, Ky. Received August 8, 1902.

ANALYSIS.

One gallon of the water contains 27.5 grains of solid matter (0.471 gram per liter) composed mainly of carbonates of calcium and magnesium and chloride of sodium, a little sulphate of calcium, traces of borates and potassium compounds and very marked traces of strontium and lithium compounds.

This water contains little mineral matter, but is remarkable for containing very considerable traces of strontium and lithium.

10070—Mineral water sent by J. L. Harris, Hopkinsville, Christian County, Ky. Received July 19, 1902.

ANALYSIS.

One gallon of the water contains 29.3 grains of solid matter (0.503 gram per liter) consisting principally of carbonates of calcium, magnesium and sodium and sulphate of sodium, with some chloride of sodium, biborate of sodium and marked traces of lithium and potassium compounds and nitrates.

This is an alkaline water containing comparatively little calcium and magnesium compounds. Such waters, when charged with carbon dioxide gas, are highly esteemed as table waters.

10072—Sulphur water sent by Winston Henry, Hopkinsville, Christian County, Ky. Received August 2, 1902.

ANALYSIS.

One gallon of the water contains 55.2 grains of solid matter (0.946 gram per liter) consisting mainly of carbonates of calcium and magnesium and sulphates and chlorides of calcium, magnesium and sodium, with marked traces of borates, iodides, potassium, strontium and lithium compounds.

The water also contains 0.43 grain of hydrogen sulphide gas to the gallon (0.0074 gram per liter).

This is a good, mild saline sulphur water.

10286—Mineral water from well of J. T. Beal, Dodge, Clark County, Ky. Received November 3, 1902.

ANALYSIS.

One gallon of the water contains 34.3 grains of solid matter (0.588 gram per liter) consisting principally of chloride of sodium with some carbonate of calcium, carbonate of magnesium and carbonate of sodium, a little sulphate of potassium and traces of iron, aluminum and lithium compounds.

This is a weak saline water, slightly alkaline in character. It would be a very good table water if charged with carbon dioxide gas, and should have some medicinal value.

9406—Water sent by Maj. B. G. Thomas, Lexington, Fayette County, Ky., from a well bored on his Hira Villa farm on the Russell Road. The sample opalescent, with dark brown sediment in the bottle. Tastes slightly brackish and of petroleum. Received February 18, 1902.

ANALYSIS.

One gallon contains 222.4 grains of total solid matter (3.814 grams per liter) composed principally of chloride of sodium with chlorides of calcium, magnesium and potassium, carbonate of calcium, iron, strontium, lithium and bromides and borates. It is similar to the water in the old well, only weaker.

10023—Water from well of Capt. Charles D. Clay, Lexington, Fayette County, Ky. Well about 50 feet deep, newly bored and on high ground. Received August 2, 1902.

ANALYSIS.

Total solids, dried 100 degrees	292.	parts in 1000000
Mineral solids by ignition	224.	" " "
Organic solids by difference	69.	" " "
Free ammonia	0.12	" " "
Albuminoid ammonia	0.04	" " "
Chlorine of chlorides	21.0	" " "
Nitrogen of nitrites	0.032	" " "
Nitrogen of nitrates	0.20	" " "

Sulphates, phosphates, lithium and strontium—traces. Calcium and magnesium, considerable amounts. Sodium and potassium, moderate amounts. Free ammonia and nitrites too high. Indications unfavorable.

10206—Water from well 260 feet deep on R. H. Wilson's place on the Georgetown pike, Fayette County, Ky. Received September 22, 1902.

ANALYSIS.

One gallon contains 19.6 grains of solid matter (0.337 gram per liter) composed mainly of carbonates of calcium and magnesium and chloride of sodium with a little sulphate of sodium and carbonate of sodium and traces of potassium and strontium compounds, nitrates, nitrites and ammonia.

This is a hard limestone water.

10231—Water brought by Capt. Charles D. Clay, Lexington, Fayette County, Ky., from a well on his farm on the Versailles Pike from which the sample No. 10023 was taken. The water has been in constant use since the first sample was taken. Received October 21, 1902.

ANALYSIS.

Total solids, dried at 100 degrees C.	298.00	parts in 1000000
Mineral solids by ignition	235.00	" " "
Organic solids by difference	63.00	" " "
Free ammonia	0.13	" " "
Albuminoid ammonia	0.08	" " "
Chlorine of chlorides	37.00	" " "
Nitrogen of nitrites	0.01	" " "
Nitrogen of nitrates	none	
Sulphates, phosphates	traces	
Lithium and strontium	traces	

Calcium and magnesium, mainly as carbonates, considerable. Sodium and potassium, mainly as chlorides, moderate. Silica, alumina and iron, traces.

10242—Mineral water brought by B. M. Cole, Lexington, Fayette County, Ky., from a new well 95 feet deep on his farm one-half mile from Lexington on Russell Cave Pike. The flow is very strong. The sample was slightly milky when received, but was said to have been clear when pumped. The water contained a notable amount of hydrogen sulphide and gave off bubbles of carbon dioxide on standing. Received October 24, 1902.

ANALYSIS.

One gallon of the water contains 25.3 grains of solid matter (0.434 gram per liter) composed of carbonates of calcium and magnesium and chloride of sodium with some sulphate of potassium and marked traces of lithium and strontium compounds.

The water also contains 0.18 gram of hydrogen sulphide to the gallon (0.0032 gram per liter).

This is a weak alkaline sulphur water of a kind that has been found to possess valuable medicinal properties.

A sample tested eight months later contained no hydrogen sulphide.

10257—Mineral water from a well of Alfred Ruh, Lexington, Fayette County, Ky., near the city limits. The well was drilled in 1900 and is 140 feet deep in solid rock. Sample, slight milkiness resembling sulphur. Received October 27, 1902.

