EIGHTEENTH ANNUAL REPORT

OF THE

Kentucky Agricultural Experiment Station

OF THE

State College of Kentucky

LEXINGTON, KY.

FOR THE YEAR 1905

019237

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

Very respectfully,

M. A. SCOVELL, *Director.*

Agricultural and Mechanical College of Kentucky

BOARD OF TRUSTEES

His Excellency, Gov. J. C. W. Beckham, ex-Officio Chairman.
James K. Patterson, President of the College, ex-Officio.
Judge Henry S. Barker, Louisville, Jefferson County.
Hon. Tibbis Carpenter, Scottsville, Allen County.
Hon. McDougal Ferguson, Paducah, McCracken County.
Hon. John F. Hager, Ashland, Boyd County.
Hon. Robert W. Nelson, Newport, Campbell County.
Judge William C. Bell, Harrodsburg, Mercer County.
Hon. Cassius M. Clay, Paris, Bourbon County.
Judge George B. Kinkead, Lexington, Fayette County.
Judge John McChord, Lebanon, Marion County.
Hon. William R. Ramsey, London, Laurel County.
Basil M. Brooks, Esq., Slaughtersville, Webster County.
David F. Frazee, Esq., Lexington, Fayette County.
Hon. Frank A. Hopkins, Prestonsburg, Floyd County.
Charles B. Nichols, Esq., Lexington, Fayette County.
Judge Robert L. Stout, Versailles, Woodford County.

585
135

LIST OF OFFICERS

Board of Control

GEORGE B. KINKEAD, Chairman, Lexington, Ky.
D. F. FRAZEE, Lexington, Ky.
C. B. NICHOLS, Lexington, Ky.
J. K. PATTERSON, President of the College.
M. A. SCOVELL, Director, Secretary.

Station Staff

M. A. SCOVELL, Director and Chemist.
A. M. PETER, Chemist.
H. E. CURTIS, Chemist, Fertilizers.
H. GARMAN, Entomologist and Botanist.
J. N. HARPER, Agriculturist.
W. H. SCHERFFIUS, Chemist.
R. M. ALLEN, Secretary, Food Division.
J. D. TURNER, Secretary.
J. O. LA BACH, Chemist, Food Division.
MISS MARY L. DIDLAKE, Ass't Entomologist and Botanist.
S. D. AVERITT, Assistant Chemist.
O. M. SHEDD, Assistant Chemist.
G. N. KELLER, Ass't Entomologist and Botanist.
H. WOOSLEY, Supt. Farm Experiments.
MISS LILLIE LISTON, Librarian.
H. W. TAYLOR, Ass't Entomologist and Botanist.
J. W. NUTTER, Dairyman.

Address of the Station,
LEXINGTON, KENTUCKY.

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 the fiscal year ending June 30, 1905, as per Act of Congress, approved March 2, 1887. $15,000.00

Expenditures:

By Salaries	$11,650.00	
Labor	242.16	
Publications	1,224.84	
Postage and stationery	216.70	
Freight and express	49.71	
Heat, light, water and power	400.13	
Chemical supplies	184.52	
Seeds, plants and sundry supplies	127.46	
Library	370.20	
Tools, implements and machinery	24.60	
Furniture and fixtures	85.50	
Scientific apparatus	25.60	
Traveling expenses	75.73	
Contingent expenses	116.35	
Building and repairs	206.50	
		$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, 1905; 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)

GEORGE B. KINKEAD,

(SEAL) D. F. FRAZEE,

Auditors.

Attest:

D. C. FRAZEE.

ANNUAL REPORT OF THE
Kentucky Agricultural Experiment Station
FOR THE YEAR 1905

REPORT OF THE DIRECTOR

The Station is divided into the following divisions:

Division of Chemistry.
Division of Entomology and Botany.
Division of Agriculture.
Division of Horticulture.
Division of Animal Husbandry.
Division of Fertilizer Control Work.
Division of Food Control Work.

Station Staff.—There have been a number of changes in the Station Staff during the year. On July 1, Mr. J. N. Harper, Agriculturist, resigned to accept the position of Director of the Agricultural Department in Clemson College and Director of the South Carolina Experiment Station. His position has been filled by the selection of Mr. W. H. Scherffius as Agronomist of the Station and head of the Agricultural Division. Mr. G. N. Keller resigned as Assistant Entomologist and Botanist September 1, to accept the position of Tobacco Expert of the Irish Government. Mr. H. W. Taylor has been selected to fill the vacancy made by the resignation of Mr. Keller.

The loss of men who have become acquainted with the work of the Station is not conducive to the best work of the Station and it brings up the question whether more decided action is not

necessary in order to keep our men with us. There is now a great demand for men of abilitiy by the various Experiment Stations.

The work of the several divisions during the year may be summarized as follows:

Chemical Division. The Chemical Division has made 230 complete analyses, mostly of soils and waters. Also a large number of samples of minerals, rocks and other materials have been examined and reported.

Fertilizer Division. During the year 574 samples of fertilizer were analyzed in this division. The number of brands registered was 358, representing 40 firms. There were printed during the year 745,968 tags, which were sent to the various firms doing business in the State.

Division of Entomology and Botany. Experiments with nodule bacteria have been continued. Work in the vivarium on seed insects has also been continued and a large amount of interesting material is being gathered on their life histories and methods of destroying them. The Division of Entomology and Botany is engaged upon the following subjects: Nursery inspection; seed inspection; the microscopic examination of foods for the Food Division; a study of seed insects and remedies therefor; nodule bacteria experiments; forage tests and studies; rotation experiments; a study of clover diseases; a study of the weeds of Kentucky; a study of methods of handling bees and rearing queens; experiments with artificial shades; a study of the distribution and life history of the Hessian fly in Kentucky; and a study of the pests of young trees.

Under the seed law, 297 samples of seeds have been examined. Of this number, 13 were found to be adulterated.

Under the Nursery Inspection law, the nurseries of the State have been inspected during the year.

Food Division. Eight hundred and twelve samples of food have been analyzed. Number on hand not analyzed, 86. Number of unofficial samples analyzed, 31. Total number of samples received, 929.

Five hundred and seventy samples were taken from the market

for analysis during the year of 1905; 207 of these were found to be adulterated. 199 adulterations were reported to the State's Attorneys. 104 cases have been terminated in the courts by verdicts "confessed." 51 cases are still pending. In one case only has there been a verdict of "not guilty." Seven cases have been dismissed by reason of defective indictments, but in these instances the grand jury has reindicted.

The division is conducting an investigation of the milk supply of Kentucky and this work covers the location and condition of all dairies and depots and quality of milk produced. In Louisville we have found 100 dairies in or near the city limits. These dairies feed distillery slop and stable the cows throughout the year in dark and unclean barns.

The pure food work is showing results in the State. During the year many circulars have been sent to the trade. A bulletin on labels has been published and below is given my report to the Governor for 1904 and 1905:

HON. J. C. W. BECKHAM,
Governor of Kentucky,
Frankfort, Ky.

DEAR SIR:—Under section 6 of chapter 13 of the Acts of the General Assembly of 1900, I submit a report of the Pure Food Work of the Station for the year 1904 and for the year 1905 to December 1. The report also contains a summary of the work of 1903 which was not included in my former report.

Former reports have called attention to adulterations and prosecutions. This report will show in addition some good results of the work of former years.

Total number of samples analyzed in 1903	824
Number found to be adulterated	276
Number reported to courts	206
Total number of samples analyzed in 1904	508
Number found to be adulterated	145
Number reported to courts	96
Total number of samples analyzed in 1905 to December 1	570
Number found to be adulterated	207
Number reported to courts	199
Total number now before courts being pushed for prosecution	190

The samples taken for inspection, examination and analysis have covered a wide field of products, but special attention has been given to meats, milk, fruit products, canned goods, vinegars, syrups, flavoring extracts, pickles, pepper and other spices.

More attention has been given to milk than any other product. As it is used extensively as food for invalids and infants, the greatest care should be exercised in keeping it pure. When the food law first went into effect, we found much of the milk sold in the markets to be adulterated. Preservatives were used extensively. Skim milk was often sold as whole milk, and milk to which an adulterant had been added to give it the consistency and artificial color to give it the appearance of cream was being sold as genuine cream. A careful inspection of the milks for the past three years has had a marked effect.

In our late inspections we have found but one sample of milk to contain formaldehyde and one to contain boracic acid. Some cases, however, of adulteration by the addition of skim milk have been detected and few samples have been found to be watered.

So far as preventing the addition of preservatives or other adulterations of milk, the law has been found effective, but still the milks on the markets in our towns and cities are not as pure as they should be. Milk is easily contaminated. Milk from cows kept in filthy stables is not a wholesome food. Carelessly washed milk vessels or unclean surroundings in its handling may cause the milk in a whole dairy to be unwholesome and often dangerous to health. Washing milk vessels in contaminated spring water was the cause of several deaths from typhoid fever in Lexington last summer. Inspection, therefore, of milk must go further than to ascertain whether it is adulterated by the addition of water or skim milk or preservatives. The dairy itself and its surroundings should be inspected as well as the dairy herd. Perhaps of late years too much stress has been put upon the healthy condition of the dairy cow and not enough on the cleanliness in handling the milk. No cow should be in the herd that is not healthy, but to this end it is not essential that cows should be inspected every month or two by a veterinarian to ascertain whether they have tuberculosis or not. Once or twice a year is quite sufficient for this, but the barn and all dairy utensils should be kept thoroughly clean at all times.

The milk supplies of Louisville, Covington, Newport, Lexington, Paducah and other large towns are now being looked into with the view of mapping out and giving reports on the hygienic condition of each. The Louisville situation presents quite a problem. There are some sixty dairies within the city. The continuous stabling of cows, fed largely on distillery slop in stables of poor ventilation and poor sewerage, necessarily tends to produce milk that

might be easily contaminated or made unwholesome. The Station's first work in taking up this problem is in co-operation with the dairymen. They have agreed to co-operate in the work and the attorney of the Dairymen's Protective Association states: "I have just had a conference with the president of the Dairymen's Protective Association, who says that his association is more than willing to comply with your request; that they want to do everything they can to assure pure milk to their consumers, and to let the public know that their milk is pure, and if you can aid them in any way, they will be glad to accept your suggestions."

Some dairy cows are kept on a pasture near Georgetown through which runs a stream and into this stream at least a part of the sewerage of Georgetown is emptied. This stream is the source of water supply for the cows and in the hot weather they stand in this stream and switch the water over their udders and other parts of their bodies. A typhoid fever epidemic might result from the using of the milk from this herd if the contaminated water should contain any typhoid fever germs. Not probably by the typhoid fever germs getting into the system of the cows and then into the milk, but rather by the cows getting the germs on their udders, tails and other parts of their bodies by standing in the water and these germs falling in the milk during milking. Such conditions should not exist. This illustrates the necessity of a thorough and careful inspection, not only of the milk, but of the herd and its surroundings.

During the year we have made a thorough examination of meat products, including fresh meats, sausages and lards. In many cases we found boracic acid used as a preservative and artificial color used, especially in sausages. Since being notified of our results, the packers have agreed to put up meat products for Kentucky without boracic acid, and to this end one firm has installed a separate department in its Chicago plant for Kentucky meats, while several other firms are packing their meats for sale in Kentucky in Louisville. Our late inspections show that the packers are now complying with the law.

The reason for using color and boracic acid in meats is thus stated in a letter from one of the packing-house firms to the Stations: "Color and boracic acid have been so universally used and advertised so openly that it seemed as though they were used by the manufacturer as a matter of course. In fact, he was compelled to use them in order to make goods of the same keeping qualities and color as his competitor. Goods containing a little boracic acid will keep fresh somewhat longer and colored goods have a little brighter appearance than uncolored."

With the elimination of preservatives and color from meat pro-

ducts, competition becomes a matter of quality and purity, which is the basis on which all products should be sold. Color is often used in food products to cover inferiority and to make a product appear superior in quality. By the use of artificial colors and preservatives, inferior goods and partly decomposed products may be used to make up various articles for sale, as tomato catsup, preserves, etc., and it is wise that our law prohibits either color or antiseptics without the label so stating it. The effect of the enforcement of the law has nearly driven out coal tar dye and antiseptics from food products in this State, and what this means is best told by the manufacturers in their own words. Says one: "We formerly used coal tar dye in our tomato soup, but during the season of 1905 and henceforward, the use of coal tar dye and benzoate of soda will be entirely discontinued in this product, for we have arranged to make it entirely from fresh tomatoes in the height of the packing season which enables us to produce a palatable looking article without the color and relieves us of the necessity of putting away stock and preserving with benzoate of soda to prevent fermentation."

Says another: "The injudicious, unintelligent and also unscrupulous manner in which such agents are employed is, without doubt a menace to the health and welfare of the general public, not only because of the presence of the antiseptic in excessive quantities, but also on account of the quality of the stuff it is made possible to purvey consumers."

One important result in the inspection of meat products is the labeling of lard substitutes to distinguish them from pure lard. These substitutes are made from cotton seed oil and can be produced much cheaper than lard. When the law first went into effect, samples of lard substitutes were purchased as "pure lard" at 11c and 12c per pound. The same products are now selling for 6c and 7c per pound since they were labeled to show their true character. This is but an instance of how honest labeling reduces the prices of wholesome imitations.

The Pure Food law also covers feeding stuffs, that is, food for domestic animals. During the year we have analyzed 81 samples of concentrated feeding stuffs. Six of these samples were found to be adulterated. A sample of shorts sold to a dairyman was found to contain 25 per cent. of corn cob meal, which, for feeding purposes, is much inferior to shorts. Another sample was found to contain nearly half of its bulk of corn cob meal. Three samples of shorts in Louisville from different firms contained about 25 per cent. of adulteration, reducing their feeding value to almost one-fourth. A sample of cotton seed meal was found to contain 50 per cent. of an adulterant. A food being sold under the name of

"corn and oat feed" was found to be a very inferior food and not as valuable as hay for the amount of protein it contained. The adulterants used in these feeding stuffs usually are ground corn stalks, rice hulls, oat hulls and other by-products obtained from breakfast food factories. The law does not prohibit the sale of bran mixed with such products, but it compels the seller to label the product either adulterated bran or a mixed food in which the composition is given. Ground corn cobs, hulls of various grains, as breakfast food products, have some feeding value as roughage, but the feeder generally has plenty of roughage as fodder, straw, and hay. The benefit of such adulteration, therefore, comes to the grinder and dealer in the sale of such mixtures as a pure article, and not the feeder.

In January last, one of the dairymen at Elizabethtown called our attention to suspicious bran being sold at Elizabethtown. Upon immediate investigation, we found that the bran was a mixture of bran and corn cob meal. It was sold to the farmer as bran. It was kept in the store properly labeled, so that when our inspector examined it he found it labeled in accordance with the law. It appears, however, that whenever this bran was sold to the farmer the label was taken off as the sacks were loaded into the wagon, and the farmer was ignorant of the fact that he was buying a mixture of this bran and corn cob meal. Our investigation resulted in the dairymen being settled with at a fair value for the mixture. The dealer has gone out of business. Careful inspection of feed for domestic animals should save the farmers thousands of dollars each year.

During the time of this report, the Station has been called upon to co-operate in the establishment of food standards by the United States Government, in the work of the International Pure Food Congress at the Louisiana Purchase Exposition and also in the work of the Association of State Food Control Officials to unify State Pure Food laws. The standards which have been so far adopted by the Secretary of Agriculture in carrying out the laws of the United States on imports, I have adopted as food standards of Kentucky in accordance with section 4 of the food law and they are included in this report. These standards have been adopted after a careful examination of thousands of analyses of food products and the investigations of food experts all over the country and after giving full hearing to the manufacturers interested who have personally come before the United States Standards Commission to present their views.

The sale of spirit vinegar as apple vinegar has been somewhat difficult to control. The manufacturers label the barrels properly, and probably sell to the jobbers and retailers as spirit vinegar, but

when a customer calls for a gallon of apple vinegar of his grocer, he sometimes gets vinegar drawn from a barrel labeled spirit vinegar, as the results of our analyses of vinegars in the report here show. But the attempt on the part of the retailer to deceive in this way is growing less each year.

Jellies, jams, preserved fruits and flavoring extracts have been quite generally inspected and examined. And while we find a large amount of inferior goods on the markets, they are being quite generally labeled to show just what they are, and therefore when bought the purchaser has a knowledge of just what they are. There is no doubt, however, but that the sale of these inferior articles is rapidly growing less. The consumer prefers a pure article, even if it costs more. He does not wish to be knowingly cheated, and when the label tells him that an article is adulterated or a mixture, he generally refuses to purchase, but selects the pure.

Our law is effective. The courts have at all times upheld its provisions and we have little complaint on the part of the manufacturers as to its fairness.