ANALYSIS.

One gallon of the water contains 46.00 grains of solid matter (0.788 gram per liter) consisting principally of chloride of sodium with some carbonate of calcium, carbonate of magnesium, sulphate of potassium, carbonate of sodium and traces of lithium and strontium compounds.

The water also contains a little hydrogen sulphide, amounting to 0.06 grain per gallon (0.0011 gram per liter).

9884—Mineral water sent by O. M. Johnson, M. D., Watervalley, Graves County, Ky. Received May 27, 1902.

ANALYSIS.

One gallon of the water contains 28.9 grains of solid matter (0.495 gram per liter) consisting mainly of carbonates and sulphates of calcium and magnesium, a little carbonate of iron, chloride of sodium, organic matters and traces of potassium and strontium compounds.

This is a weak chalybeate water and no doubt possesses the usual tonic properties.

10068—Mineral water sent by J. M. Dockery, Sedalia, Graves County, Ky. Received July 12, 1902.

ANALYSIS.

One gallon of the water contains 4.6 grains of solid matter (0.08 gram per liter) nearly one-half of which is organic, the rest consisting mainly of carbonate of iron and silica with small quantities of carbonates, sulphates and chlorides of calcium, magnesium and sodium and traces of potassium and lithium compounds. The amount of carbonate of iron in the gallon was found to be 1.1 grains (0.019 gram per liter).

This is a weak chalybeate water, remarkable for the small amount of mineral matter it contains.

10172—Mineral water sent by Dr. J. A. McNeely, Wingo, Graves County, Ky. Dr. McNeely says the water is from a well 167 feet deep and has had from the first a medicinal taste; also that reports say the constant use of the water has had a decided effect upon the kidneys and has been beneficial in cases of rheumatism. Received September 4, 1902.

ANALYSIS.

One gallon of the water contains 3.6 grains of solid matter (0.061 gram per liter) consisting mainly of the carbonates of calcium and iron with some silica and traces of sulphates and chlorides of sodium, potassium and magnesium and organic matter.

This water is remarkably free from mineral matters, but as it contains a notable amount of iron it may have some medicinal value.

10173—Mineral water sent by Dr. P. W. McKeel, Wingo, Graves County, Ky., from a well 10 feet deep. Received September 24, 1902.

ANALYSIS.

One gallon of the water contains 18.4 grains of solid matter (0.316 gram per liter) consisting mainly of carbonates of iron and calcium, with some carbonate of manganese and traces of the sulphates and chlorides of sodium, potassium and magnesium and a good deal of organic matter.

This is a chalybeate water of moderate strength and as such should have some medicinal value.

10238—Mineral water sent by Dr. O. M. Johnson, Water Valley, Graves County, Ky. Received October 17, 1902.

ANALYSIS.

One gallon of the water contains 16.1 grains of solid matter (0.276 gram per liter) consisting of sulphates and chlorides of calcium, magnesium, sodium and potassium, a little silica and traces of aluminum and lithium compounds and carbonate of iron.

This water contains very little mineral matter and is hardly to be classed as a mineral water.

10419—mineral water found at 920 feet in well of Hoosier Oil & Gas Co., in the northeast corner of Harrison County, Ky. Sample brought by Prof. A. M. Miller. Salty water, smelling of petroleum and containing a good deal of white sediment. Received November 19, 1902.

ANALYSIS.

One gallon of the water contains 633 grains of solid matter (10.856 grams per liter) consisting principally of sodium chloride with sulphates and chlorides of calcium, magnesium and potassium, carbonates of calcium and magnesium and traces of iron, lithium and strontium compounds and bromides.

The mineral matter in this water is very similar in character and amount to that contained in Blue Lick water, except that the sample contained no sulphides when received. These may have undergone oxidation.

10440—Black sulphur water from the Drennon Springs, Drennon, Henry County, Ky. Sent by W. L. Crabb. Received November 25, 1902.

ANALYSIS.

One gallon contains 683 grains of solid matter (11.712 grams per liter) consisting of chlorides and sulphates of sodium, calcium and magnesium, sulphide of sodium, carbonates of calcium and

magnesium and very marked traces of iodides and bromides and traces of potassium, lithium and strontium compounds.

The water contains also some free hydrogen sulphide gas; the total amount present, including both free and combined, being 4.4 grains per gallon (0.076 gram per liter).

This is a good saline sulphur water, very similar to Blue Lick, but somewhat stronger.

10221—Mineral water from W. C. Crabb, Eminence, Henry County, Ky. Received October 11, 1902.

ANALYSIS.

One gallon of the water contains 337.0 grains of solid matter (5.784 grams per liter) consisting principally of chloride of sodium with chlorides and sulphates of calcium and magnesium, some carbonate of calcium and traces of bromides, potassium, lithium and strontium.

This is a saline water and should have medicinal value.

9539—Mineral Water from W. I. Hamby, Dawson Springs, Hopkins County, Ky. Received March 12, 1902.

ANALYSIS.

One gallon of the water contains 47.5 grains of solid matter (0.816 gram per liter) composed mainly of carbonates and sulphates of calcium and magnesium and chloride of sodium with small quantities of carbonate of iron, and nitrates, and traces of strontium and borates.

Later analysis shows it to be a good chalybeate water. (See No. 9816.) No doubt the iron was overlooked on account of its having deposited as a sediment in the jug.

9885—Mineral water sent by John G. Orndorff, Sec. and Treas. Logan Co. Oil and Gas Co., Russellville, Logan County, Ky., for the company. Water was struck in great abundance at a depth of 635 feet. Received May 31, 1902.

ANALYSIS.

One gallon of the water contains 2626.0 grains of solid matter (45.04 grams per liter) consisting mainly of sodium chloride with chlorides and sulphates of calcium and magnesium, sodium sulphide, iodides and bromides, borates and lithium and strontium compounds. It contains also some free hydrogen sulphide. The total amount of this substance, both free and combined, was 26.5 grains per gallon (0.44 gram per liter). The sediment in the jug contains some sulphide of iron.

A very strong saline sulphur water, resembling Blue Lick, but three times as strong.

9812—Mineral water from well of J. W. Boyle, Livia, McLean County, Ky. Received May 19, 1902. Water slightly brownish.

ANALYSIS.

One gallon of the water contains 49.0 grains of solid matter (0.84 gram per liter) consisting mostly of carbonate of lime, sulphate of magnesia and chloride of sodium with small quantities of carbonates of magnesia, iron and manganese, sulphates of lime, potassium and sodium, traces of sulphate of lithia and some borates, nitrates and organic matter.

There was a mere trace of nitrite and free ammonia.

10258—Mineral water from well of Dave Lewis, Pomp, Morgan County, Ky. Slight, floculent sediment. Received October 28, 1902.

ANALYSIS.

One gallon of the water contains 17.0 grains of solid matter (0.292 gram per liter) consisting of carbonate of calcium, chloride of sodium, sulphates of magnesium and potassium, traces of iron and lithium compounds and silica.

This water contains very little mineral matter and is hardly to be classed as a mineral water. It is quite a pure water.

9169—Mineral water from W. McGuire, West Liberty, Morgan County, Ky., from a well in his yard. Received January 17, 1902.

ANALYSIS.

One gallon of the water contains 36.0 grains of solid matter (0.617 gram per liter) composed mainly of the carbonate, sulphates and chlorides of calcium, magnesium and sodium.

The quantity of water sent was too small for satisfactory examination.

10220—Mineral water from B. F. Carter, West Liberty, Morgan County, Ky. Received October 9, 1902.

ANALYSIS.

One gallon of the water contains 11.2 grains of solid matter (0.192 gram per liter) consisting principally of the carbonates of calcium, iron and sodium with a little carbonate of magnesium and traces of sulphates, chlorides, potassium and strontium.

This is a weak chalybeate water and no doubt has useful medicinal properties.

10135—Mineral water from a well 460 feet deep, bored by the Nicholas County Oil and Gas Co., below Parks Hill in Nicholas County, about half way between the upper and lower Blue Licks. Sample brought by W. T. Wyatt, Lexington, Ky. Water slightly yellowish, tastes very strong of salt and sulphides, does not smell very strongly of hydrogen sulphide. Received August 18, 1902.

ANALYSIS.

One gallon contains 1810.6 grains of solid matter (31.06 grams per liter) consisting mainly of chloride of sodium, with chloride of calcium and magnesium, some carbonate of calcium, sulphate of calcium, sulphide of sodium, iodides, bromides, borates and potassium, lithium and strontium compounds. The water contains also a considerable amount of free hydrogen sulphide gas. The total weight of this substance, including both free and combined, was found to be 18.4 grains to the gallon (0.32 gram per liter).

This is a strong saline sulphur water in which a large part of the sulphur is in the form of alkaline sulphide. It resembles Blue Lick water, but is three times as strong.

10071—Mineral water sent by J. B. Howard, Fordsville, Ohio County, Ky., from his well. Received August 1, 1902.

ANALYSIS.

One gallon of the water contains 192.0 grains of solid matter (3.292 grams per liter) consisting mainly of carbonates and sulphates of calcium, magnesium and sodium and chloride of sodium, with traces of borates and strontium.

This is a saline water containing a good deal of magnesia.

10201—Mineral water sent by W. M. Cassaday, Ballardsville, Oldham County, Ky. Received September 24, 1902.

ANALYSIS.

One gallon of the water contains 3.2 grains of solid matter (0.054 gram per liter) composed mainly of carbonates of lime, iron and sodium with traces of magnesium, potassium and strontium compounds, silica and organic matter.

This water is remarkably free from mineral matter, though possibly the small amount of iron it contains might have some therapeutic action. This water would be excellent for most purposes where purity is required.

9886—Mineral water sent by J. W. & J. T. Yager, La Grange, Oldham County, Ky. Received June 19, 1905.

ANALYSIS.

One gallon of the water contains 17.5 grains of solid matter (0.301 gram per liter) consisting mainly of carbonate of lime and carbonate of magnesia with traces of sulphates, chlorides and nitrates.

The water is of the same character as the hard limestone waters of this region, containing only a trifle more than the average of solids.

10167—Mineral water sent by J. M. Weathers, Elkton, Todd County, Ky., from the public well. Received Sept. 3, 1902.

ANALYSIS.

One gallon of the water contains 64.3 grains of solid matter (1.103 grams per liter) consisting mainly of chloride of sodium with carbonates of calcium, magnesium and sodium, sulphide and sulphate of sodium, borates and traces of potassium, strontium and lithium compounds. The water also contains some free hydrogen sulphide gas. The total amount of hydrogen sulphide, both free and combined, was found to be 1.2 grains to the gallon (0.02 gram per liter).

This is a very good alkaline-saline sulphur water.

10239—Mineral water sent by Dr. S. K. Fischer, Bedford, Trimble County, Ky. Received October 22, 1902.

ANALYSIS.

One gallon of the water contains 25.4 grains of solid matter (0.436 gram per liter) consisting principally of carbonate of calcium and sulphates of calcium, magnesium and sodium, with small quantities of sulphate of potassium and chloride of sodium and a trace of carbonate of iron.

This is a weak calcic-magnesian water and should have some medicinal value.

9167—Mineral water sent by A. G. Mitchell, Smith's Grove, Warren County, Ky. Received January 13, 1902. The water contained a slight brownish, floculent sediment which Mr. Mitchell says is not present when the water is first drawn.