When the retailer purchases goods from out of the State, however, he is held responsible if the goods are not labeled according to the law, regardless of any guarantee. This is often a hardship on the retailer. The majority of prepared food products are articles of interstate commerce, and it is a fair proposition that such products should be truthfully labeled in every respect and labeled to show the presence of any adulteration before such products are allowed shipment from one State into another. If food products were so labeled before they enter our State, the retailers would know the exact character of the products which they sell, and there would then be no hardship in holding the retailer responsible for the sale of adulterated products. A national Pure Food Law would be of great assistance in the just enforcement of the provisions of our own law.

The analyses herein cover a large number of food products and the results include a large fund of information concerning the quality, purity and condition of food products on sale in the State. This information should be in the hands of the people of the State, especially the retail grocers and all health officers and other citizens interested in bringing about the sale of pure food. The report is not only intended to show what food products are adulterated, but also those that have been found to be pure, and the report is intended for the manufacturer and dealer as well as the consumer. In its preparation we have endeavored to make it a handbook of information for consumers, dealers, and manufacturers. I would respectfully recommend, therefore, that a large edition of the report be printed for distribution.

The work is in charge of the Food Division of the Station. Mr. R. M. Allen, head of the division, has charge of inspection and court work. Mr. J. O. La Bach, chief chemist of the division, has charge of the chemical work. The microscopical examinations have been made under the direction of Prof. H. Garman

Respectfully submitted,

M. A. Scovell, Director.

Agricultural Division. On the farm we are continuing our experiments in breeding tobacco, especially the burley types, and corn. Variety tests of wheat and hemp are being continued; also experiments in the dairy line.

Publications. We have published during the year the following bulletins:

Bulletin No. 118.

Corn.

Bulletin No. 119.

Labels on Adulterated and Imitation Foods sold in Kentucky.

Bulletin No. 120.

1. Some Tree and Wood Infesting Insects.
2. Cabbage Snakes.

Bulletin No. 121.

Commercial Fertilizers.

Bulletin No. 122.

Corn—

1. A Method of Selecting Seed Corn.
2. A Chemical Study of the Composition of a Number of Varieties of Kentucky Corn.

Bulletin No. 123.

Commercial Fertilizers.

The bulletins published during the year are appended herewith and then follow the analyses of the general work of the Station that are deemed of most interest. After this the Meteorological data will be found.

M. A. Scovell, *Director.*

Lexington, Ky., Aug. 23, 1906.

Dr. M. A. Scovell, *Director.*

Dear Sir:—The work of the general chemical laboratory in

1905 comprised some 230 analyses which may be classified as follows:

Soils	57
Corn	53
Mineral and potable waters	65
Forage plants	3
Butter from churn tests	6
Limestones and marls	4
Coals	13
Clays	7
Iron, steel, and alloys	9
Ores and minerals	5
Miscellaneous (tobacco stems, oil, paint, poison, human milk, whisky)	8
Total	230

The analyses of corn were made by Mr. W. H. Scherffius and have been published in Bulletin No. 122. Those of soils have been published in Bulletin No. 126. The analyses of forage plants, butter, mineral waters, and of one sample of leached tobacco stems are herewith submitted for publication in the Eighteenth Annual Report under the heading "Miscellaneous Chemical Analyses," page 225. Besides the analyses enumerated, a large number of specimens of minerals, rocks and other materials have been examined and reported upon to the senders without formal entry on the records of the laboratory.

Most of the analyses were made by Mr. Averitt with his usual efficiency. He was assisted part of the time by Mr. H. L. Amoss, a graduate of this college.

Very respectfully,

ALFRED M. PETER.

KENTUCKY

Agricultural Experiment Station

OF THE

State College of Kentucky.

BULLETIN No. 118.

CORN.

FIELD TESTS.

LEXINGTON, KENTUCKY.
March 1, 1905.

KENTUCKY
Agricultural Experiment Station.

BOARD OF CONTROL.

GEO. B. KINKEAD, Chairman, Lexington, Ky.
D. F. FRAZEE, Lexington, Ky.
C. B. NICHOLS, Lexington, Ky.
J. K. PATTERSON, President of the College.
M. A. SCOVELL, Director, Secretary.

STATION OFFICERS.

M. A. SCOVELL, Director and Chemist.
A. M. PETER, Chemist.
H. E. CURTIS, Chemist, Fertilizers.
H. GARMAN, Entomologist and Botanist.
J. N. HARPER, Agriculturist.
W. H. SCHERFFIUS, Chemist.
R. M. ALLEN, Secretary, Food Division.
J. D. TURNER, Secretary to the Director.
J. O. LaBACH, Chemist, Food Division.
MISS M. L. DIDLAKE, Ass't Entomologist and Botanist.
S. D. AVERITT, Ass't Chemist.
O. M. SHEDD, Ass't Chemist.
G. N. KELLER, Ass't Entomologist and Botanist.

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. 118.

CORN.—FIELD TESTS.

By J. N. Harper, Agriculturist.

Though Kentucky is not numbered among the leading corn growing states yet there is raised in this Commonwealth about 80,000,000 bushels per annum of this cereal. The total value of the crop amounts to millions of dollars. How to increase this yield by better methods of cultivation and a better knowledge of the requirements of the plant, should be of vital interest to every farmer.

That the yield of corn is largely modified by the variety used and the methods employed in its cultivation, is no longer questionable.

The possibilities of the improvement of corn by judicious selection appear to be very great. Through all the ages man has changed the characters of plants by consciously or unconsciously making selections. It does not require scientific knowledge on the part of the farmer to improve corn, for the methods by selection are simple. It is an established fact that any plant that is easily improved by careful selection will in like manner deteriorate if neglected.

The corn plant readily adapts itself to its surroundings. In adapting itself to varying soil and climatic conditions it necessarily undergoes changes in its physical make-up. The great number of varieties of corn is probably due to this fact. We would not advise farmers in general to devote any time to the breeding of corn, for it takes several years to develop and fix a type; but we do advise every man that grows corn to plant

only standard varieties. The variety of corn which will produce the largest yields in a given locality is usually that variety which has grown for the longest time in the same latitude and under the same soil and climatic conditions.

Every one who has grown corn knows how readily it "runs out" or degenerates. Plant breeders are agreed that the most potent cause for this degeneracy in corn is inbreeding. To avoid this it is best to select ears from different portions of the field, and these ears are to be selected at as great a distance from each other as possible. Corn being a plant that scatters its pollen freely to the wind is subject to a great many crosses and is thus guarded by nature from close inbreeding.

The extent of the injury to seed corn that is pollinated by the pollen from barren stalks is not yet fully known. We believe, however, that the number of barren stalks is dependent largely upon the number of stalks to the hill and the soil and climatic conditions, together with the variety of corn grown. Southern corn, that is the tall, one-ear-to-the-stalk variety, will have more barren stalks when thickly drilled in the row than will corn from the North.

There are other lines of improving corn aside from those pursued by the agriculturist. It is thought the percentage content of nitrogen and fat in corn may be increased by laboratory methods of selection, that is by making chemical analyses of kernels from any number of ears and selecting those ears for seed whose kernels show the highest percentage of nitrogen or fat.

No one variety of corn possesses all of the qualities that are desired by farmers. That variety which will give the largest yield of shelled grain is generally the most desirable. Stock feeders prefer a variety that will yield a large number of small ears. The small ear is much more easily eaten by cattle and the waste is less, unless the feeders are followed by hogs.

Too much stress cannot be laid upon the importance of planting only those standard varieties that have been thoroughly

tested and proven themselves prolific on our kinds of soil and under our climatic conditions.

The demand for good seed corn in this section of the country was never as great as it is now. Already there are several men in the state growing the improved types, especially for seed, and it is our earnest desire to see every farmer in this state grow only those varieties that have been highly bred and kept pure and true to type.

Those varieties that we have tested, the results of which are reported in this bulletin, are considered by corn experts to be the leading varieties of the country.

The soil on which the varieties were tested is typical blue grass soil, that is a rich loamy soil with clay sub-soil. But the land was in a badly run down condition when the Station purchased it in 1901. We had the same field in corn in 1901 and 1902. Some parts of the Experiment Station Farm are much richer than others. In 1903 Roseland White Corn produced 62 bushels per acre on land that had been in hemp for five years. And in 1904 on the same land that there was produced to the acre 72 bushels of Boone County White, 66 bushels of Roseland White, and 59 bushels Iowa Silver Mine corn. From three acres of this land that were planted to these three varieties, there were harvested 198 bushels of well dried corn. It will thus be seen from these results that the land on which the varieties were tested was in poor condition. It is our plan however to grow the different varieties under varying soil conditions. While the low yield may be due partly to the worn condition of the soil, it is not entirely so, for the climatic conditions were very unfavorable during both 1903 and 1904.

The plots upon which the varieties were tested were sufficiently large to furnish field conditions. Both years a cover crop of rye was plowed under in the early spring. Before planting the seed the soil was thoroughly pulverized and put in perfect tilth by disking, harrowing, and rolling. The seed was planted in check rows three and one half feet apart. A different variety was planted in each row, and four duplications were

made in 1903, and six duplications in 1904. The rows were 480 feet long. A fairly good stand was obtained both years. All missing hills were replanted, and when the young plants were about 14 inches high they were thinned, leaving two stalks in each hill. The table, giving the number of stalks, shows that most of the fields had a few missing hills. During the growing season the soil was kept loose and free from weeds by repeated shallow cultivation. The early cultivation was with a weeder, afterwards a two-horse cultivator was used, running both ways. When the corn was about five feet high a fifteen tooth harrow cultivator was used. In 1903 all of the varieties were planted May 12th and all were up May 21st. In 1904 all of the varieties were planted May 5th and were coming up May 14th. Both years the varieties were harvested the first week in October and were shucked the middle of November.

TABLE 1.—Comparative Yield and Quality of the Varieties, 1903.

Station Number.	VARIETY.	Yield per Acre.		Per cent. of Grain.	Pounds of Grain in 70 lbs. of Corn on Cob.	Date when Plants were Ripe.
		Bushels of Grain on the Cob. 70 lbs. per bu.	Lbs. of Fodder.			
8	Boone County White (Ind.)	35.7	4495	83½	58½	Sept. 22
7	Cocke Prolific	35.5	5716	84½	59	" 28
9	Hannah Corn	34.9	5716	82	57½	" 30
10	Sanders' Improved	34.5	5827	85½	59¾	" 28
14	Riley's Favorite	34.1	4051	85	59½	" 16
12	Reid Yellow Dent	33.7	4329	85	59½	" 16
1	Boone County White (Tenn)	33.5	4329	83½	58½	" 22
3	U. S. P. B. Selection 77	33.3	4440	83½	58½	" 24
13	Number 167 (Pa.)	32.9	4606	81½	57	" 24
11	Leaming Yellow	32.5	4273	84	58¾	" 16
15	Champion Yellow Dent	32.5	3607	83	58	" 18
2	Hickory King	31.7	4884	86½	60½	" 24
4	Champion White Pearl	29.9	3552	83	58	" 18
5	Mosby Prolific	28.5	5994	87½	61¼	" 28
6	Iowa Silver Mine	27.9	3441	84½	59	" 10

Table II.—Comparative Yield and Quality of the Varieties, 1904.

Station Number.	VARIETY.	Yield per Acre.		Per cent. of Grain.	Pounds of Grain in 70 lbs. of Corn on Cob.	Date when Plants began to Tassel.
		Bushels of Grain on the Cob. 70 lbs. per bu.	Lbs. of Fodder.			
8	Boone County White (Ind.)	50.6	2733	83.5	58½	July 15
18	Roseland White Corn	48.7	4222	82.	57½	" 27
1	Boone County White (Tenn.)	46.7	2733	83.5	58½	" 15
9	Hannah Corn	45.5	3585	82.	57½	" 23
7	Cocke Prolific	43.7	3600	84.	58¾	" 23
16	McMackin's Gourd Seed	43.5	3804	85.	59½	" 20
12	Reid Yellow Dent	43.5	2246	85.	59½	" 15
17	Boone County Special	42.6	2376	84.	58¾	" 14
11	Leaming Yellow	42.6	2019	84.	58¾	" 12
14	Riley's Favorite	42.6	2397	86.	60¼	" 12
3	U. S. P. B. Selection 77	42.1	2463	83.	58	" 14
10	Sanders' Improved	38.3	4054	87.5	61¼	" 23
6	Iowa Silver Mine	37.1	2259	85.5	60	" 12
5	Mosby's Prolific	36.9	4171	87.5	61¼	" 23
4	Champion White Pearl	34.6	2947	83.	58	" 12

Our experiments indicate that the depth to which corn should be planted varies with the temperature of the soil and the amount of moisture it contains. The dryer and the warmer the soil the deeper should the seed be placed, and corn should be planted deeper on loose soil than on compact soils. On very loose soils corn may be planted six inches deep without danger, but it is usually safer to plant only two inches deep. It is thought by many planters that the deeper the seed are sown the deeper will the root system be developed, but this is a mistake, for the young plants develop roots near the surface and those roots that are deep down in the soil will in time decay. If the soil is very dry at the time of planting a heavy roller should be run over the field. This will bring some moisture to the surface. It is desirable to have all the seed germinate at the same time, if possible, and this requires the most favorable conditions of temperature and moisture.

There are three main objects in the cultivation of corn; to kill the weeds, loosen the soil so the air and roots can easily penetrate the soil, and to conserve the soil moisture. Shallow or surface cultivation gives better results than deep tillage. The soil should be put in perfect condition before planting the corn and the only cultivation that is necessary afterward, unless heavy packing rains occur, is to keep the surface loose and free from weeds.

There is no cheaper and better method of destroying young weeds and at the same time putting the ground in condition to conserve the soil moisture than the proper use of a good weeder. By its use a thin layer of loose soil is obtained which acts as a mulch. This loose soil has very little power to draw up water from below, hence the great saving of moisture. Capillary action or upward movement of water in the soil is due to the tension of the soil particles. If the soil particles are fine the capillary action is strong and a large amount of water may be held by the soil, but if the soil particles are coarse or far apart, making a mulch that is loose, only a small amount of water can be held by capillary action. Therefore, the early culti-

vation or breaking of the land should be as deep as possible, and the later cultivation should be shallow, for two reasons, namely: To avoid disturbing the roots of the growing plants, and to avoid losing any more of the soil moisture by evaporation than necessary. While cultivation does not add water to the soil, it prevents excessive loss. Moisture may be retained by harrowing the surface after each rain. If another rain follows within a day or so this cultivation may do little good, but if a dry season follows, the cultivation may save the crop by preventing the evaporation of the moisture.

If the soil is dry the running of a roller over young corn is beneficial, the roller to be immediately followed by a weeder. The rolling of the ground causes the water to be drawn up from below to the roots of the young plants and the use of the weeder or harrow prevents it from being lost by evaporation.

The weeder may be used effectively until the corn is eight to twelve inches high. But if the soil is compacted by heavy rains and the young weeds are more than one inch in height the weeder is of little value and other means of cultivation are necessary. After the corn is too high to use a weeder or harrow the best plow to use is a two-horse cultivator with small hoes. Unless the soil is wet the corn should be cultivated every ten days until it begins to tassel.

In planting corn the distance between the rows and hills is governed, of course, by the fertility of the soil and the variety of corn planted, and by the amount of moisture that will probably be available during the growing season. Our results from five years work with seed corn from the North and the South, indicate that the tall Southern varieties require more sunlight and consequently more room in the row to produce maximum yields of corn than do the varieties from the North that do not make such a tall and leafy growth. Close planting may do well one season, whereas the next a variation in the rain-fall will cause wide planting to yield much better. Of course, as every one knows, the rainfall being constant, the richer the soil, the closer may planting be done with safety. Some varieties of

corn when spaced far apart in the row, will produce a great many more suckers than will other varieties.

When corn is intended for silage the most satisfactory method of planting is to use a two-horse planter with drill attachment, making the rows three and a half feet apart and sowing the seed so as to get two good stalks every twelve inches.

The best method of planting corn so that cultivation will keep weeds down is to plant in checks and plow both ways, and if a field is badly infested with weeds this method should always be used. But the results from the experiment stations and any number of practical farmers indicate that better yields are obtained from planting one grain every twelve inches than by planting three grains every forty-two inches.

The method of handling corn fodder that is almost wholly pursued in Kentucky is to cut the corn when the fodder is ripe and place in shocks of 256 hills. After the corn has dried sufficiently to crib it is shucked by hand, leaving the shucks on the stalk. The fodder is then carefully reshocked and tied together, and remains in this condition until hauled out to the cattle in winter. If there has not been an abundance of blowing rains and snow this fodder keeps in good condition. The method of feeding is to scatter the fodder in loose piles upon the ground and allow the cattle to run over it and eat what they will, which generally is a very small percentage of the whole. Most farmers are of the opinion that, with the exception of the blades and shucks, the fodder possesses but little feeding value. This is not true, for, where the corn has been cut at the proper time and the weather conditions have been favorable the whole plant is a valuable feed, provided it has been well shredded and is fed in combination with more nitrogenous feeds. We have been shredding the fodder grown on the station farm for the last six years and it has kept fairly well, with the exception of the fall of 1901. That year heavy rains came after quite a dry spell and these rains caused the corn to "green up" to such an extent that the stalks were filled with moisture after the ears and leaves had become dry. Before shredding the fodder should remain

shocked in the field, or preferably under a shed, until well dried out.

To have corn germinate well it is essential to dry the ears in the fall before cold weather sets in. The system we have adopted is to put the selected corn, as soon as it is brought from the field, into a wire netting case. The frame for this case is made of 2x4 inch pine. The size of the frame is 4x4x14 feet. This frame work is covered with wire netting with a two inch mesh. (See plate II.) Such a frame will hold 40 bushels of corn. By having the legs of the frame covered with tin it becomes practically rat proof. This frame should be put in some dry, well ventilated place.

To insure a perfect stand it is necessary that the proper number of kernels be placed in each hill, and that these kernels will germinate. If the corn is planted by a machine it is of great importance to so select that only those ears will be used for seed that have uniform sized kernels. If the kernels are all uniform in size and shape the corn planter can be so regulated that the desired number of kernels will be dropped in every hill. The corn should be tested as to its germinating powers before planting so one may know the number of kernels to plant in the hill.

We are constantly receiving inquiries as to the points and rules used in the scoring and judging of corn. We give therefore in this bulletin the standards of perfection as adopted by one of the state corn breeders associations. It is very helpful to have score cards in studying the points of perfection in corn, and in making comparisons between different samples. Of course these points are relative and may not represent the true value of the different points. The following is the score card adopted by the Illinois Corn-growers Association:

Name.	Perfect. Score
1 Uniformity	10
2 Shape of ears	5
3 Color of ears	10

4	Market condition	5
5	Tips of ears	10
6	Butts of ears	5
7	Uniformity of kernels	5
8	Shape of kernels	5
9	Space	10
10	Length	10
11	Circumference	5
12	Per cent. of corn	20
		100

Uniformity. (See plate III.)

Uniformity of ears in a variety is the best indication that that variety has been carefully selected for a number of generations.

Shape of Ears. (See plate IV.)

The nearer the shape of an ear approaches that of a cylinder the greater will be the percentage of corn to cob. This cylindrical shape will permit the ear to carry straight, parallel rows of kernels from butt to tip.

Color of Ears. (See plate V.)

Those varieties of corn that have received the greatest care in their selection and improvement are uniform in color, and the white varieties have a white cob and the yellow and red varieties have a red cob. No corn should be used for seed that shows the effect of cross pollenization. The effect of pollen is shown the first year.

Market Condition. (See plate IX.)

By market conditions is meant the soundness of the ear and the conditions of the kernels. The ears should be free from decay or fungous disease; and the kernels should not be shriveled or chaffy, but show full maturity.

The Tips. (See plates VI. and VII.)

The tips of the ears should be covered with regular, uniform kernels so that no part of the cob can be seen.

The Butt. (See plate VI.)

The butt of the ear should be well filled out with even rows of kernels and swell out evenly beyond the end of the cob around the shank.

The Kernels. (See plate VIII.)

The kernels should be uniform in size, shape and color, and should possess similar characters. The shape of the kernel on the broad side should be as near that of a wedge as possible. This shape will permit of the largest number of rows of kernels on the cob.

There should be very little space between the rows of kernels. A wide space shows shallow kernels of a bad shape.

Per Cent. of Corn. (See plate X.)

The per cent. of corn on the ear is determined by weighing the ears, shelling the grain, and reweighing the cobs and grain. A hundred pounds of ear corn should never shell out less than eighty pounds of grain.

DESCRIPTION OF VARIETIES TESTED.

2. Hickory King.

This variety has a very small ear and cob. Shape of ear, cylindrical; length, 6 to 8½ inches; circumference, 5 to 6 inches. Length of kernels, 7-16 inch; color, pearl-white; shape, very broad and thick; indentation, rough. Number of rows, 8 to 10. Space between the rows, very wide. Butt and tip, partly filled. Shank, small. Size of cob, very small; color, white.

The seed of this variety was obtained through the U. S. Department of Agriculture, from the Agricultural Experiment Station, Knoxville, Tennessee.

3. U. S. P. B. Selection 77.

Shape of ear, cylindrical; length, 7 to 9 inches; circumference, 6½ to 7½ inches; length of kernels, 7-16 inch; color, white; shape of kernels, long wedge; indentation, medium rough, Number of rows, 16 to 22; space between the rows, narrow. Butt, well rounded. Tip, well filled. Shank, small. Cob, large, white.

The seed of this variety was obtained from the U. S. Department of Agriculture.

4. Champion White Pearl.

This variety has a slowly tapering ear of medium length, varying on our soil from 6½ to 8¼ inches; circumference of ear, 6½ to 7 inches. Length of kernel, one half inch; color, pearl white; shape, broad wedge; indentation, rough. Number of rows, 14 to 18; space between the rows, wide. Butt, moderately rounded. Tip, very poor. Size of shank, medium. Size of cob, medium; color, white.

The seed of this variety was obtained from Mr. J. C. Suffern, Voorhies, Illinois.

5. Mosby's Prolific.

Shape of ear, slowly tapering; length of ear, 6 to 8 inches; circumference, 5½ to 6½ inches. Length of kernels, one-half inch; color, horn-white; shape, narrow wedge; indentation, rough. Number of rows, 12 to 14; space between the rows, very wide. Butt, flat. Tips, poorly filled. Shanks, small; cob, very small; color, white.

Obtained from J. K. Mosby, Lockhart, Mississippi.

6. Iowa Silver Mine.

Shape of ear, cylindrical; length, 6 to 8½ inches; circumference, 6 to 7 inches. Length of kernels, 9-16 inch; color, cream-white; shape, medium wedge; indentation, very rough. Number of rows, 16 to 18; space between the rows, narrow. Butt, well rounded; size of cob, small; color, white; Tips, well filled; rows, regular. Shank, small.

Seed from F. A. Warner, Sibley, Illinois.

7. Cocke Prolific.

Shape of ear, tapering. Length, 5 to 7½ inches. Length of kernel, one-half inch; color, pure white; shape, broad and thick; indentation, medium rough. Number of rows, 10 to 12; space between the rows, wide. Butt, poor. Tips, good with regular rows. Shank, small. Size of cob, small; color, white.

Obtained through the U. S. D. A. from the Tennessee Agricultural Experiment Station.

1 and 8. Boone County White.

Shape of ear, cylindrical; length, eight to ten and one-half inches; circumference 7 to 8 inches. Length of kernels, one half inch; color, pearl white; shape, medium wedge; indentation, rough. Number of rows, 16 to 20; space between the rows, narrow. Butt, well rounded. Tip, well filled. Size of shank, small. Size of cob, medium; color white.

Obtained through the U. S. D. A. from Mr. Marley Riley of Thorntown, Indiana.

9. Hannah Corn.

Shape of ear, cylindrical; length, eight to nine and one-half inches; circumference, six and one half to seven and one half inches. Length of kernel, one-half inch; color, horn-white; shape, wide wedge; indentation, moderately rough. Numbr of rows, 14 to 18; space between the rows, medium. Butt and tip, moderately filled. Shank, medium. Size of cob, large; color, white.

Seed from J. H. Burrow, Lynnville, Tenn.

10. Sanders' Improved.

The ear is slightly tapering varying in length from seven and one half to nine and one half inches; circumference of ear, 6 to 7 inches. Length of the kernels, one-half inch; color, cream-white; shape, wedge; indentation, medium smooth. Number of rows, 14 to 16. Butt, moderately filled. Tips, poor. Size of shank, medium. Size of cob, medium; color, white.

The seed was received through the U. S. D. A. from Mr. W. S. Sanders of Danielsville, Georgia.

11. Leaming Yellow.

Ears strongly tapering, varying in size from seven to nine and one-half inches; circumference of ears, six to seven inches. Length of kernels, nine-sixteenth inch; color, deep yellow; shape, medium wedge; indentation, moderately rough. Number of rows, sixteen to twenty-two; space between the rows, medium in width. Butt, moderately rounded. Tip, well filled with regular rows. Size of shank, medium. Size of cob, medium; color, red.

Obtained through the U. S. D. A. from Mr. P. D. Leaming of Wilmington, Ohio.

12. Reid Yellow Dent.

Shape of ears tapering, uniform size, varying in length from eight to nine and one-half inches; circumference, six to seven inches. Length of kernels, one-half inch; color, horn orange with light yellow cap; shape of kernel, long wedge; indentation, medium smooth. Number of rows, 18 to 22; space between the rows, very narrow. Butt, well rounded. Tip, well filled with regular rows. Shank, small. Size of cob, medium; color, red.

Obtained through the U. S. Department of Agriculture from Mr. James L. Reid, of East Lynn, Illinois.

14. Riley's Favorite.

It has slowly tapering ear varying in length from seven to nine inches; circumference of ear, six and one half to seven inches. Length of kernels, nine-sixteenth inch; color, yellow; shape, medium wedge; indentation, rough. Number of rows, 14 to 18; space between the rows, very distinct. Butt, moderately rounded. Tip, well filled with regular rows. Shank, small. Size of cob, medium; color, red.

Obtained through the U. S. Department of Agriculture from Mr. Marley Riley of Thorntown, Indiana.

15. Champion Yellow Dent.

Shape of ear, cylindrical; length, eight and one-half to ten inches; circumference, seven inches. Width of kernels, very broad; indentation, medium smooth. Number of rows sixteen to eighteen; space between the rows, medium. Butt and tip only moderately filled. Shank, medium; cob, medium; color, red.

Obtained from J. C. Suffern, Voorhies, Illinois.

16. McMackins' Gourd Seed.

The ear is slightly tapering, and varies in length from seven to nine and one-half inches; circumference, six and one-half to seven and one half inches. Length of kernels, five-eight inch; color, horn white; shape, long narrow deeply wedge; indentation, rough. Number of rows, fourteen to eighteen; space between rows, narrow. Butt, evenly filled. Tip, poorly filled. Shank, medium. Size of cob, medium; color, white.

Obtained through the U. S. Department of Agriculture.

17. Boone County Special.

This variety resembles Boone County White in many respects. It did not, however, produce as much grain or fodder.

Obtained through the U. S. Department of Agriculture.

18. Roseland White Corn.

This is one of the very best varieties of corn we can raise in Kentucky for ensilage or fodder. It also ranks high as a yielder of grain. It is a vigorous grower, and produces more fodder than any other variety we have tested. When fully tasseled a great many of the leaf blades measured six inches in width. A number of the plants were twelve and one half feet high. The ear is of a cylindrical shape, and varies in length from eight and one half to eleven inches; circumference of ear, seven and one half to eight and one half inches. Length of ker-

nels, one-half inch; color, dull white; shape, broad and thick; indentation, medium smooth. Number of rows, 14 to 16; space between the rows, wide. Butt, shallow rounded. Tip, moderately filled with regular rows. Shank, large. Size of cob, large; color, white.

Seed bought from Mr. Thos. D. Hubbard, Kimball, Kansas.

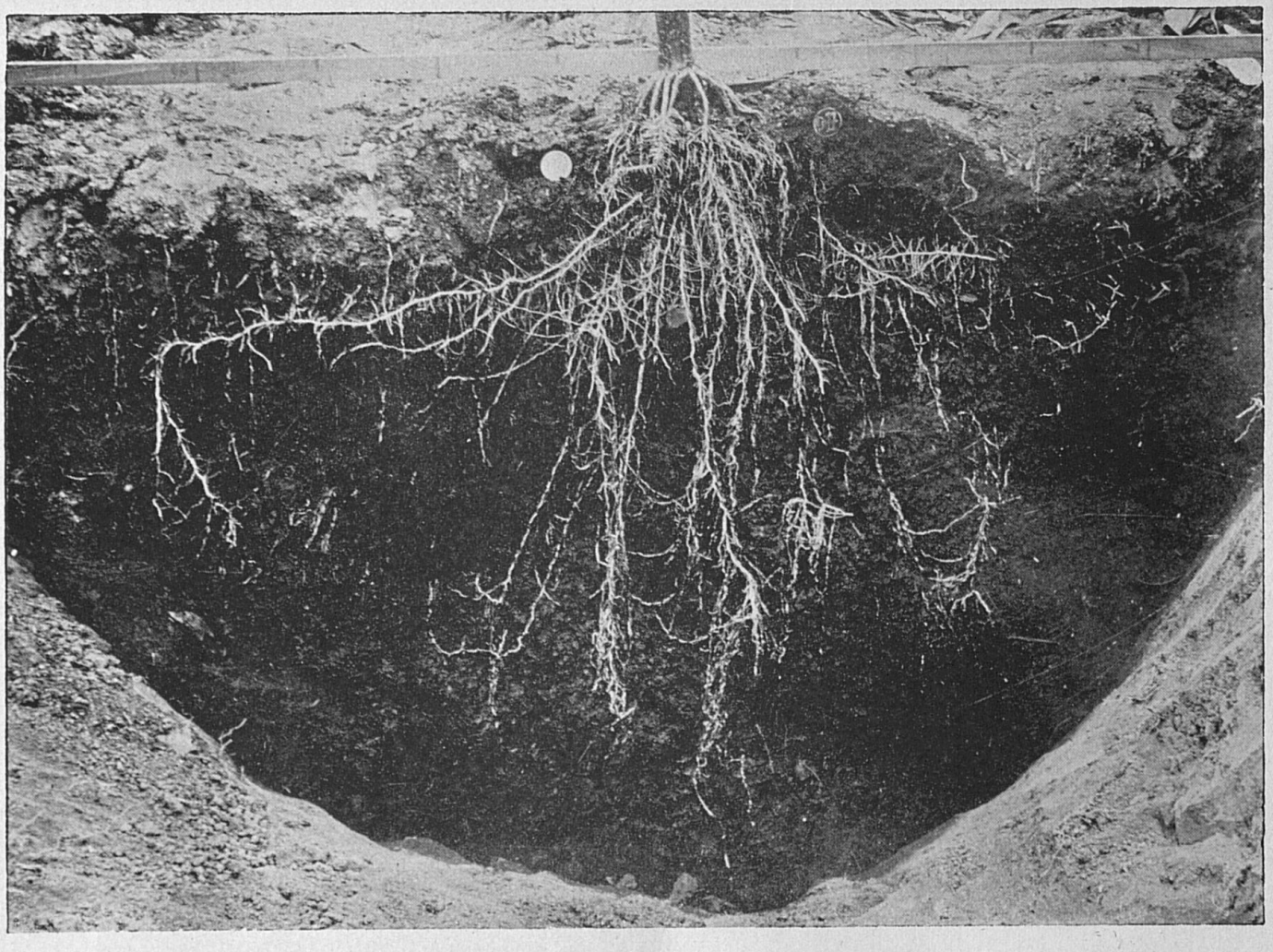


Plate I.—The distribution of corn roots.

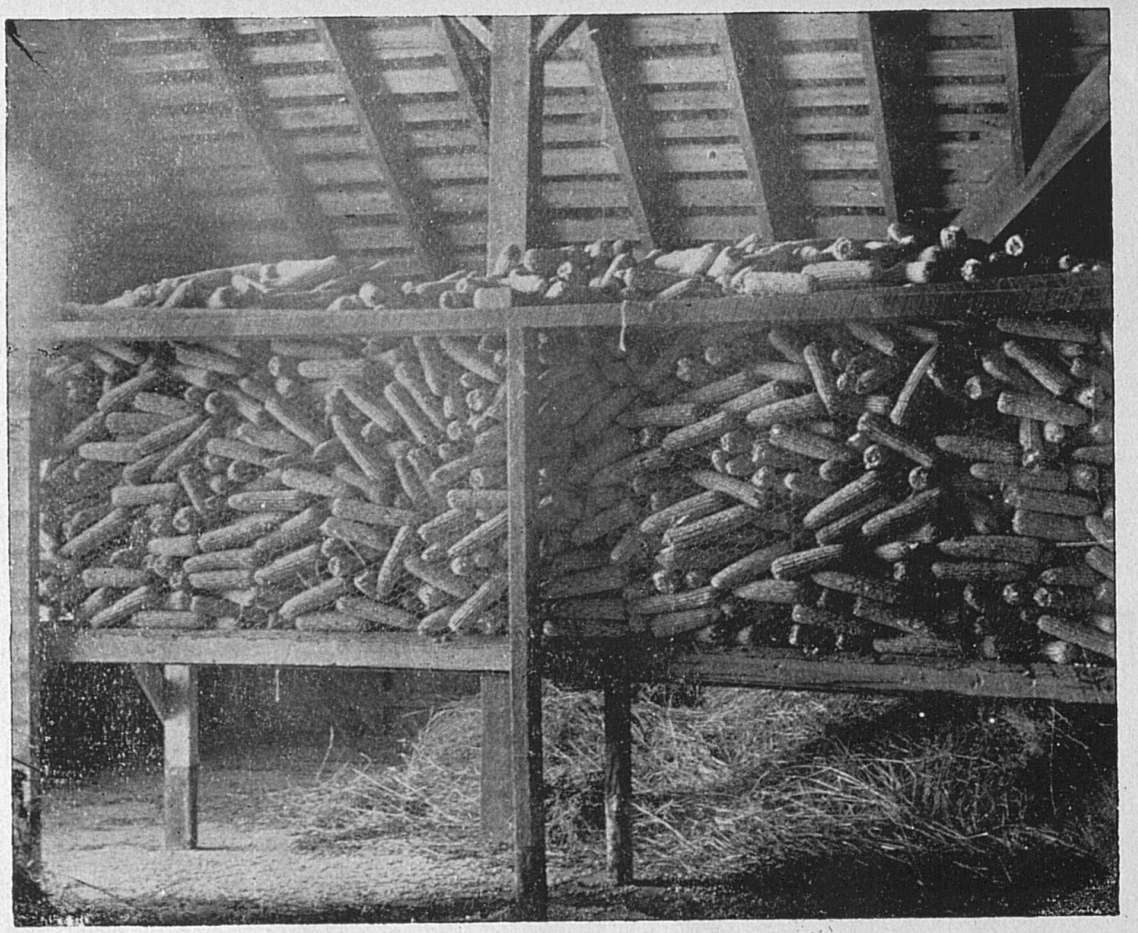


Plate II.—A curing and storage bin for seed corn.