ANALYSIS.

One gallon of the water contains 23.2 grains of solid matter (0.398 gram per liter) consisting of carbonates of calcium, magnesium and iron with small quantities of sulphates and chlorides of calcium, magnesium, sodium and potassium and traces of strontium, lithium and borates.

This is a weak chalybeate water and should have some medicinal value.

10159—Mineral water sent by Isaac Stephens, Sebree, Webster County, Ky. Received August 25, 1902.

ANALYSIS.

One gallon of the water contains 10.7 grains of solid matter (0.184 gram per liter) composed of carbonates of calcium, sodium, magnesium and iron, a little chloride of sodium, sulphate of potassium and traces of lithium and strontium compounds and borates.

This water contains so little mineral matter that it is hardly proper to class it as a mineral water. It would be an excellent table water, especially is artificially charged with carbon dioxide.

10160—Mineral water sent by C. H. Howe, Sebree, Webster County, Ky. Received August 25, 1902.

ANALYSIS.

One gallon of the water contains 46.3 grains of solid matter (0.733 gram per liter) composed of carbonate of iron, sulphates of calcium, magnesium, sodium and iron, chloride of sodium and traces of sulphates of potassium and lithium.

This is a calcic-saline chalybeate water. It should have medicinal value.

10166—Mineral water, Page Hotel, Dixon, Webster County, Ky. (See analyses Nos. 10168 and 10169.)

ANALYSIS.

One gallon of the water contains 155.6 grains of solid matter (3.669 grams per liter) consisting mainly of sulphates of iron, calcium, magnesium and sodium with traces of the sulphates of potassium and lithium.

This is a strong chalybeate water of the so-called alum class and as such should have some medicinal value.

10168—Mineral water from a well on the Thos. M. Page property, Dixon, Webster County, Ky., sent by Dr. J. A. Goodman. Well 92 feet deep; water 65 feet deep in the well. A very copious ferruginous sediment had formed in the jar which contained the water. Received September 4, 1902.

ANALYSIS.

One gallon of the water contains 163.2 grains of solid matter (2.8 grams per liter) consisting mainly of the sulphates of sodium, calcium, magnesium and iron, some chloride of sodium and traces of sulphates of potassium, lithium and strontium. The amount of iron present was found to be equivalent to 17.7 grains of ferrous sulphate to the gallon.

This is a strong chalybeate water of the so-called alum class and as such should have medicinal value.

10169—Mineral water from a spring on the Thos. M. Page property, Dixon, Webster County, Ky., sent by Dr. J. A. Goodman, Dixon, Ky. A copious ferruginous sediment had formed in the jar. Received September 4, 1902.

ANALYSIS.

One gallon of the water contains 296.9 grains of solid matter (5.093 grams per liter) consisting mainly of the sulphates of sodium, calcium, magnesium and iron, some chloride of sodium and traces of the sulphates of potassium, lithium and strontium. The amount of iron present was found to be equivalent to 46.3 grains of ferrous sulphate to the gallon (0.795 gram per liter).

The water is of the same character as No. 10168, but more than twice as strong.

METEOROLOGICAL SUMMARIES

FOR THE YEAR 1902.

Compiled from the records of the U. S. Weather Bureau Station in the main college building

PRESSURE.

ELEVATION OF THE BAROMETER CISTERN ABOVE MEAN SEA:LEVEL, December 31, 989 feet.

MONTHS.	Monthly	Highest Observed	Date	Lowest Observed	Date	Absolute range.
	In	*In.*		*In.*		*In.*
January	29.08	29 70	28	28 95	21	0.75
February	28 93	29.28	3	27.91	28	1.37
March	28.93	29.43	18	28.38	1	1 04
April	28.93	29.25	24	28.65	6	1.60
May	29.00	29.19	31	28.86	19	0 32
June	28 92	29 23	1	28.68	16	0.55
July	29 02	29.17	2	28.90	21	0.26
August	28.94	29.16	24	28.87	6	0.29
September	28.97	29.28	14	28.62	30	0 66
October	29.02	29 42	31	28.69	5	0.73
November	29.02	29.30	1	28.50	26	0.80
December	29.14	29.40	8	28.63	3	0.77
		Highest		Lowes		
Mean	28.98	29.70	Jan. 28	27.91	Feb. 1	0.72

PRECIPITATION.

(Amount in inches and hundredths.)

Elevation of top of guage above ground December 31, 68 feet

Months.	Total Amount.	Greatest Am't in any 24 consecutive hours.		No. of days on which 1 in. fell.	No. of days on which no rain except "Trace" fell	Greatest No. of consecutive days without rainfall (Dates inclusive)	Normal rainfall.
		Am't	Date-				
January	4.77	1.87	28 & 29	0	22	1 to 17	3.82
February	0.90	0.34	11 & 12	0	18	13 to 16	3.70
March	2.92	0.80	4 & 5	0	20	17 to 26	4.90
April	1.27	0.58	28 & 29	0	20	12 to 18	3.72
May	2.43	0.75	23 & 24	0	19	8 to 19	3.49
June	5.19	1.25	26 & 27	0	18	21 to 25	4.25
July	2.33	1 56	19 & 20	1	24	21 to 28	5.10
August	1.89	0.66	21	0	24	22 to 31	3.52
September	2.60	0.97	24 & 25	0	20	2 to 8	2.54
October	2.11	1 24	11	0	25	14 to 26	2.22
November	3.09	1.20	24 & 25	0	18	7 to 14	3.72
December	6.60	1.75	14 & 15	0	14	17 to 19	3.40
Total	36.10				242		44.38

CLOUDINESS.