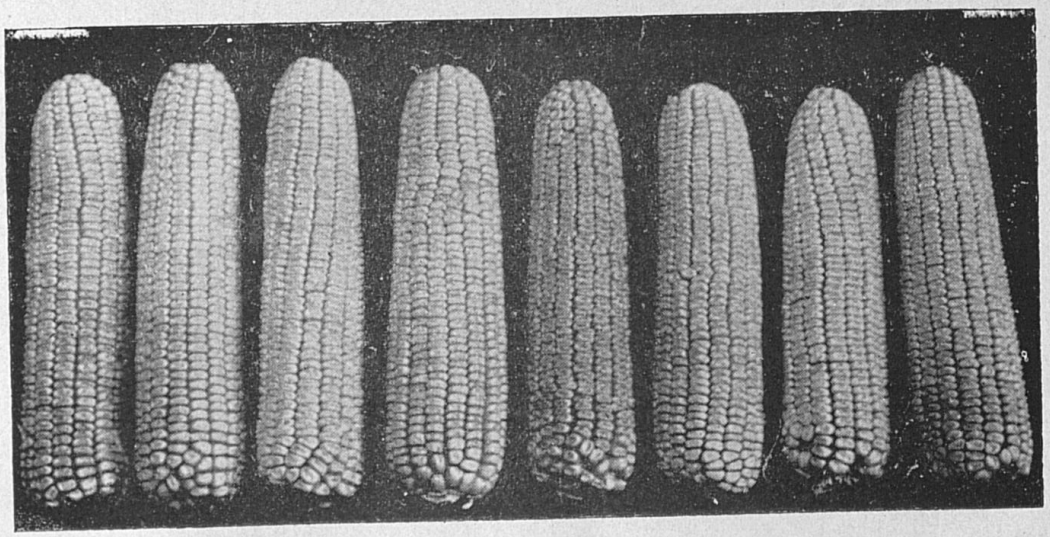
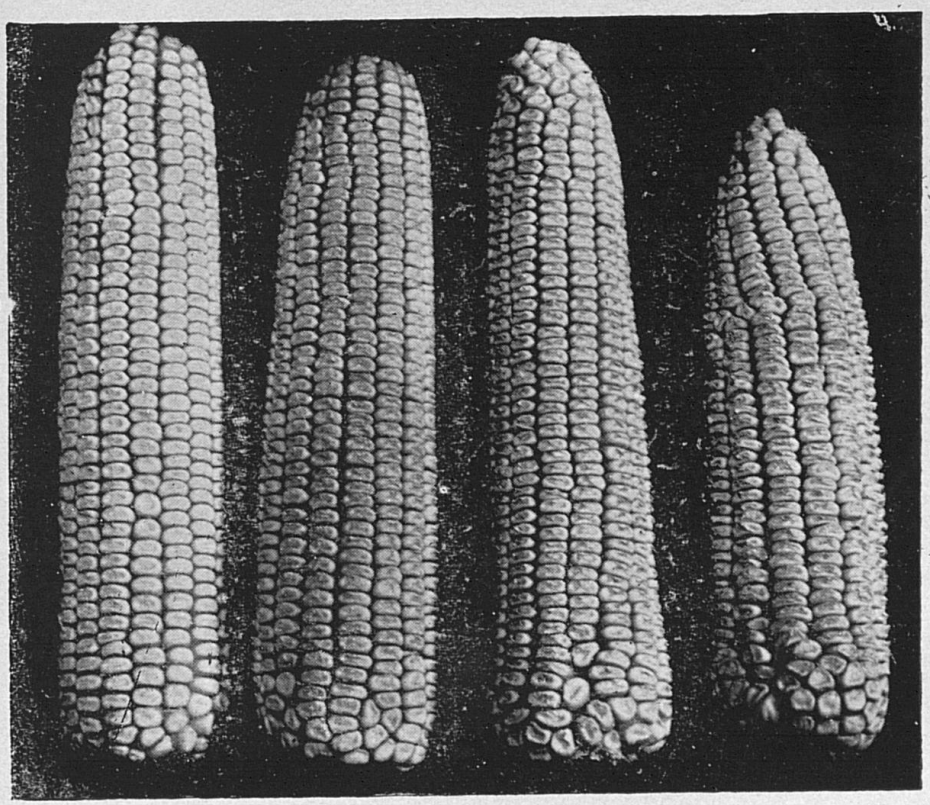


Plate III.—Uniformity. Variety, Boone County White.



1 2 3 4

Plate IV.—Shape of ears. Nos. 1, 2, good shape. Nos. 3, 4, too tapering.

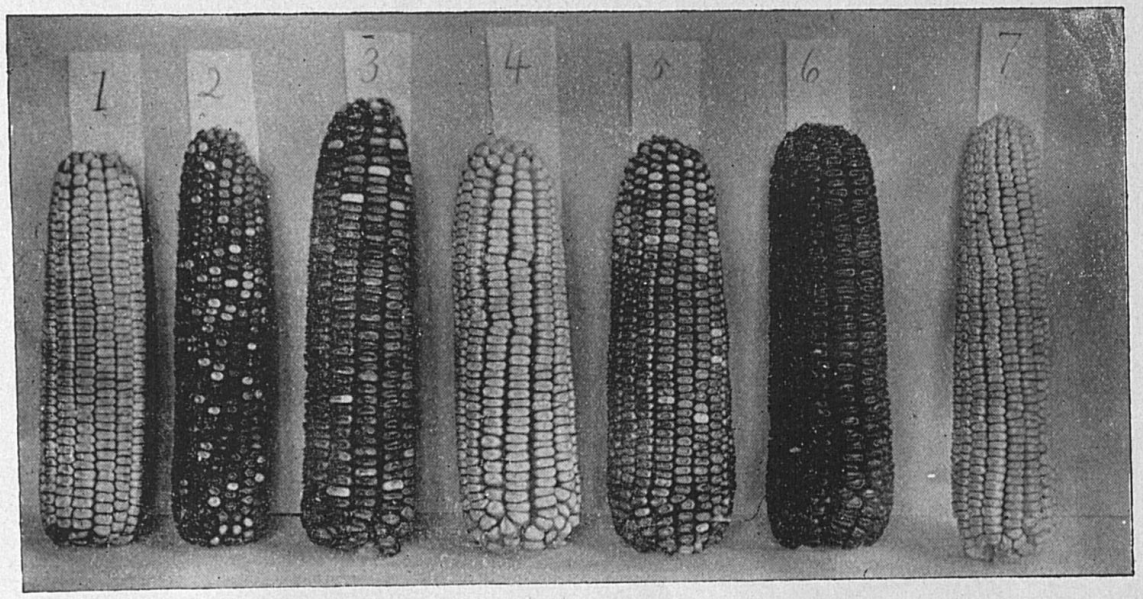
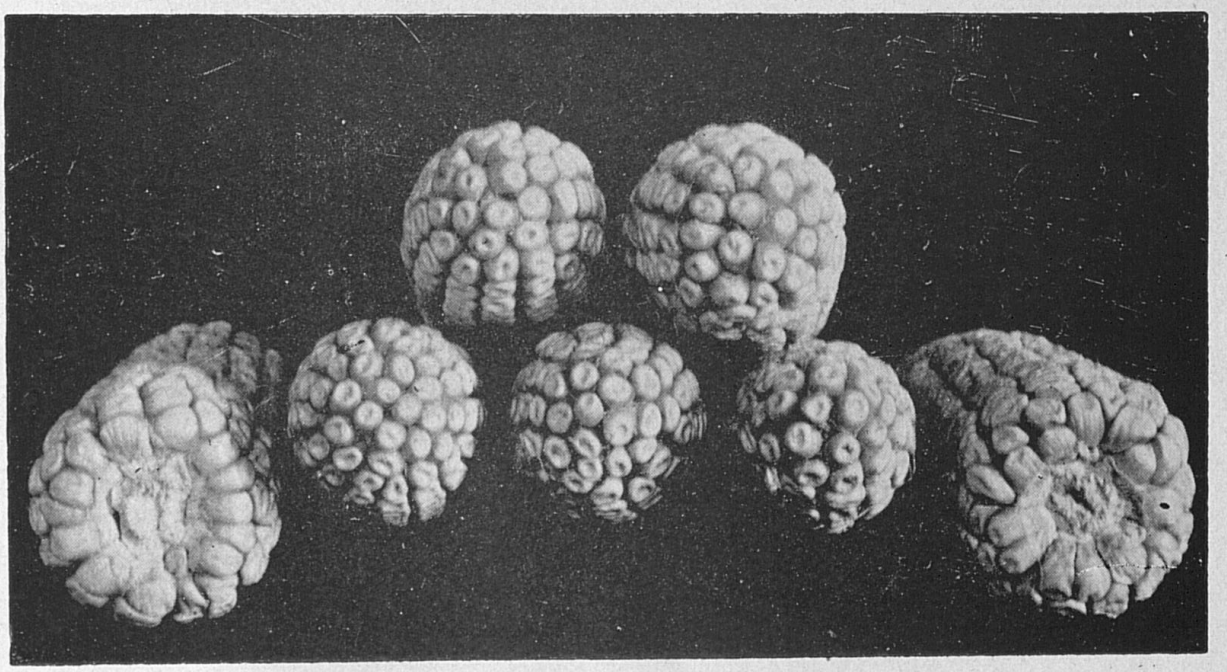


Plate V.—Color of ears. The direct effects of cross pollenization on the color.



Piate VI.—Well filled tips and butts.

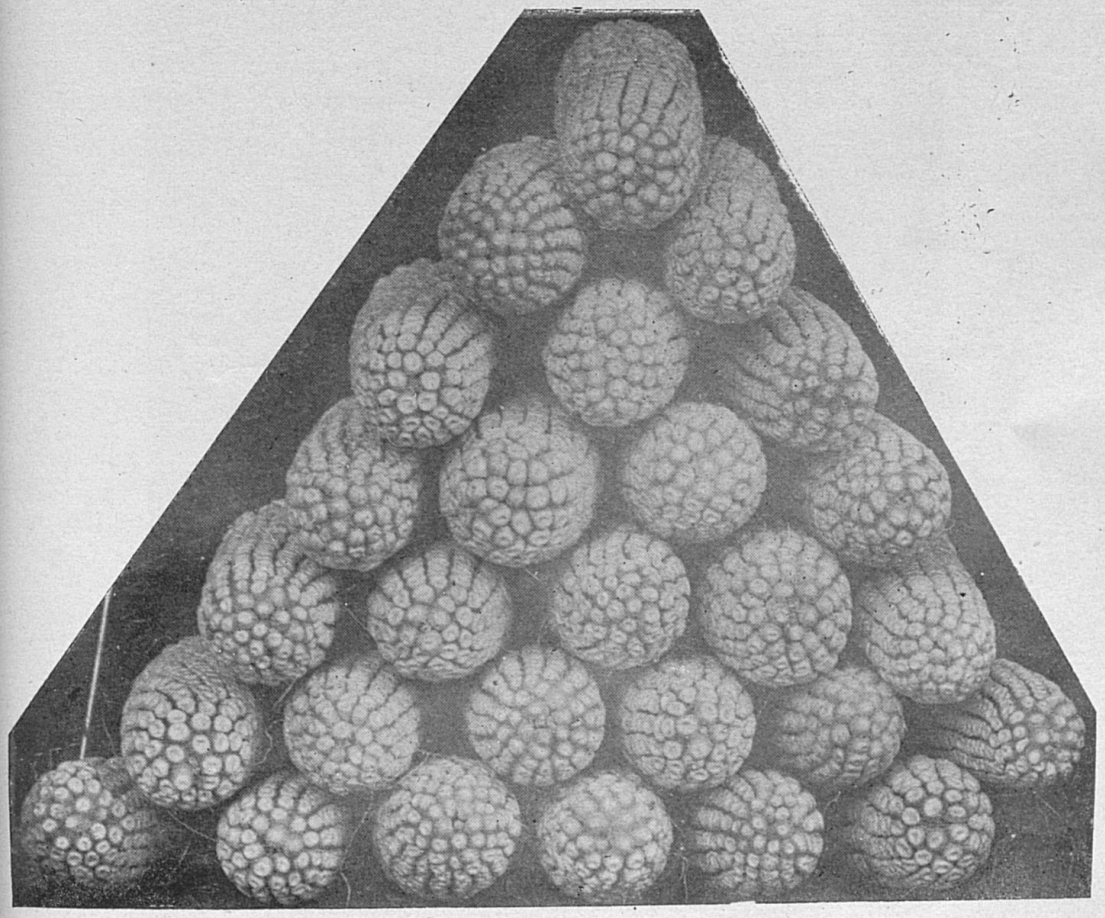
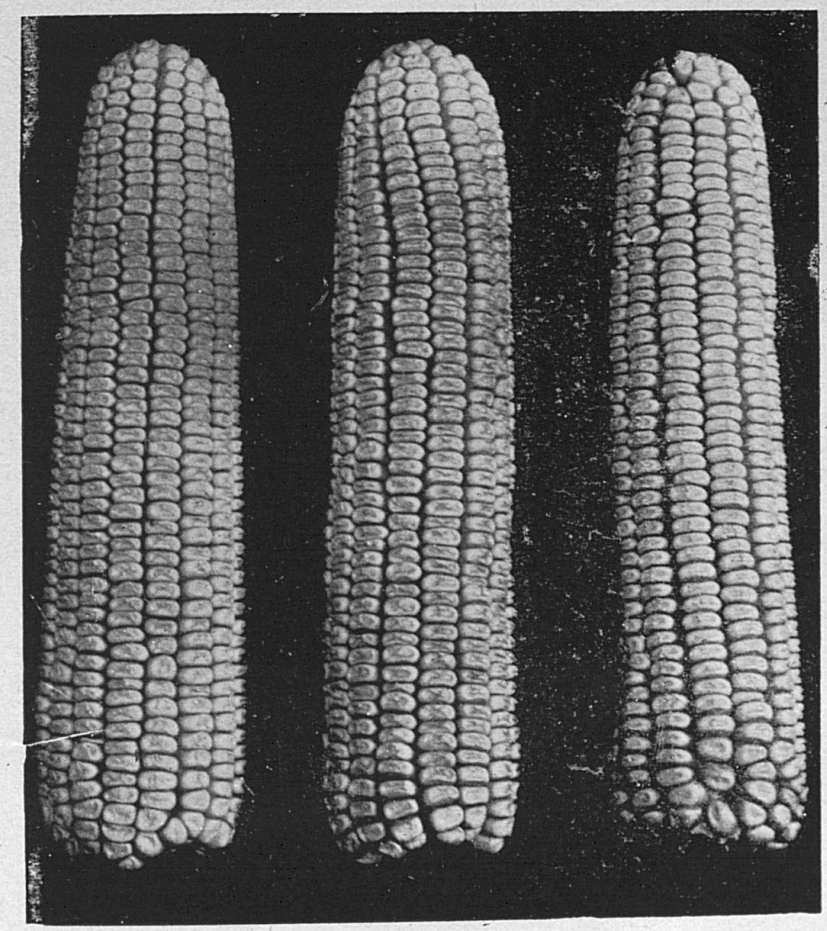
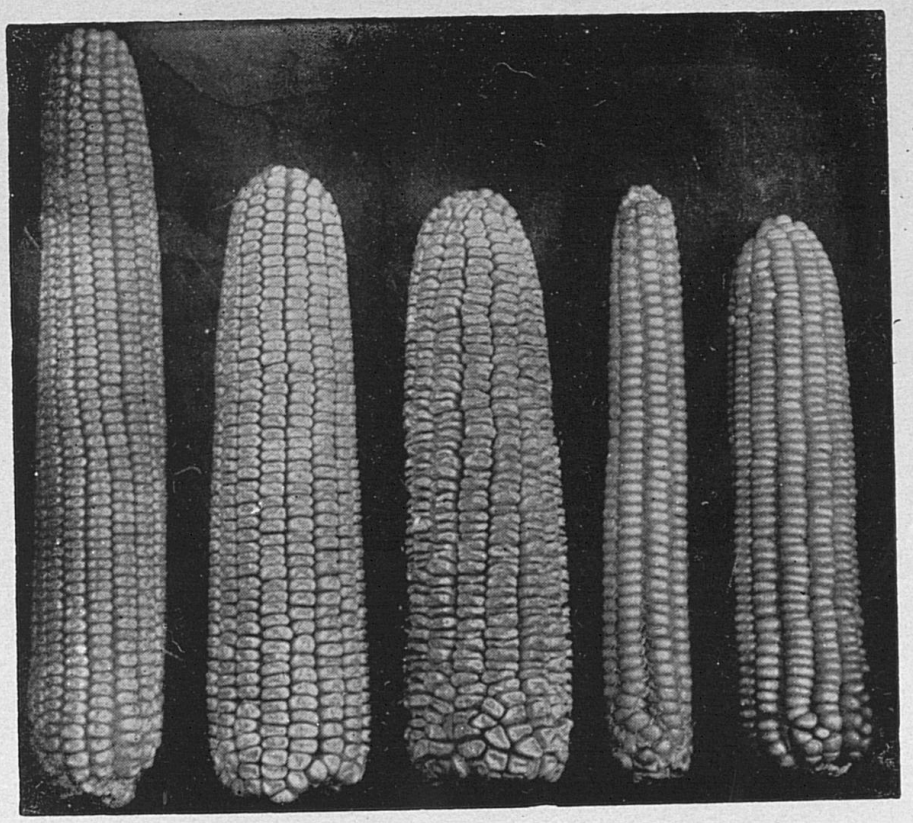


Plate VII.—Well filled tips.



1 2 3

Plate VIII.—No. 1, a typical ear. Nos. 2 and 3, space between rows of grain too wide.



1 2 3 4 5

Plate IX

No. 1. An excessively long ear with shallow grains.
No. 2. A good ear of dent corn.
No. 3. An immature ear.
No. 4. An ear of flint corn.
No. 5. An ear of dent corn which has become flinty through deterioration.

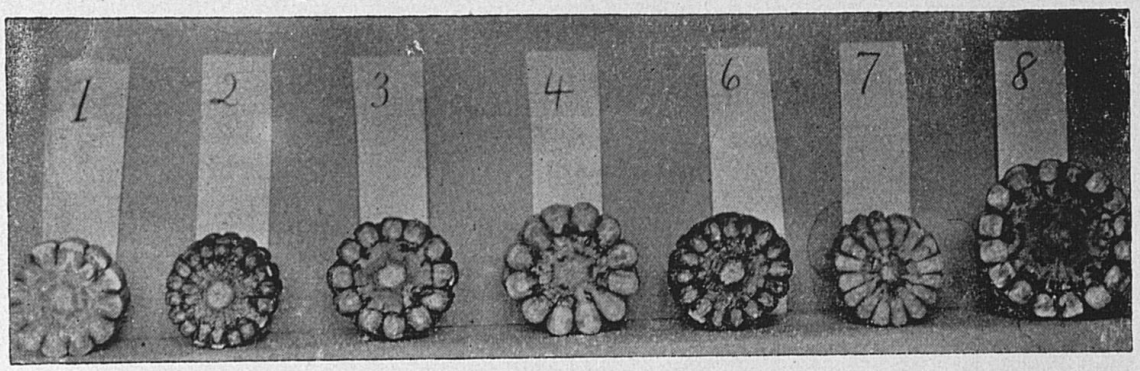


Plate X.—Variations in the size of cob. A good ear should shell out 85 per cent. grain.

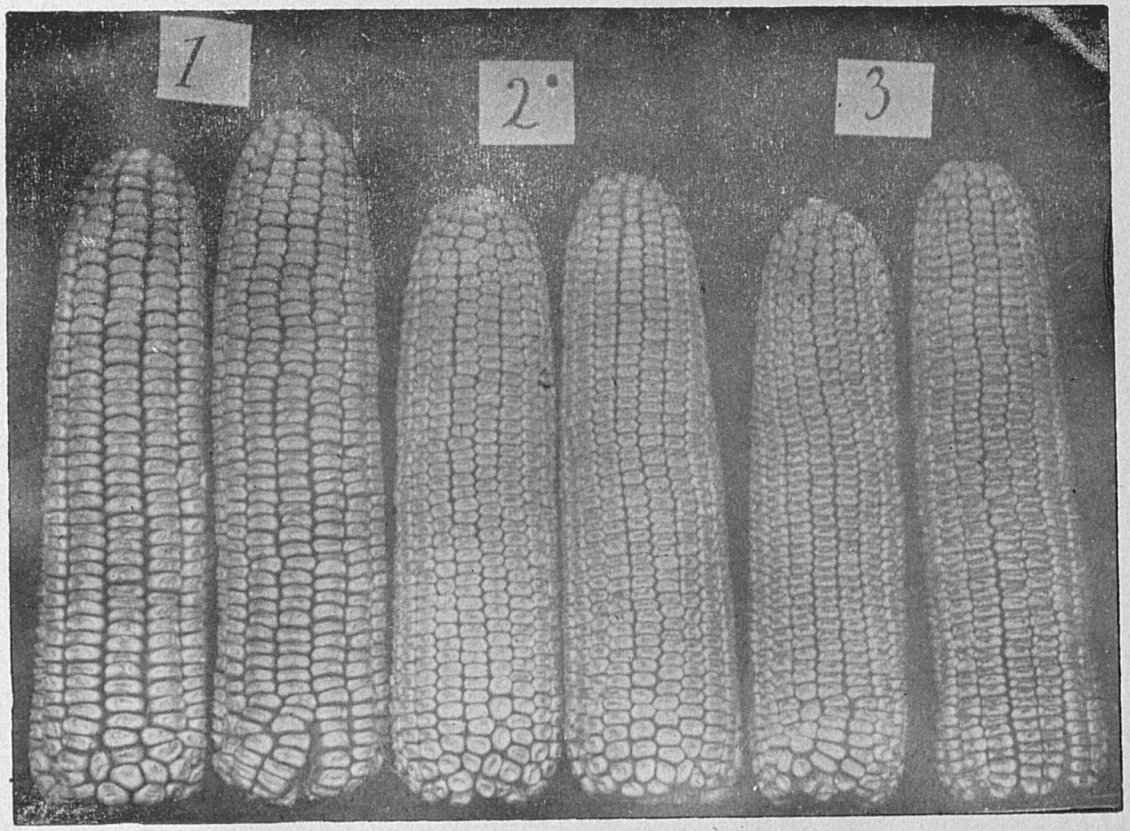


Plate XI.—No. 1, Roseland White Corn. No. 2, Boone County White. No. 3, Iowa Silver Mine.

Plate XII.—Corn grown for ensilage. Variety, Boone County White. Compare with Plate XIII.

Plate XIII.—Corn grown for ensilage. Variety, Roseland White, producing a luxuriant growth much superior for ensilage to Boone County White.

KENTUCKY

Agricultural Experiment Station

OF THE

State College of Kentucky.

BULLETIN NO. 119.

LABELS ON ADULTERATED AND IMITATION FOODS SOLD IN KENTUCKY.

LEXINGTON, KENTUCKY.
April 15th, 1905.

KENTUCKY
Agricultural Experiment Station.

BOARD OF CONTROL.

GEO. B. KINKEAD, Chairman, Lexington, Ky.
D. F. FRAZEE, Lexington, Ky.
C. B. NICHOLS, Lexington, Ky.
J. K. PATTERSON, President of the College.
M. A. SCOVELL, Director, Secretary.

STATION OFFICERS.

M. A. SCOVELL, Director and Chemist.
A. M. PETER, Chemist.
H. E. CURTIS, Chemist, Fertilizers.
H. GARMAN, Entomologist and Botanist.
J. N. HARPER, Agriculturist.
W. H. SCHERFFIUS, Chemist.
R. M. ALLEN, Secretary and Executive Officer, Food Division.
J. D. TURNER, Secretary to the Director.
J. O. LaBACH, Chemist, Food Division.
MISS M. L. DIDLAKE, Ass't Entomologist and Botanist.
S. D. AVERITT, Ass't Chemist.
O. M. SHEDD, Ass't Chemist.
G. N. KELLER, Ass't Entomologist and Botanist.

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. 119.

LABELS ON ADULTERATED AND IMITATION FOODS.

(By R. M. ALLEN.)

The effect of antiseptics on health and the reasons for using artificial color and otherwise adulterating food substances may be controverted, but no one will deny the right of the consumer to know it whenever such adulterations have been practiced.

The name and describing term given to or incorporated in the label of an article of food or drink have much to do with the price and supposed food value of the article so named or labeled. The terms, pure—adulterated, genuine —imitatiton, aged—immature, wholesome—deleterious to health, should be restricted or commanded to the true qualities of substances intended for human consumption.

The names, honey—glucose, butter—olemargarine, lard beef stearin and cottonseed oil, apple vinegar—spirit vinegar, imply different food and money values. Such names as honey, butter, lard, indicate food substances in which the people have for all times had confidence, and no one has the right to employ them to give name to an imitatiton, be it of less or greater value, any more than one manufacturer or artisan has the right to pirate the trade marks of another.

Chapter 53, of the Acts of the General Assembly of 1898 as amended by Chapter 13 of the Acts of 1900, provides for the labeling of food products as follows:

Section 2, "The term mis-branded 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 any substance 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."

Section 3, Paragraph 4, "If it be labeled or branded so as to deceive or mis-lead the purchaser or purport to be a foreign product when not so, or is an intimation either in package or label of another substance of a previously established name."

"Provided, That any articles of food which are adulterated or mis-branded within the meanings 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 food which contain no unwholesome substances to disclose their trade formulas, except so far 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."

For six years the State food law has been operating to have adulterated and imitation foods so labeled, and to have the information that a food is adultered, stated to the consumer whenever the food is sold in bulk as in the case of meats and milk. This publicity has about stopped the use of formaldehyde in milk and boric acid in meat. It is stopping the use of aniline dyes in fruit products and saccharin in canned corn. It is stopping the use of salicylic and benzoic acids in jellies, preserves, ciders and grape juices. Imitation products are being labeled for what they are, and if th consumers will purchase with ordinary care they can protect health, and obtain fair values in the purchase of foods.

In many instances these labels are not as plain as they

should be. The information which the law commands shall be made known to the consumer, is often printed in small type or placed where it is least liable to be read, or put in terms with which the general public are not familiar.

The following pages explain some of these terms and point out where to look for the labels and what they mean. The labels reproduced in the illustrations were taken from articles of food on sale in Kentucky.

EXPLANATIONS OF TERMS USED IN LABELS.

Benzoate of Soda, Benzoic Acid, Boric Acid, Salicylic Acid, Formaldehyde, Freezine, Preservaline, Sulphites, Saccharin,	Are terms used in labels indicating the presence of antiseptics.
Corn Syrup, Grape Sugar,	Are terms indicating the use of glucose.
Distilled Vinegar, Family Vinegar, Grain Vinegar, Colored Vinegar,	Indicate that the vinegar is not Apple or Cider Vinegar.
Acquic Acid, Aluminum Sulphate, Sulphate of Aluminum,	Are terms used indicating the presence of alum, in Baking Powder.

"Artificial color" usually conceals some adulteration or inferiority. The phrases "non injurious coloring and preservative used," "harmless coloring used" usually denote some antiseptic or aniline dye whose effect on health is questionable.

LABELS SHOWING ANTISEPTICS OR ARTIFICIAL COLOR OR BOTH.

COLORING AND PRESERVATIVE USED.
(a)

(a) Taken from a bottle of tomato catsup. A plain label.

Guaranteed absolutely pure and free from artificial coloring. Preserved with sodium benzoate.
(b)

(b) Taken from a bottle of tomato catsup. Note the "Preserved with Sodium Benzoate," an antiseptic. The "guaranteed absolutely pure" is a label designed to "deceive" and "mislead."

ARTIFICIAL COLORING AND ANTISEPTIC USED.
(c)

(c) Taken from a can of soup. A plain label.

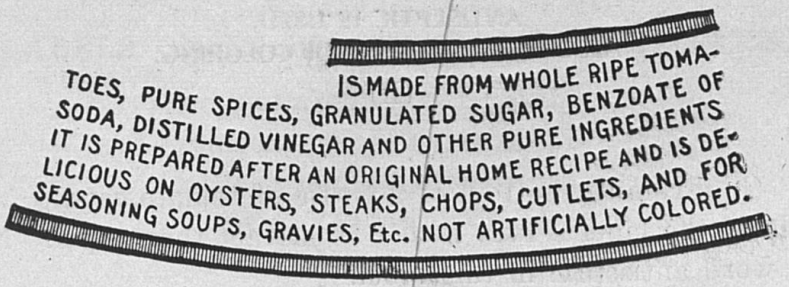
These goods are thus branded adulterated to conform to the pure food laws of Kentucky.
(d)

(d) Taken from a bottle of tomato catsup which contained color and antiseptic and starch. The food laws of Kentucky do not require the word "adulterated" on any pure or properly labeled product.

Contains an antiseptic and artificial color.

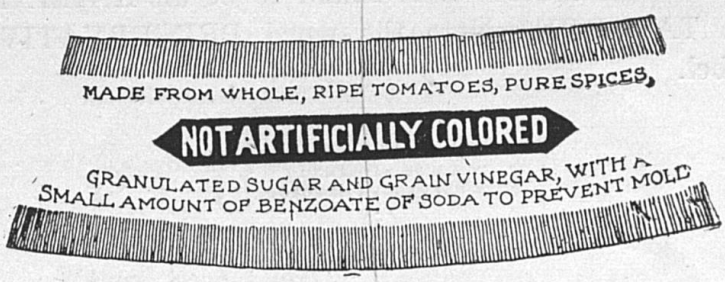
(e)

(e) Indistinctly printed on the neck band of a bottle of catsup and in such a manner as not to be noticed by the average consumer.



(f)

(f) Taken from the neck of a bottle of catsup. Note the label shows that the catsup contains "BENZOATE OF SODA," an antiseptic, enumerated among the other "pure ingredients." The firm which puts out this catsup has discontinued the use of aniline colors.



(g)

(g) From the neck of a bottle of tomato catsup. Note the words, "SMALL AMOUNT OF BENZOATE OF SODA

TO PREVENT MOLD.'' Note also how much larger the notice, ''NOT ARTIFICIALLY COLORED.'' This notice was printed in white letters on a red strip while the rest of the label was in a dull type.

YOU WILL LIKE IT

EVERY BOTTLE IS SOLD
UNDER A GUARANTEE TO BE
OF EXCELLENT QUALITY.
TO RESIST CLIMATIC CONDITIONS
ANTISEPTIC IS USED,
ALSO SMALL AMOUNT OF COLORING.

(h)

(h) From the bottom of a bottle of tomato catsup. The style of the label serves rather to attract than repel. Note the word antiseptic in this label.

We guarantee the purity of the contents of this package. A small amount of Preservative is used to prevent fermentation and a small amount of harmless coloring matter.

(i)

(i) The ''Small amount of harmless color'' set forth with this ''guarantee'' was found to be an ANILINE OR COAL TAR DYE. Note the word PRESERVATIVE in the label.

COLORED PRESERVED WITH
BENZOATE OF SODA.

(j)

(j) From the bottom of a bottle of catsup, printed upside down on the edge of the label.

Manufacturers of high grade catsup are leaving the coal tar dyes out of it, which means that uncolored catsup

must be made from whole ripe tomatoes, and without starch, in order to present a good color. Antiseptics are used in smaller quantities than formerly. All catsups are labeled now to show their presence. There are two brands of catsup on the Kentucky market which do not contain either artificial color or an antiseptic. So far the experiment has been a success.

LABELS ON IMITATION JELLIES AND JAMS.

60% FRUIT
15% SUGAR
25% CORN SYRUP.

(a)

(a) Taken from the neck of a jar of "Plum" butter. This is the original formula before the mixture was boiled. The cooked butter analyses 60 per cent. glucose, or as stated in the label, "Corn Syrup." This label is therefore misleading. Wherever the word "Glucose," or "Corn syrup," appears in the formula of a compound the consumer can be sure that the glucose is not contained in a quantity below 50 per cent.

COLORED AND FLAVORED AS

PLUM JELLY

Made and thus branded, to conform to the Pure Food Laws of Kentucky, and is guaranteed to be pure and wholesome, being made of Apple Juice, Granulated Sugar, Glucose and Pure Acid Phosphate.