Months.	Mean Cloudn's (0 to 10)		Character of Day.		
	8 A. M.	Monthly	Clear	Partly Cloudy	Cloudy
January	5.7	5.7	9	11	11
February	5.6	5.4	8	10	10
March	6.4	5.8	7	14	10
April	4.5	4.3	12	14	4
May	3.6	3.1	18	13	0
June	5.4	4.6	13	13	4
July	3.3	3.6	14	17	0
August	3.6	4.0	13	16	2
September	5.0	4.8	10	13	7
October	4.1	4.1	15	7	9
November	7.0	6.5	4	14	12
December	7.5	7.9	3	7	21
Summary	.....	.....	126	149	90
Mean	5.1	5.0		.....	.....

TEMPERATURE.

Months.	Elevation of the Dry Thermometer Bulb Above Ground Dec. 31st, 75 Feet — From Self-Registering Instruments.										No. of Days.		
	Mean			Highst	Date.	Lowest	Date.	Range.		Mean daily change	Max. below 32 degrees.	Max. above 90 degrees.	Min. below 32 degrees.
	Max.	Min.	Monthly.					Absolute.	Mean Daily.				
				°									
January	39.8	24.8	32 3	60	9	8	28	52	15.0	6.8	6	0	27
February	31.5	18.5	25.0	57	28	3	3	54	13.0	4.4	17	0	23
March	52.8	36.6	44.7	71	11	10	18	61	16 2	6.1	2	0	9
April	62.0	43.1	52.6	85	25	22	8	63	19.0	6.0	0	0	4
May	78.3	58.1	68.2	89	20	40	28	49	20.2	4.3	0	0	0
June	80.1	62.2	71.2	92	12	50	9	42	17.9	4.6	0	2	0
July	86.2	67.3	76.8	96	17	58	22	38	18.9	3 4	0	11	0
August	83.6	64.0	73.8	93	3	55	17	38	19.6	3.4	0	3	0
September	76.3	57.8	67 0	86	8	43	14	43	18.5	3.7	0	0	0
October	68.6	49.5	59.0	80	25	34	15	46	19.1	5.1	0	0	0
November	59.9	45.2	52.6	75	11	28	30	47	14.7	3.9	0	0	2
December	40.8	27.7	34.2	60	2	9	26	51	13.1	6.7	5	0	19
				Max.		Min.							
Mean	63.3	46.2	54.8	96	Jul.17	3	Feb. 3	49	17.1	4.9	...	.....	.....

WIND

Elevation of the Anemometer Cups above ground Dec. 31, 102 ft.

Months.	Prevailing Direction.	Maximum hourly velocity during month.			No. of days with gales.*	No. of Calms.
		Miles	From	Date		
January	N. W.	31	N. W.	21	0	0
February	W.	50	W.	28	1	0
March	S.	55	W.	30	0	0
April	W.	45	W.	26	1	0
May	S. W.	40	N.	20	1	0
June	S. E.	40	N. W.	27	1	0
July	S. W.	38	W.	19	0	0
August	N. E.	52	W.	21	1	1
September	S. E.	35	N. W.	9	0	0
October	S. W.	30	W.	28	0	0
November	S.	32	S.	14	0	0
December	S. W.	40	S.	15	1	0
Mean	S. W.	.....	.....	....	.....	....

*Days with 40 miles per hour and over.

NUMBER OF DAYS.

Months.	Thunder Storms	Snows.	Hail	Fog
January	0	4	0	0
February	1	4	0	0
March	1	3	1	0
April	1	1	0	0
May	9	0	0	0
June	10	0	0	0
July	9	0	1	1
August	7	0	0	0
September	0	0	0	2
October	2	0	0	0
November	0	2	0	1
December	2	5	0	3
Summary	42	19	2	7

INDEX

Acuan illinoensis 13
Adulterated food products 86
Agricultural Division x
Agricultural lime, analysis of 320
Agrostis alba and canina 47. 298
Allen, Dr. M. K. xv
Allen, R. M. ..... v, xiii, 86
Alfalfa, 24, analyses of 52, 59, 299, 302
Alopecurus pratensis 47, 298
Alsatian clover 36
Alsike clover, 36; analyses of 52, 59, 300, 2
American vetch 42
Amorpha fruticosa 13
Analysis of agricultural lime 320
banner dissolved bone 319
Blatchford's calf food 309
butter from churn tests 286
clays 317, 18
commercial fertilizers 176-224, 256
corn bran 309, 10
corn (shelled) 163
cottonseed meal 308, 9
cow manure 320
distiller's dried grains 163, 310
distillery slop (fresh) 310-16
ensilage 164
forage plants 51-59, 297-305
foods 106-137
grasses and forage plants 51-59, 297-305
hominy meal 164
Indianaite 317, 18
mineral waters 320-335
mushrooms 307, 8
nitre earth 319
ochre 317, 18
soy beans, shelled 163
soy beans with and without root tubercles 306
root tubercles 306
soils 286-297
sorghum juice 283, 4
wood ashes 296, 7
Anderson County mineral waters 320, 1
Andropogon sorghum 47, 298
Anthoxanthum odoratum 47, 298
Anthyllis vulneraria 13, 54
Apios apios 14
priceana 14
Arrhenatherum elatius 47, 298
Astragalus carolineanus 14
Australian salt-bush, analysis of 52
Averitt, S. D. ..... v, vlll, 283
analyses of oats by 72
Bacteria causing root tubercles 7
Bacterial cultures for wheat and corn 11
Baking powders, analyses of 106
Ballard County mineral water 321
Banner dissolved bone, analysis of 319
Baptisia alba, leucantha and tinctoria 14
Barker, Henry S. iv
Barnyard grass, analysis of 299
Barren County mineral water 321
Beal, J. T., mineral water 323
Beatty, L. O. ..... v, viii, 283
Beckham, Gov. J. C. W. iv
Bell, W. C. iv