(b)

(b) The "PLUM JELLY" in the label is a deliberate misrepresentation, as one can see by reading the label in full. When the small type is read closely, the consumer discovers that the "Plum" jelly is only a mixture of glucose, acid phosphate, coal tar dye and enough sugar and apple juice to permit the introduction of these terms into the formula.

PURE APPLE JUICE
GRAPE JELLY
FLAVOR
PRESERVED IN GRAPE SUGAR COLORED

(c)

(c) Before the food law went into effect, this mixture was called, as one sees in the label, "Grape Jelly." The old labels were reprinted and the consumer now sees that the "Grape jelly" is a mixture of glucose, apple juice and color, the color in this instance is coal tar dye.

COMPOUND PRESERVE
FORMULA.
60% FRUIT AND FRUIT JUICE,
15% SUGAR,
25% CORN SYRUP.
COLORED PRESERVED WITH
BENZOATE OF SODA.

(d)

(d) Pasted on the back of a jar of "High Grade Quince Preserves." This is also the formula of a mixture before it was cooked. The jar is misbranded as to the amount of glucose. There is a wide difference between the price of glucose, and the price of fresh fruit and sugar, and it is a gross misrepresentation to put the per cent. of glucose at twenty-five, when it is sixty.

LABELS ON SYRUP.

(a)

SYRUP COMPOUND
80 per cent corn syrup
20 per cent sugar syrup

(b.)

(a) This label surrounded a picture of a beehive on a can of glucose. The little label (b) was placed in dull type on the back of the can. There is much more in the little label for the consumer, than in the large one, especially so, if he is charged the price of cane molasses as in the cost of this sample.

The manufacturer designed (a) for his own benefit, (b) for the benefit of the consumer. Note the difference in size.

Pure glucose is a good food, but it has not the food or market value of cane syrup, sugar syrup or honey. It is a fraud all along the line to sell it under these names.

LABELS ON FLAVORING EXTRACTS.

This Flavor is Composed of

Alcohol (diluted)	.52500
Aqua	.40000
Vanilline Crystals	00325
Coumarine	.00175
Glycerine	.07000
	100000

(a) and (b)

Do not spoil cake or ice cream by adding such mixtures as are described in the labels above.

(a) Has no vanilla in it; (b) but a trace of lemon oil, (0.35 per cent.). The standard for lemon extract is 5 per cent. lemon oil. This sample has about one fifteenth the strength of standard lemon extract and costs one-half as much. These facts are pointed out obscurely in the "compound" at the bottom of the labels.

LABELS ON BAKING POWDERS.

This
Baking Powder contains
the following ingredients only:
SODIUM BICARBONATE,
REFINED CORN STARCH, ANHY-
DROUS BASIC ALUMINUM SULFATE
AND ANHYDROUS SODIUM SULFATE.
it is composed of the purest materials is compounded
in the most scientific manner and produces the
most healthful and nutritious bread; its use
safeguards the food against the delsterious
physiological effects of Rochelle Salts
which are left in the bread by the
use of cream of tartar
powders.

(a)

A(a) From the end of a can of Alum Baking Powder. Note the "ANHYDROUS BASIC ALUMINUM SULPHATE," in the label.

Cream Tartar, Phosphate, Sodium Aluminum Sulphate Baking Powder.

(b)

(b) This label extended up the side of a can of Alum Baking Powder, in very small indistinct letters.

THIS IS AN ALUM BAKING POWDER

(c)

(c) An honest label.

GUARANTEED A PURE, CREAM TARTAR POWDER.

(d)

(d) On a can of Cream-Tartar Baking Powder.

VINEGARS.

The law requires that all vinegars be labeled to show the process of manufacture. The barrel, however, is often placed in the store so that its labels cannot be read and much of the colored spirit vinegar is sold as "apple vinegar."

The consumers have the protection of the label on the barrel, if they will examine the label when buying vinegar.

LARD

Cans and tubs of lard mixed with beef stearine and cotton-seed oil are labeled COMPOUND LARD with the formula of the mixture. Look for the label on the can or tub of lard.

PEPPER AND OTHER SPICES.

The only sure protection against adulteration is to buy pepper or other spices whole and grind them at home, especially if the price of the ground article is less per pound than the price of the whole berry.

The original packages of adulterated peppers and spices are generally labeled ADULTERATED and it is a violation of the law for a grocer to sell the contents of such a package as pure pepper or spices.

SOME OTHER INFORMATION FOR CONSUMERS.

Do not buy catsup from a keg or jug, or jelly from a bucket which stands open in the grocery store day after day.

Examine the label on foods. Insist that your grocers guarantee the quality and purity of everything they sell you for food and drink. The grocer should know his business as well as the doctor, druggist or attorney should know his.

Do not eat food which is, "guaranteed to keep for any

length of time in any climate.'' Such an embalmed mixture has no business in the human stomach.

Do not, under any circumstances, buy a bottle or jar or package of food in the original package which is not labeled with the name and address of the manufacturer who puts it up.

When you buy an imitation jelly or other food product, take into consideration that the glass, labor in cooking and packing, drayage, freight, costs of selling, advertising and similiar expenses are the same for an imitation as for a pure product. There are many mixtures in the food market, which, besides having no food value, are deleterious to health. Half a pound of pure fruit jelly is worth more to the consumer than a pound of an imitation in which there is everything but fruit.

FOOD ADULTERATION AND PRICES.

Labels undoubtedly effect prices, and for this reason foods are misbranded. It is self evident that a product labeled, ''Imitation'' or ''Adulterated'' will sell for less than when the same product is labeled ''Genuine'' or ''Pure.'' The advertising circular of a certain Grocer quotes a brand of imitation lard made from cotton seed oil and beef stearin, at six cents per pound. An Inspector's record shows that in 1901 this same brand of cotton seed oil product was sold as ''Pure hog lard'' at eleven cents per pound. The operation of the Kentucky food laws is demonstrating that the price of every imitation product is lowered by truthful labeling.

It is claimed that the restriction of antiseptic will raise prices. The elimination of salicylic acid from grape juice benzoic acid from jellies and preserves and from two brands of catsup, boric acid from butter and meats and formaldehyde from milk has not effected the prices of these products in Kentucky. If it is true that the use of antiseptics effects the cost of production, then the consumer should derive

some financial benefit, by getting foods containing antiseptics at a reduced price, when they risk their health to consume such foods. It is claimed that to label a product that it contains an antiseptic will operate against the sale of such products. This is true, but the consumers, and the consumers only, have the right to determine whether or not they will eat foods containing antiseptics.

It is claimed that honest labels discriminate in favor of the genuine product. All products have the right to whatever discrimination the merit system of competition will impose.

Three purposes are contemplated in the enactment of food control laws. The protection of public health, the protection of the consumer against fraud and the protection of honest industry. If the adulteration of foods presented a hygenic problem only these laws would be easy to enforce. But the problem presents a commercial side; many interests are intrenched in the business of adulterating and false labeling, so much so that food commerce must be revolutionized before the principles of honest standards and truthful labels will be put into practical effect in the factory.

ANTISEPTICS AND ARTIFICIAL COLOR.

The flavor and color of a food product are intimately associated together, and wherever the natural color is an indication of the flavor or other qualities and genuiness of a food product it is a fraud to misrepresent by artificial color that such flavor and qualities exist. It is also a fraud to represent by synthetic or imitation flavors that a food product possesses qualities which it does not.

The wholesale preservation and distribution of food products present many problems which cannot be treated lightly, and for which the food interests are not altogether to blame. The gathering of the large fruit and vegetable crops and the storage of the pulps before they are finally

bottled or canned, the utilization of the by-products of the canning factory as a basis for imitation, the public demand for a food which will not "spoil," and the general business temptation to insure an investment in meats, milk, preserves, cider and grape juice against loss by spoilage present opportunities for the use of many antiseptics.

But the use of substances of a harmful character is not justified by the general need for some method of food preservation; nor by the fact that many consumers can not afford refrigerators and ice; nor by the fact that spoiled meats and decayed fruits are not wholesome; nor by the fact that the antiseptics used are used in minimal quantities.

On account of the conditions attending the storage of tomato pulp and the manufacture of tomato catsup this product needs the addition of some antiseptic like benzoic acid more than any other article of food, yet two firms are demonstrating in Kentucky that sweet catsup can be put upon the market free from any antiseptic. The food interests have sufficient unobjectionable methods to meet all demands for food preservation and the use of antiseptics is largely a matter of competition which the manufacturer will dispense with provided his rival is required to do likewise, as will be seen from the following letters:

(a) From the Chemical Laboratory of one of the Packing Houses, May 12, 1902:

"On returning from the South, I find that ———are in communication with your State on the subject of the use of color and boracic acid in sausages. Both of these articles have been so universally used and advertised so openly, that it seems as though they were used by the manufacture as a matter of course. In fact he was compelled to use them in order to make goods of the same keeping qualities and color as his competitor. You no doubt have known of this state of affiairs for some time. Of course it will be different for ———to compete with other manufacturers if your laws

are not strictly enforced. Goods containing a little boracic acid will keep fresh somewhat longer, and colored goods have a little brighter appearance than the uncolored. However there is no use discussing this subject for———have decided to manufacture these products without using either the color or boracic acid, and I think that you know the firm well enough to know that they will do as they say they will."

(b) From the member of the firm and the manufacturing manager of one of the largest catsup and fruit and vegetable manufactures:

April 12, 1905.

"I still believe that this whole controversy can be amicably settled between the food authorities and the manufacturers without any harsh measures; just as the United States Government has regulated the import of many articles of food, which for years past, have been adulterated and which now come into this country pure. If the food manufacturers would select their representatives and meet the representatives of the food authorities, ways and means can be devised by which this whole matter can be settled to the best interest of all.

I personally would favor the ruling out of all preservatives from a certain time, giving the manufacturer an opportunity to dispose of all stock, and holding the distributor and retailer immune for all stock he has on hand, and yet to be sold, then commence with the new era.

Each manufacturer will then know what he is up against, and all would have ample time to prepare themselves for the new conditions which will revolutionize methods of packing, and in most cases, change from a larger package to a smaller. * * * *

The putting up of catsup without a preservative in large bottles has not yet proven the success it was expected to be, but after the consumer once becomes educated to the fact that certain food products will have to be consumed

quickly, so as to keep them from spoiling, then matters will easily adjust themselves. On the other hand, if, after a trial of a few years without preservatives, it should become desirable or advisable to permit the restricted use of a preservatives in a few food products, then this might be permitted, provided the presence of the preservative, and the quantity of it be stated on the label.

I sincerely hope that a meeting can be arranged between the manufacturers and the food authorities for the purpose of getting at this matter in a thorough manner and decide before the meeting is adjourned definitely what is going to be done in the future.''

(c) From a Kentucky firm of fruit and vegetable manufacturers, replying to the resolutions on antiseptics and color adopted by the St. Louis conference of food control officials.

March 4, 1905.

''What we have to say, may or may not have any direct bearing, or relation, to ourselves as manufacturers of prepared food products and methods, for we are prepared to comply the requirements set forth in these resolutions whenever the market conditions, and the regulations of our competitors enable us to do so. We have for some time entertained the opinion that we will sooner or later be subject to restrictions and regulations as set forth in these resolutions. We have therefore not been idle, and we are now prepared to say that we can comply with these requirements, which will eventually be to our benefit and not to our detriment.

The injudicious, unintelligent and also unscrupulous manner in which such agents are employed is, without doubt, a menace to the health and welfare of the general public, not only because of the presence of antiseptics in excessive quantities, but also because of the character of the stuff it is made possible to purvey consumers. This we believe to be the best, in fact the real reason why the use of preservatives should be prohibited.''

The following resolutions on Antiseptics and Color are given to show the consensus of opinion regarding the use of these substances in foods:

The resolutions were adopted by the International Pure Food Congress and Eighth Annual Convention of the National Association of State Dairy and Food Departments, which was held in the Hall of Congresses, Louisiana Purchase Expostion, St. Louis, September 26 to October 1, 1904.

The meeting was composed of delegates from nine foreign governments; the State Dairy and Food Departments and Experiment Stations and State Boards of Health in the United States, charged with the inspection and analysis of foods and drinks and with the enforcement of food control laws; representatives from the United States Department of Agriculture, which is charged with the enforcement of federal food control laws; and representatives from the various food manufacturing interests.

Whereas, Certain food products have distinct natural colors which are regarded as indices of excellence and purity; therefore, be it resolved by this Congress:

1. That we deprecate the artificial coloring of food products to imitate the natural, distinctive tints referred to above, and urge upon food manufacturers the propriety of discontinuing the use of pigments of any kind for the purpose above mentioned.

2. That the manufacture of food products which are mixtures or compounds having no distinctive colors, which are used as candies, confections, ices, delicacies and desserts, and which are expected by the consumer to be colored or tinted, only such colors, preferably of vegetable origin, shall be used, which are determined by acknowledged authorities to be harmless; and the use of aniline, other coal-tar dyes mineral colors and synthetic colors of all kinds is regrettable.

Whereas, There are available unobjectionable methods of preserving foods, for example, limited cold storage, des-

sication, sterilization and the use of the long employed and condimental preserving agents, such as salt, sugar, vinegar and wood smoke; therefore, be it resolved:

1. That this Congress does not approve of the use of preservatives or antiseptics in the preservation of food other than those named.

2. That since a preservative or antiseptic other than those above named to be effective must destroy or paralyze all fermentative organisms, they induce a condition which must be more or less unfavorable to digestion, and they are therefore to this extent hurtful.

3. That the use of preservatives and antiseptics other than those above named in minimal quantities is not justification of their employment, since even in minimal quantities, where their use is long continued, they may become harmful.

4. That the use of preservatives and antiseptics other than those mentioned above must be, previous to their use, justified by the manufacturer, and no citizen should be required to ascertain for himself whether or not the food we consume contains an added preservative other than those mentioned above, and therefore when any other antiseptic or preservative is added to food, the name and amount thereof should plainly appear upon the label.

KENTUCKY

Agricultural Experiment Station

OF THE

State College of Kentucky.

BULLETIN No. 120.

---

1. SOME TREE- AND WOOD-INFESTING INSECTS.
2. CABBAGE SNAKES.

LEXINGTON, KENTUCKY.
May, 1905.

KENTUCKY
Agricultural Experiment Station.

BOARD OF CONTROL.

GEO. B. KINKEAD, Chairman, Lexington, Ky.
D. F. FRAZEE, Lexington, Ky.
C. B. NICHOLS, Lexington, Ky.
J. K. PATTERSON, President of the College.
M. A. SCOVELL, Director, Secretary.

STATION OFFICERS.

M. A. SCOVELL, Director and Chemist.
A. M. PETER, Chemist.
H. E. CURTIS, Chemist, Fertilizers.
H. GARMAN, Entomologist and Botanist.
J. N. HARPER, Agriculturist.
W. H. SCHERFFIUS, Chemist.
R. M. ALLEN, Secretary and Executive Officer, Food Division.
J. D. TURNER, Secretary to the Director.
J. O. LaBACH, Chemist, Food Division.
MISS M. L. DIDLAKE, Ass't Entomologist and Botanist.
S. D. AVERITT, Ass't Chemist.
O. M. SHEDD, Ass't Chemist.
G. N. KELLER, Ass't Entomologist and Botanist.

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. 120.

1. SOME TREE- AND WOOD-INFESTING INSECTS.

By H. Garman, Entomologist and Botanist of the Station.

THE ELM LEAF-BEETLE.

Galerucella luteola.

Since my account of this insect's appearance in Kentucky, printed in 1899 (Bul. 84, p. 65), was issued, it has gradually spread until it has occupied most of the eastern half of the State, and promises to extend its distribution throughout the interior of the United States, wherever English elms are grown. I have recently* received from Professor Burgess, Chief Inspector of Nurseries for Ohio, a letter informing me of an outbreak of the insect during the past summer at Dayton, Ohio. Within Kentucky it has been observed at Winchester, Danville, Harrodsburg, Lexington, Lawrenceburg, Springfield, Lebanon, Wakefield, Bardstown, Perryville and Bowling Green. At all of these places it has proved exceedingly destructive, in some cases destroying, and in others threatening with ruin, some of the finest elms in the State.

Too often the attacked trees have been utterly neglected, and the injury allowed to take its course, until it became evident that they would be destroyed if something were not done to prevent. Even then, absurd practices are sometimes adopted, including the ancient one of introducing sulphur into holes bored in the trunks, and the almost equally useless one of wrapping them with

*Written in 1904.

bands of cotton batting, with the object of preventing the insects ascending the trees. It is gratifying to report that some very effective spraying has been done too, and to Mr. R. F. Planta is due the credit of having devoted himself to the work of saving valuable elms in Marion and other counties, having at one time 500 trees in his charge.

The Use of Bands.

About cities, one often sees bands that have been secured about the trunks of elms with the object of keeping the insects away from the foliage. They are utterly useless for the purpose. The adult is the only condition of the elm leaf-beetle that goes to the leaves from the ground, or from other trees, and its ample wings enable it to get there by more direct routes than by crossing bands of any sort. I have sometimes observed them when confronted with an obstruction which they could not safely cross. unfold the wings and take to the air at once. But a habit of the immature insect may place it at our mercy. When a brood of the grubs is ready to assume the next stage, they descend the trunks of the trees and become yellow pupæ lying exposed on the ground immediately about the base of the tree. If, as was suggested years ago by Townend Glover, then Entomologist of the United States Department of Agriculture, some trap can be arranged about the trunk that will capture, and, at the same time, destroy these descending young, it will be a long step toward saving our English elms from injury. An opportunity to test this method of destroying the young was offered by an elm at the edge of Lexington that was attacked by the beetles last summer. When the last brood was coming down in late August and early September, all the pupæ and larvæ that had already accumulated at the base of the tree were gathered up and preserved. Partly by counting and partly by estimate, we found that these numbered about 9500. A band of sticky fly paper was then secured about the trunk, three feet from the ground, the unevenness of the bark being provided for by a layer of cotton batting behind the paper. The band remained on the tree seven days, and was removed on the sixth of September. The result was a little surprising. When

the grubs found the band across their path they generally tried it a time or two, but before getting caught, drew back, and finally went in behind the paper, sometimes pushing their way well into the cotton and changed to pupæ there. Some of the grubs were caught, but the number was not great, compared with those that changed behind the paper. While the band was on the tree, it was observed closely to see if adults would be caught. A few were maturing from pupæ that were concealed so as to escape us when the others were gathered from about the base of the tree. While their wings were still soft, they frequently ascended the trunk, as if with the object of reaching the leaves by that route. When they came to the band, however, they would after trying their fore feet on the sticky surface draw back, as did most of the larvæ from above, and thus escaped. Some, however, were so unwary as to become entangled, and remained there when the band was finally removed. From behind the band I took on September 6, 3596 beetles, as follows:

Larvæ, 1545; Pupæ, 2026; Imagos, 25.

Together with the beetles destroyed at the base of the tree, we thus secured 13096 beetles from this one tree. Not more than fifty beetles, larvæ and adults were captured on the sticky surface of the band. Flies, ants and other wandering insects were captured in some numbers, but it must finally be said that the band was a failure so far as destroying the insects is concerned, for they could just as well have been captured when gathered about the base of the tree.

The experiment has a value, however, as showing how completely the insect is at our mercy when it is changing to the pupa state, and in what large numbers it may then be destroyed. Supposing that half of the 13096 insects were females, that half of these survive the winter, then in the spring of 1905, about 3274 beetles would be ready to place eggs on the leaves of the tree. Supposing that each of these females laid 300 eggs, (They are believed to average about 600), then 982,200 eggs would be secured to the young leaves early in the spring. If half of these eggs produced females, we should have when the first brood of the sea-

son was mature, 491,100 females, which, if each laid 300 eggs, would produce 147,330,000 with which to start the second brood which develops each season.

It is a simple matter for any one whose trees are attacked to do just as effective work as we did, by using a little scalding water about the trees from time to time, during the summer, or a little coal oil. It might be supposed that poultry would devour the tender pupæ in large numbers, but chickens observed about the tree showed no disposition to feed upon them. It is possible that they are unwholesome, as other members of the same insect family are known to be. The only insects observed feeding on the young beetles were immature soldier bugs (*Podisus spinosus*), and an occasional young of one of the lace-wing flies. The praying mantis observed devouring the pupæ at Bardstown some years ago has not been observed among the beetles—is in fact not a common insect here.

Spraying.

When the insects are already at work on the leaves, the only way to reach them is by spraying with poisonous mixtures. Paris green being the commonly used arsenite for gnawing insects, is generally employed, one pound of the powder being stirred into 100 gallons of water, together with a pound of slaked lime, to check its caustic action on the leaves. Arsenate of lead may be used in almost any strength desired. Three or four pounds of this poison stirred into 100 gallons of water are common proportions. It will not burn foliage when used even as strong as six or eight pounds in this quantity of water. It may be secured of the Merrimac Chemical Co., 75-77 Broad street, Boston, Mass., and under the name "Disparene" is sold by the Bowker Insecticide Company, 43 Chatham street, Boston, Mass. It is put up in the form of a white paste resembling the white lead used by painters, but mixes readily with water, and besides its harmlessness to leaves, remains in suspension much better than Paris green.

The question of what pump is best suited for the work of spraying large trees comes up whenever any one is advised to spray his elm trees, and frequently proves a stumbling block in

the way of getting anything done to save trees. Even those who value their trees most highly fret a good deal about any outlay in dealing with the insect. I have known of trees worth hundreds of dollars when considered purely from a commercial point of view, that were allowed to be destroyed when the alternative was the expenditure of thirty-five or forty dollars to save them.

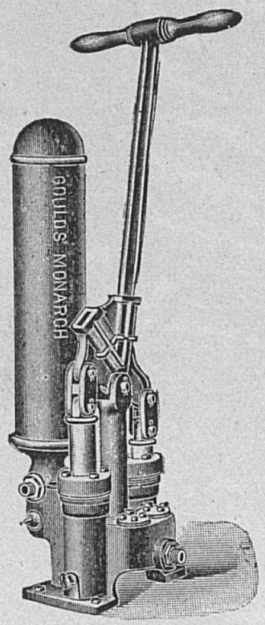


Fig. 1.—The Monarch Pump, made by the Goulds Company.

It should be said at the outset that it is not worth while to spray at all unless thorough work is done, and to do this it is necessary to secure a piece of long stout hose, ladders, and a strong pump. The smaller sizes of pumps, such as the Pomona, may be used on small elms, but are hardly strong enough for elms sixty to seventy-five feet high. The Bonanza Double-Acting Spray Pump, made by the Deming Company of Salem, Ohio, and the Monarch and Sentinel pumps made by the Goulds Company of Seneca Falls, New York, are of sufficient power to throw a spray to the topmost branches of tall trees, and pumps of this grade must be secured where much difficult spraying is called for. Dr. E. B. Southwick, of the Department of Public Parks, New York City, writes me that most of his spraying is done with a gasoline power sprayer. He uses, however, at times a hand sprayer, costing $35.00, made by J. H. Woodhouse & Company, 119 Water street, New York City, which he says is the best hand-pump sprayer of which he knows.

The Life-history of the Beetle.

The life-history of the elm leaf-beetle is given on pages 67 and 68 of our Bulletin 84, to which the reader who has an interest in this matter, is referred. Several broods develop each sum-

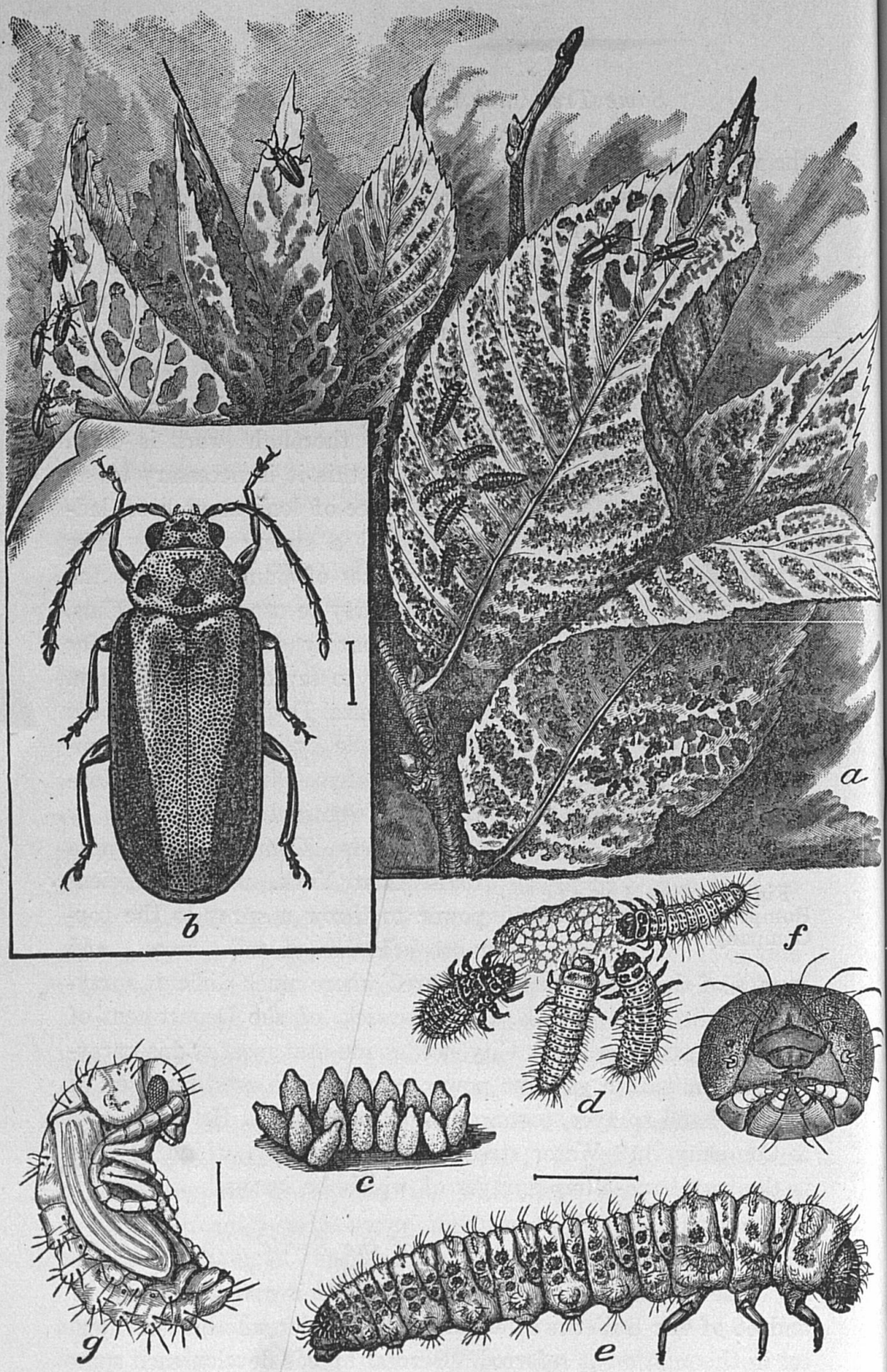


Fig. 2.—The Elm Leaf-beetle. *a*, showing nature of injury—natural size; *b*, adult beetle; *c*, cluster of eggs; *d* and *e*, larvæ; *f*, front view of head, fully grown larva; *g*, pupa—all magnified. From L. O. Howard, Bureau of Entomology, U. S. Dep. Agr.

mer, and by timing applications of sprays to the periods when females are placing their eggs for new broods the effectiveness of spraying may be increased.

AN INSECT INJURY TO OAK TREES IN BLUE-GRASS KENTUCKY.

The two oaks most common in Blue-grass Kentucky are the Bur-oak (*Quercus macrocarpa*) and the Chinquepin Oak (*Q. acuminata*), the latter sometimes also called Chestnut and Yellow Oak. Both are large when well grown, and are valuable trees on lawns and in woodland pastures. The Bur-oak receives its common name because of the large and heavily fringed cup of its acorn, and is the only oak we have that produces such an acorn. Its leaves are deeply lobed, the lobes rounded. The second oak produces a very small acorn, so little astringent and so sweet that boys frequently eat it. The cup is small, without fringe. As one of its common names implies, the leaves are like those of the chestnut tree,—lance-shaped and sharply toothed.

Both of these oaks suffer from the attacks of leaf miners, which work between the cuticles of the leaves. The Bur-oak is especially liable to attack, and is noticed at times with the greater part of its foliage embrowned by the injury. The mine is apparent only from the upper surface of the leaf, and appears to be the work of the little moth described by Clemens as *Lithocolletis hamadryadella.*

For a couple of seasons past a bark louse (*Kermes pubescens*) has been growing abundant on the twigs of these oaks, like the leaf miner showing a disposition to become destructive to the Bur-oak. In the latter part of July of last summer, I examined trees that showed dead tips of twigs and a general appearance of ill health that seemed to be due very largely to the large number of bark lice attached to the twigs, though some of the leaf miners were present also. See Figure 7 for this scale insect, represented of natural size and also magnified.

The insect is very different from the San Jose scale and

619257

from the maple tree bark louse. It is globular in shape, the body wall rather firm and smooth, the whole surface covered with a fine gray felt-like down. When this down is removed, the surface proves to be glossy, and the colors to be a marbling of yellowish brown and black, with some appearancce of cross banding. It looks very much like a minute marble of the sort styled "crockys" by boys. Its general resemblance to a twig gall is such that it would scarcely be taken for anything else by any one not an entomologist. There is no appearance of segmentation. Limbs and other appendages are entirely wanting. When removed from a twig the under side of the body is found to be a little hollowed out to fit it to the twig. Adults vary some in size. The following dimensions were taken from three examples measured:

(1) 0.16 x 0.12 x 0.12 inch.
(2) 0.13 x 0.12 x 0.10 inch.
(3) 0.13 x 0.12 x 0.12 inch.

In late June and early July from under the edges of these adults come myriads of red mite-like young, which move about on the twigs and finally settle down to grow and lead the sedentary life of their parents. Seen from above these young are elliptical in shape, being widest at the middle, a little more pointed behind than in front, where the margin is also slightly notched, and with two rather long slender hairs. An example measures 0.0074 x 0.0036 inch. The body is seen under the microscope to be provided with a double row of short conical teeth along each side, and with a single row on each side toward the middle of the back. Other similar teeth arise from the surface of the head. At this stage the body segments are plainly visible. The antennae are short and stout, composed of six divisions, the terminal one being a little more slender and longer than the rest, but terminating bluntly and bearing a couple of short hairs. The limbs are stout, each terminating in a single strong claw. The slender threads constituting its puncturing apparatus can be seen arising from the under side of the body.

In the fall of the year the twigs of oaks are still found to bear the bodies of the adults, but when examined they are found

to be dead and empty shells merely, which become detached by a touch. But under the edges of these shells may be seen many young lice recently hatched, and occasionally one will be found at some distance from an adult in a crevice about a bud. These young measure but little larger than those seen running about in the summer, but each bears a white cottony covering consisting of threads of wax. I take it these are the individuals that carry the insect through the winter, since they have been observed late in November.

The species was first described* in the Canadian Entomologist in 1898 (Vol. 30, p. 172), by Professor E. E. Bogue, of Kansas, who says it is there destructive to the Bur-oak and to *Q. prinoides* (the Shrubby Chinquepin Oak). King (Canadian Entomologist, Vol. 31, p. 139, 1899) says it is destructive to young white oaks at Lawrence, Andover and Methuen, Massachusetts, and in Psyche, Vol. 9, p. 80, adds the red oak to its list of food plants. The latest notice of the insect that has come to my knowledge is by J. G. Sanders in the Ohio University Bulletin, Ser. 8, No. 17, p. 37, where it is said to be abundant near Columbus on the Bur-oak.

Remedial Treatment.

The only treatment for such insects is one that most people will pronounce out of the question in the case of large oak trees. And it is undoubtedly difficult and costly to treat trees of large size by spraying. Where the trees are worth the labor and expense, however, this is the only remedy that can at present be employed with any assurance of doing good.

The lime-sulphur-salt wash applied in the winter or early spring would undoubtedly destroy most of the bark lice. Young trees can be treated very conveniently and cheaply. Any of the ordinary outfits used for fruit trees can be employed for this scale, though it is best to have pumps with working parts of iron, because of the corrosive action of the wash. For large forest

*Specimens, young and adult, are in the Station collection, collected by me at Lexington, June 29, 1892.

trees a powerful pump, such as the Bonanza Double Acting Spray Pump of the Deming Company of Salem, Ohio, or the Monarch or Sentinel Pumps, made by the Goulds Manufacturing Company of Seneca Falls, New York, is required, and will cost in the neighborhood of forty dollars. Extensive spraying of the sort calls for some sort of power pump, and a good one will cost four or five times as much as the hand pumps.

The leaf miner is in the leaves when these fall in October and November. (They have been taken as late as November 24.) So that raking up and burning these fallen leaves should reduce the injuries from this insect. The adult moths have been noted abroad from August 12 until September 3.

A small Hymenopterous parasite has been described under the name *Microterys cincticornis,* by Mr. Ashmead, and is probably the same as that noted here as sometimes attacking the bark-louse. The miner is also subject to parasites, and large numbers of the latter emerge from the mines at Lexington.

THE WALNUT WORM.

Datana integerrima.

In Kentucky black walnut trees are very badly injured by worms that devour the leaves in midsummer. The injury is so constant and severe that trees about dwellings are often removed to get rid of the annoyance from the presence of the worms when these descend for pupation, and from the refuse thrown upon walks and roofs by the worms when feeding among the branches . The insect will be recognized by most people when it is stated that it is the species that collects at times in large masses on the branches and trunks of the trees, somewhat as shown in Figure 8.