Bent grass, 47; analysis of 298, 302
Berry, G. F., distillery slop from 310
Black locust 35
Black lupine 23
Black medick, 23; analysis of 52
Blakely, W. H., clay from 317
Blatchford's calf food, analysis of 309
Bluegrass, 48, 49; analyses of 52, 54, 299, 300, 2
Bluegrass seed, when to gather 49
Board of Control of the Station v
Board of Trustees of the College iv
Bokhara clover 29
Boyle, J. W., mineral water 330
Bradburn, B. W. iv
Breckinridge County, analysis of soil from 286, 7
Brome grass, 47, 48; analyses of 298, 302
Bromus erectus, inermis and unioloides 47, 48
Bromus inermis and unioloides, analyses of 298, 302
Broom 42
Brown, W. C., mineral water 321
Buffalo Clover 41
Bulletin 98—Kentucky Forage Plants, Clovers, etc. 3
99—Oats 65
100—Inspection and Analyses of Foods 83
101—A Comparison of Feeds for Pigs 151
102—Commercial Fertilizers 167
103—Hessian Fly Experiments 231
104—Commercial Fertilizers 247
Bulletins of the Station, list of 226
Burnet, analyses of 300, 2
Bush Clovers 22
Butler County mineral water 322
Butter from churn tests, analyses of 286
Butter sold in the State, analyses of 108-113
Butterfly pea 15
Campbell, W. G. ..... ix, x
Canada bluegrass, 49; analysis of 52, 299, 302
Canada field pea 34
Canary grass, 49; analyses of 52, 299, 302
Canned goods, analyses of 112
Carolina vetch 42
Carter, B. F., mineral water 331
Casey County, analysis of soil from 287, 8
Cassaday, W. M., mineral water 332
Cassia chamaecrista, marylaudica, nictitans and tora 14
Cat gut 15
Catsups and sauces, analyses of 132-135
Cercis canadensis 14
Cheat, analysis of 52
Chemical Division ..... viii, 283
Christian County mineral waters 322, 3
Cladrastris lutea 15
Clark County mineral water 323
Clay, C. M. iv
Clay, Chas. D., mineral water 324, 5
Clays, analyses of 317, 18
Clitoria mariana 15
Clovers, analyses of 52-57, 298-305
Clovers and their allies 3
Clover seed, adulteration and testing of 40
Coffee bean 15
Cole, B. M., mineral water 325
Commercial fertilizers, Bulletins 102 and 104 on 167, 247
Common vetch, 42; analyses of 59
Corn bran, analysis of 309, 10
Corn, shelled, analyses of 163
Cottonseed meal, analyses of 308, 9
Coulter, Gus. G., clay from 317
Cow manure, analysis of 320
Cowpeas, 42; analyses of 52, 59, 300, 1, 4
Crabb, W. L., mineral water 328, 9
Crab grass, analysis of 299, 302
Cracca spicata 15
virginiana 15

Crimson clover, 37; analyses of 52, 59, 300, 2
Curtis, H. E. ..... v, xii
Curtis, W. J., mineral water 320
Cystisus scoparius 15
Dactylis glomerata 48, 54, 298
Dawson Springs, water of 329
Dickerson, John E., soil from 293-4
Didlake, Miss M. L. ..... v, x
Digestibility of forage plants 59
Distillers corn bran, analysis of 309-10
dried grains, analyses of 163, 310
Distillery slop, fresh, analyses of 310-16
Division of Agriculture x
Animal Husbandry xi
Chemistry ..... viii, 283
Entomology and Botany ix
Dockery, J. M., mineral water 327
Dodson, John M., soil from 295, 6
Drennon Springs, water of 328, 9
Dutch clover 41
Egyptian clover, 35; analysis of 54
Ellis, W. C., soil from 292
English bluegrass, 48; analysis of 52, 298, 302
Ensilage, analysis of 164
Entomological and Botanical Division ix
Esparsette 33
Euchlaena luxurians 48, 56, 298
Experiments in feeding pigs 151
Experiment Station farm, soil from 288, 9
Explanation of terms used in analyses of feed-stuffs 58
Falcata comosa 15
pitcheri 15
False indigo 13
Fayette County, analysis of soil from 288, 9
mineral waters 324-6
Feeding stuffs, analyses of 114, 308-10
Feeds for pigs, a comparison of 151
Fenugreek, 41; analysis of 54
Ferguson, McD. iv
Fertilizer Control Work xii
tags issued xiii
samples analyzed xiii
Fertilizers, field experiment on oats 71
Festuca ovina 48, 298
elatior 48, 56, 298
Field pea 34
Fiorin, analysis of 54
Finger grass, analysis of 299
Fischer, S. K., mineral water 333
Flat pea, 21; analyses of 54, 299, 302
Florida beggar-weed, 32; analysis of 54
Food Control Work xiii
Food law 138
information concerning 142
violations of 102
Food samples analyzed xiii
Forage plants, analyses of 297-301
Fowler, W. T. iv
Foxtail 47
Frazee, D. F. ..... iv, v
Furze, 42; analysis of 54
Galactia volubilis 15
Gardiner, C. R., wood ashes from 296, 7
Garman, H. ..... v, ix, xiii
Bulletins by 3, 231
Gilfin, Geo., soil from 287
Gleditschia aquatica 15
triacanthos 15
Glycine hispida 16, 56, 298
Goats rue 15
Goodman, J. A., mineral water 334, 5
Gorse 42
Grainger, C. F., clay from 317
Grasses and forage plants, analyses of 52-57, 297-301

Graves County mineral waters 326, 8
Ground nut 14
Gymnocladus dioicus 15
Hager, J. F. iv
Hagweed 15
Hairy vetch 42
Hairy bush clover 22
Hamby, W. I., mineral water 329
Harper, J. N. v
field experiments with oats 65
Harris, J. H., soil from 287
Harris, J. L., mineral water 323
Harris, G. N., soil from 287
Harrison County mineral water 328
Hart County, Indianaite from 317, 18
Henry County, analysis of soil from 290
mineral water 328, 9
Henry, Winston, mineral water 323
Hessian fly experiments 231
Hog peanut 15
Holcus lanatus 299
Hominy meal, analysis of 164
Honey locust 15
Hoosier Oil and Gas Co., mineral water 328
Hop clover 40
Hopkins County, analysis of soil from 291
mineral water 329
Howard, J. B., mineral water 332
Howe, C. H., mineral water 334
Index to common names of clovers, etc..... 60
Indianaite, analysis of 317, 18
Inoculation with nitrogen-fixing bacteria 8
Inspection and analyses of foods 83
Italian clover 37
Italian rye grass, 48; analysis of 299, 302
Ixophorus italicus 299
Japan barnyard millet, analyses of 299, 302
Japan clover, 22; analysis of 54
Jellies and preserves, analyses of 116
Johnson grass, analysis of 54, 59
Johnson, O. M., mineral water 326, 8
Jones, C. S., mineral water 321
Kentucky bluegrass, 49; analysis of 300, 302
Kentucky coffee tree 15
Kentucky forage plants 3
Kidney vetch, 13; analysis of 54
Kinkead, Geo. B. ..... iv, v
Kohn, Aaron xv
Kuhnisteria candida, foliosa and purpurea 21
Kraunhia frutescens 21
LaBach, J. O. ..... v, xiii
Lard, anayses of 128
Lathyrus palustris 21
sylvestris, 21; analyses of 54, 299, 302
Leafy prairie clover 21
Leersia oryzoides 299
Leguminous plants, root tubercles of 6
as nitrogen gatherers 4
Leguminosae of Kentucky, list of 13
Lespedeza angustifolia and frutescens 22
hirta, 22; analyses of 52
nuttallii 22
striata, 22; analyses of 54
struvei, violacea and virginica 22
Letter of transmittal iii
Lewis, Dave, mineral water 330
Lewis, Dr. H. A., agricultural lime made by 320
Lexington lithia water, analysis of 325
Lindsay, T. N. iv
List of officers v
Literature of nitrifying and nitrogen-fixing bacteria..... 12
Livingston County, analysis of soil from 292
Locust, black, 35; honey and water 15
Logan County Oil and Gas Co., mineral water..... 329

Lolium italicum and perenne, 48; analyses of 299, 302
Low hop clover, 40; analysis of 54
Low senna 14
Lucerne 24
Lupines 22, 23, 56
Lupinus albus, 22; analysis of 56
hirsutus and luteus 23
Mammoth clover, 38; analysis of 54
Mands wonder forage plant, 48; analysis of 299, 302
Marcum, J. B. ..... iv, v
Mathews, C. W. v
May, D. W., v; Bulletin 101 by 151
McChord, John iv
McGinnis, E. G., soil from 290
McGuire, W., mineral water 331
McKee, L. H., mineral water 322
McKeel, P. W., mineral water 327
McLean County mineral water 330
McNamara, M. G., Indianaite from 317
McNeely, J. A., mineral water 327
Meadow brome grass, analysis of 302
Meadow foxtail, analysis of 298, 302
Meadow muhlenbergia, analysis of 299, 302
Meadow soft grass, analysis of 299, 302
Medicago lupulina 23, 52
sativa 24, 52, 299
Medick, black; analysis of 52
Meiboma bracteosa, dillenii, glabella, grandiflora, laevigata, marylandica, michauxii, nudiflora, paniculata pauciflora, rigida, sessiliflora, viridiflora 32
Meiboma tortuosa, 32; analysis of 54
Melitot, white, 29; analysis of 56
yellow 31
Melilotus alba, 29; officinalis 31
Meteorological summaries 77, 78, 336-340
Millet, Texas 48
pearl, 48; analyses of 299, 302
Milk, analyses of 118-125
Milk pea, downy 15
Milk vetch, carolina 14
Mince meats, analyses of 128
Millo maize, 47; analyses of 298, 302
Mimosa, Illinois 13
Mineral waters, analyses of 320-335
Mitchell, A. G., mineral water 333
Morgan County mineral waters 330, 1
Mucuna utilis 33, 56
Muhlenbergia mexicana 299
Mushrooms, analyses of 307, 8
Narrow-leaved bush clover 22
Nelson, R. W. iv
Nicholas County Oil and Gas Co., mineral water from 331
Nitre earth, analyses of 319
Nitrifying bacteria 11
Nitrogen-fixing bacteria 7-12
Nitrogen gatherers 4
Nodules of plant roots 6
Notes on grasses 47
Notes on Kentucky leguminosae 13
Norwood, C. J., clays from 317
Nunn, E. S., analysis of lime from 320
Nuttalls' bush clover 22
Oats, analyses of 54, 73, 75, 6
Bulletin 99 on 65
relative feeding value of the varieties 72
test of varieties 65
test of fertilizers on 71
treatment for smut 70
winter 66
Oats-grass, tall 47
Ochre, analysis of 317, 18
Officers of the Station v
Ohio County mineral water 332
Oldham County mineral waters 332

Oldham, J. H., soil from 291
Oleomargarine, analyses of 126
Olive oil, analyses of 128
Onobrychis sativa 33
Orchard grass, 48; analyses of 54, 59, 298, 302
Orndorf, J. G., mineral water 329
Ornithopus sativus 34, 56
Osborn, Ike, soil from 291
Page Hotel mineral water 334
Page, Thos. M., mineral waters 334, 5
Panicum crus-galli and sanguinale, analyses of 299, 302
Panicum texanum 48
Partridge pea 14
Patterson, Prest. J. K. iv
Pearl millet, 48; analyses of 299, 302
Pencillaria, 48; analysis of 299, 302
Pencil flower 35
Pennisetum typhoideum, 48; analyses of 299, 302
Perennial rye grass, 48; analysis of 299, 302
Pezotettix femur-rubrum, injury to alfalfa 25
Peter, A. M., ... v, viii, 283
Analyses of Forage Plants 51
Protein contents of oats 72
Pepper and spices, analyses of 114
Phalaris arundinacea 49, 52, 299
Phaseolus polystachyus 35
Phloeum pratense 49, 299
Pigs, experiments in feeding 151
Pink wild bean 35
Pisum arvense 34, 52
Poa compressa 49, 52, 299
pratensis 49, 300
Prairie clovers 21
Protein content of oats cut at different times 75
Protein content of varieties of oats 73
Poterium sanguisorba 300
Psoralea onobrychis, pedunculata, stipulata 35
Pulaski County, analysis of soil from 293-4
nitre earth from 319
Rabbit foot clover 36
Ramsey, W. R. iv
Rape, analysis of 54
Red-bud 14
Red clover, 38; analyses of 54, 59
Red-top, 47; analyses of 59, 298, 302
Reed canary-grass, 49; analyses of 52, 299, 302
Reeves, Geo. W., mineral water 321
Report of the Auditing Committee vi
Director viii
Rescue grass, 48; analyses of 298, 302
Rhode Island bent grass, 47; analysis of 298, 302
Rhyncosia erecta and tomentosa 35
Rhyncosia, twining 35
Rice grass, analysis of 299, 302
Richmond, T. L. ..... v, x
Riley, W. M., soil from 287,
Roberts, Geo. ..... v, xi
Robinia pseudacacia 35
Root tubercles, analyses of 306
Root tubercles of leguminous plants 332
Royal Magnesian Spring water 326
Ruh, Alfred, mineral water 54, 56, 300, 304
Russian vetch, 42; analyses of 48
Rye grasses 33
Sainfoin 52
Salt-bush, Australian; analysis of 302
Samarcand alfalfa, analysis of ..... v, xii
Scherffius, W. H. 15
Scotch broom viii
Scovell, M. A., v; Report of 14
Senna, low 14
Sensitive pea 56, 59
Serradella, 34; analyses of viii
Shedd, O. M. .....

Sheeps fescue, 48; analysis of 298, 302
Siberian millet, analysis of 299, 302
Slender bush clover 22
Small-flowered wild bean 35
Smooth brome grass, analysis of 302
Smut of oats, treatment for 70
Soda fountain drinks, analyses of 130
Soil, analyses of 286-297
Soil from Breckinridge County 286
Casey County 287
Fayette County 288
Henry County 290
Hopkins County 296
Jefferson County 296
Livingston County 292
Pulaski County 293
Washington County 294
Wayne County 295
Sorghum, analyses of 283, 4
Soy bean, 16; analyses of 56, 59, 298, 9, 302
Soy beans, shelled, analysis of 163
Spurry, analysis of 56
Station officers v
Stephens, Isaac, mineral water 334
Stewart, E. P., mineral water 322
Stoll, R. C. iv
Strophostyles pauciflora and umbellata 35
Stuve's bush clover 22
Sugar beets, analyses of 284, 5
Sweet clover, 29; analysis of 56
Sweet vernal grass, 47; analysis of 298, 302
Syrups, sugars and honey, analyses of 132
Tall oats grass, analysis of 298, 302
Taylor, E. P. x
Teff, analysis of 56
Teosinte, 48; analyses of 56, 298, 302
Texas millet 48
Thomas, B. G., mineral water 324
Tick trefoil 32
Timothy, 49; analyses of 59, 299, 302
Tobacco growing under canvas xi
Todd County mineral water 333
Tomato catsups, analyses of 132-135
Trailing wild bean 35
Trifolium alexandrinum, 35; analyses of 54
arvense 36
hybridum, 36; analyses of 52, 300, 302
incarnatum, 37; analyses of 52, 53, 300, 302
medium, 38; analysis of 54
pratense, 38; analyses of 54
procumbens, 40; analysis of 54
reflexum, repens and stoloniferum 41
Trigonella foenum-groecum 41
Trimble County mineral water 333
Trustees of the College iv
Tubercles of plant roots 6
Tufted vetch 42
Turner, J. D. v
Ulex europaeus 42, 54
U. S. Appropriation vi
Velvet bean, 33; analysis of 56
Velvet grass, analysis of 299
Vetches, 42; analyses of 54, 56, 59, 300, 4
Vetchling, marsh 21
Vicia americana, caroliniana, cracca, and sativa 42
Vicia villosa, 42; analyses of 54, 56, 59, 300, 4
Vigna catjang, 42; analyses of 52, 300, 304
Vinegars, analyses of 136
Violations of the food law 102
Violet prairie clover 21
Walls, J. K., soils from 294, 5
Wand-like bush clover 22
Warren County clays 317
mineral water 333

Washington County, analyses of soils from 294, 5
Water locust 15
Wayne County, analysis of soil from 295, 6
Weathers, J. M., mineral water 333
Webster County mineral waters 334
Whinn 42
White clover 41
White indigo 14
White lupine 22
White melilot, 29; analysis of 56
White millo maize, 47; analysis of 302
White prairie clover 21
Wild beans 35
Wild indigo 14
Wild rye, virginia, analysis of 56
Wild senna 14
Wistaria, American 21
Wilson, C. O., soil from 292
Wilson, R. H., mineral water 324
Worrell, J. K., nitre earth from 319
Wyatt, W. T., mineral water 331
Yager, J. W. & J. T., mineral water 332
Yellow lupine 23
Yellow millo maize, 47; analysis of 302
Yellow melilot 31
Yellow-wood 15