To check the injury the masses of worms should always be destroyed by the use of hot water or coal oil. When at work on the leaves it is only possible to reach them with sprays of Paris green or arsenate of lead such as are recommended for the elm leaf-beetle.

THE COTTONWOOD LEAF-BEETLE.

Lina scripta.

Young Carolina poplars growing in nurseries in Kentucky are often badly damaged by the gnawing of an insect much like the willow leaf-beetle described below in size and general character, but it appears to prefer poplars to willows, though sometimes found also on willow. Both insects occur throughout the central states, but the one now under consideration appears to be the more eastern in distribution.

This beetle measures from about 0.28 to 0.34 inch in length. It is brown, with black head, the thorax brown at the sides and with a black isolated dot in this area on each side, the disc black as in the related insect. The wing covers are notably different from those of the other beetle, being here marked with short lines and dots, instead of with dots alone, of black. These dots and lines occupy much the same position, however, as the dots on the wing covers of *L. lapponica,* two dots being near the base, two lines near the middle, and the remaining pair, consisting of a line and a dot, placed near the tip and with the line joining a narrow black sutural edging. Beneath, the body is black, with the bases of the femora and the middle region of the tibiæ red.

Both species do their mischief here early in the season, and then disappear from the nurseries. Whether or not other broods develop during the season in other situations has not been determined. As in the other species, the adults of *L. scripta* hibernate among dead leaves, grass and rubbish.

The same treatment is to be employed as for *L. lapponica,* namely spraying the attacked foliage with Paris green or arsenate of lead in water. In some experiments on this insect made at the New York (Geneva) Station some time ago, it was found that a green arsenite made by the Adler Chemical Company of New York City, worked rather better than Paris green because it is a much finer powder and remains in suspension much longer.

THE VAGABOND GALL-LOUSE.

Pemphigus vagabundus.

The peculiar growth described below as appearing on willows as the result of attacks of mites has not been observed on poplars, but a somewhat similar, though rather more symmetrical growth, is often seen in winter at the tips of twigs of the latter. It looks at first glance like a dried up leaf, but stands perfectly rigid. This growth is found on examination to be a flat-lobed gall that has grown on the twigs during the summer as a result of the attack of a plant louse that lives within. In winter the galls are blackish, and measure an inch or more across. The insect is shining, black, soft-bodied, with delicate membranous whitish wings expanding about one-half inch. It belongs to a gall-producing group of plant lice, distantly related with familiar species such as the rose aphis and corn plant louse. When it leaves the gall it wanders in an apparently aimless fashion, being found on a great variety of plants, a peculiarity that has suggested the common name. It is not common enough to excite alarm at present, and probably where it appears it will only be necessary to remove and burn the galls while the makers are still in them.

THE POPLAR LEAF-TYER.

Melalopha inclusa.

Carolina and Lombardy poplars, and also sometimes willows, when planted along streets and on lawns in Kentucky are badly marred by worms that appear among the leaves, which they draw together, singly, so as to make a nest, leaving openings by which they can go in and out, and then sow the petiole to the twig to keep it from becoming detached. In these swinging cases a half-dozen or more larvæ live together, and forage on the leaves near by. Generally they are not observed about the trees until August, but the adult moths emerge very early in the spring, March 18 and April 3, by my notes on rearings, and place eggs for an early spring brood that attracts no attention because of

the small number of individuals occurring at this time on the trees.

Adults of this brood lay their eggs on the leaves soon after the latter unfold, but my earliest record is dated June 4 (1891), when a cluster was found on the under side of a willow leaf. These eggs hatched the following night. On June 9 the young worms were one-half inch long, and in a note made at the time were described as of a yellowish green color, with relatively large black head, and black jointed legs, the body clothed with slender pale hairs. They feed gregariously at this stage, either on the upper or under surface of a leaf, spinning over themselves a light web of silk, which being unyielding causes the leaf as it grows to bend and its edges to come together, the case thus formed being made secure additional strands of silk, and the whole finally being closely lined so as to make a snug retreat and lodging place for the worms. At first, they eat away the green substance of the leaf, leaving only the veins and veinlets, but when well grown are compelled to forage on the leaves outside the case. The larvæ of this brood become grown about June 27th, and then change to reddish brown pupæ within the cases. Adults emerge about the middle of July, and soon place eggs for the second brood. In 1893 eggs were found on poplar July 19, and hatched during the night of July 29. Larvæ generally become abundant and their injuries noticeable from August 19 to August 26.

Pupæ have been secured on various dates between and including August 7 and September 8.

Adults have been secured on the dates, July 8, 15, and August 11. The last date may indicate either a third brood or represent belated individuals of the second. The winter is spent by the insect in the pupa stage.

Description.

Egg.—The eggs are of a beautiful pale lilac, or rose color, and are covered with a bloom that gives them under a magnifier the appearance of small grapes. They are smooth, subspherical,

being flattened on the attached side. They are placed in a single layer, either on the under, or upper, surface of a leaf, in clusters of from 115 to 134. They measure 0.02 inch in diameter.

Larva.—Young fresh from the egg are pale green, with large shining black head, and numerous black dots. The double black tubercles on the fourth and eleventh body divisions are barely visible. When about one week old and two-thirds of an inch long, the general color is pale yellow, this color being disposed in narrow stripes alternating with still narrower more or less broken brown lines. The head, the jointed legs, a pair of spots on the first body division, two series of dots along each side, the two double tubercles, and a tail plate are black. Beneath, the color is uniform greenish yellow. The whole body is clothed with soft whitish hairs.

When ready to pupate the larva measures about 1.12 inch in length. It is marked with black, as already described, and is characterized especially by four longitudinal lines of bright sulphur-yellow extending along the middle of the back. The stigmata are black. The double tubercles on the fourth and eleventh body divisions are conspicuous, as is the clothing of soft whitish hairs.

Pupa.—This is formed within the case. It is chestnut brown, smooth, shining, somewhat darker in front, about 0.50 inch long, with a greatest diameter of 0.18 inch. . The spiracles are large, elongate, the last, a mere line. At the tip of the abdomen is a slender spine, expanded at its extremity to form a minute anchor, a little hook extending outward on each side.

Imago.—The adult is a rather rare moth. It is small, obscurely colored, with a wing expanse in the male of 1.10 inch, the body being about 0.52 inch long, while the female is a trifle larger, measuring 1.16 inch from tip to tip of the expanded front wings, and with a length of body of about 0.56 inch. The color is dull drab, the front wings with a touch of rusty (ferruginous) near the tips and at the bases. Thorax in front with a large spot of chestnut. The front wings are oddly marked with narrow whitish lines, the most noticeable of which form a triangle

the base of which is on the front margin of the wing, the apex beyond the middle of the hind margin. Two series of small dusky dots follow the outer margin of the front wing. The hind wing is crossed by a wavy line that becomes angled near the front margin. The males differ from the females in having broader antennæ, and in being provided with a conspicuous fan-shaped fringe of hairs at the tip of the abdomen.

Enemies.

The case made by the larvæ makes a very comfortable house, swinging in the breezes, sheltering them from weather, and, perhaps, to some extent, from enemies; but as might be expected of a species, individuals of which live closely crowded together, it is subject to an epidemic disease that sometimes carries off most of the individuals of the second brood. It has some appearance of a bacterial disease, the recently dead worms being limp and discolored, while their fluids swarm with motile bacteria in doubles and of large size.

They are attacked also by a gray fly parasite (*Frontina frenchii*), which emerged from confined lots in some numbers.

Remedial Treatment.

When the trees are not large it is not a difficult matter to remove the rolled leaves by hand. Larger trees must be sprayed with Paris green, or arsenate of lead.

THE WILLOW LEAF-BEETLE.

Lina lapponica.

Willows growing on lawns and in the nursery in Kentucky are almost completely denuded of foliage in the early spring months by rather sluggish grubs that when young feed in company on the green substance so as to leave finally only a brown network of veins and veinlets. The injury is widespread in the State, though generally increasing in severity for a time, then waning until scarcely noticeable and remaining so for a succes-

sion of years. Few of our insects prove more troublesome than this one when once it has become abundant.

The adult of this species is a shining brown insect of the same family as the Colorado potato beetle and the Elm Leaf-beetle. It measures from 0.24 to 0.30 inch in length. The body is elongate oval, moderately convex above, smooth, shining, the wing covers closely, finely, punctured when seen under a magnifier. The head is black, and is received in the hollowed out thorax; the antennæ are short, thickened outwardly, black at base and tip, the intermediate joints pale. Thorax black centrally, with a wide brown or red border, a black dot on each side lying contiguous to the central black area. Wing covers brown (testaceous) to flesh color, pretty constantly marked with black as follows: Two spots at the base of each wing cover; two spots at the middle of each, and a couple of contorted ones, narrowly united, near the tip. Beneath, the body is black, the legs largely black, but showing red or brown on the middle of the tibiæ. The wings are ample, and the legs, though short, are used with some address, though when disturbed the beetles are disposed to draw them up to the body and let themselves drop to the ground. At Warsaw, April 27, 1901, they were found in large numbers on young nursery trees not yet leafed out, and as one passed among them they made a constant pattering on the dead leaves on the ground.

The beetles are always abroad during April in Kentucky beginning in the middle of the month. Larvæ have been found* at Lexington May 26, and pupæ on June 1. On June 17, 1901 adults began to emerge from pupæ kept in confinement at the Station, from which it appears that the early spring brood is about two weeks ahead of that developing at the latitude of Central Illinois, where according to Professor Forbes pupation began on July 1, and the first adults emerged on July 3.

The eggs are placed in clusters attached by their ends to the leaves. They are yellow, smooth and about 0.056 inch long.

***During forward seasons adults emerge here during the latter part of May.**

The grubs are variable in color with age, from yellow to blackish; have three rather strong pairs of jointed legs, and at the tip of the body are provided with an adhesive organ by means of which they can cling. When ready to become pupæ, the tip of the body is secured to the leaf, and after a time the skin is moulted and pushed down in a wrinkled blackish mass next the leaf, leaving the yellow and black pupa projecting. An alcoholic example of the pupa measures 0.26 inch in length. The wing pads extend downward close against the sides. The legs are held close against the breast.

Both larvæ and adults feed on the foliage, and can be destroyed by the use of sprays of Paris green, or of arsenate of lead. One pound of the former in 100 gallons of water is a good proportion, with enough freshly slaked lime added to make the whole milky in color. Of the arsenate of lead three pounds in 100 gallons may be used. The insects are little disturbed by birds owing probably to a powerful secretion, that can be recognized years after collecting, in alcoholic specimens.

THE WILLOW FLEA-BEETLE.

Crepidodera helxines.

A small oval, leaping, metallic green, blue, or bronzy, beetle, with pale brown antennæ and legs is common in early spring on willows and sometimes poplars and other trees, which it injures by gnawing round holes in the leaves. At times it becomes common enough to do severe injury, but generally its work on foliage is passed by unnoticed because of its insignificant character. Beetles were noted as exceptionally common in Lexington Aug. 6, 1889, and again May 1-10, and May 26, 1891. It was again observed in large numbers at Dickey's Mills, Edmonson county, in the latter part of June, 1896. The life-history of the insect is imperfectly known, beyond the fact that the adult lives through the winter. A specimen before me measures just 0.1 inch in length.

THE HERALD.

Scoliopteryx libatrix.

A green worm is rather common in late summer and fall among the leaves of willow trees in Kentucky, and while it never attracts general attention because of its injuries, frequently does enough to demonstrate its capacity in this direction should it at any time become sufficiently common. It produces a moth that is not uncommon at sirupy baits placed on the trunks of trees to attract night flying insects, and becomes especially common during the month of July. More than one brood is reared each season. The moths hibernate and are abroad in May, a brood of larvæ being ready for pupation by the last of the month, and yielding fresh moths by the middle of June. Larvæ have been taken also in October during which month adults commonly come out in numbers and conceal themselves for the winter.

A larva taken from willow October 1, 1898, was green, with a narrow black line along the upper part of the side, a reddish brown neck plate, and two ink-like blotches one on each side of the second and third body divisions. This larva began spinning a loose web for pupation October 3, and on October 4 had become a black pupa about 0.80 inch long and 0.24 inch in diameter. The surface is opaque and the abdomen tipped with several curved hooklets for clinging to the silken web.

Hibernation of the Adult in Caves.

This is the only moth known to me that habitually enters caves. This it does for hibernation, never, however, penetrating much beyond the penetration of light and being commonly found within the first twenty feet. Individuals have sometimes been found in the caves as early as the 12th of September, when larvæ were still present on the trees. They are found in the caves thereafter until spring, my latest date of capture being March 28. The situation chosen by these hibernating individuals is quite in keeping with the oddness of the moth. As far as observed they invariably cling to the walls overhead, where they are safe from pursuit by mice and other predatory cave inhabi-

tants. On one occasion the bodies of individuals were found studded with droplets of moisture.

The Herald is a fine, though odd-looking moth. The wings expand about 1.6 inch, the front margin of the front wings being nearly straight except at the extreme tip where it is rather abruptly bent. The outer margin is strongly angled and is toothed both before and behind the angle. The hind wings are of the ordinary shape. Color of the front wings, drab, with a dash of ferruginous extending out from the base upon the disc of the wing. A pale zig-zag line extends across the outer part of the wing nearly parallel with the toothed and angled outer margin. Within this is a pair of sinuous white lines extending across from the front to the hind margins. Still another white line crosses the wing between this pair and the base of the wing. Besides these lines, each wing is marked with a distinct point of white on the disc, and with another at the base. The hind wings are dull gray above, with a curved dusky line crossing the disc. Beneath, the front wings are dotted along the front margin with dusky, and show traces of the lines of the upper surface. The hind wing is dotted with black, is crossed by a median dusky line, upon and outside of which is a large blackish smudge. The thorax is ferruginous, the abdomen drab. The legs are flecked with white, the tarsi of the middle and hind pairs being largely white.

The moth is one of a few that appear to be indigenous both in America and in Europe.

THE WILLOW SLUG.

Pteronus ventralis.

A black, slimy worm frequently appears on willows in Kentucky, and occasionally is found on poplar, both of which may be pretty completely denuded of foliage by it when it becomes extremely common. It is to be recognized among the willow and poplar frequenting insects by its dark color, and a row of eleven bright yellow spots along each side of the body. The hind part

of the body is kept bent in a fashion peculiar to certain members of the saw-fly family to which this insect belongs. It is provided with six pairs of blue fleshy legs and a seventh pair of smaller ones is situated at the hind end of its body. The three well developed pairs of jointed legs are uniformly dark in color like the head and body. When first hatched it is pale in color, but assumes the characteristic dark hue on moulting its skin. When fully grown it measures 0.72 to 0.80 inch in length. Several broods appear each season.

The fly which lays the eggs from which this slug hatches appears about willows at Lexington very early in spring, and the slugs may be seen in large numbers on shrubby willows about the city reservoir in April and May. The very small greenish eggs are inserted by the female fly in slits which she makes with her ovipositor in the under side of the leaves. These cause the upper surface of the leaves to become roughened with little mounds, each indicating the position of an egg. The fly has four rather large thin membranous wings, hyaline, but slightly smoky tinted, the veins blackish. At the front margin at about the beginning of the outer third of the front wing, is an elongate blackish region known as the stigma. Specimens in the collection measure about 0.28 inch in length of body, are blackish in general hue, marked above on the segments with yellow, the body beneath largely yellow or green.

The insect is a near relative of the rose slug of our gardens but fortunately for our willows is not so generally distributed.

Like the rose slug it may be destroyed by spraying infested plants with powedered white hellebore in water, or by the use in the same way of Paris green and freshly slaked lime.

AN UNDESCRIBED WILLOW PHYTOPTOCECIDIUM.

All through the winter, willows near Lexington growing at the edges of ponds and streams bear grayish black growths of irregular shape at the tips of the twigs and for some distance below. Trees that have been cut back and have subsequently

made a succulent growth are sometimes thickly covered with the growth. The galls consist seemingly of abnormally developed leaves and twigs, all contracted as a result of the attacks of microscopic four-legged mites of the genus Phytoptus into an ill-looking shapeless mass two or three inches long by one or one and a half in diameter. In some cases the growths are scattered in knotty masses along the twigs for a distance of eight or ten inches, though the chief mass is generally at the tip.

In April and May as the leaves unfold these abnormal growths may be seen as grayish green masses of retarded and contorted leaves, thickly covered with whitish pubescence, in the midst of which the mites and their eggs are to be found in large numbers. The mites are members of the genus Phytoptus, as restricted by Nalepa, the body being long cylindrical and finely transversely lined.

Treatment for such injuries must be by the use of oils or other materials that kill insects by contact. Applications of coal oil emulsion are to be recommended for this mite. Sulphur has proved so excellent a material for mite injuries in my experience that I am persuaded to suggest that cutting away in winter all evidently affected twigs and giving the remainder a thorough spraying with the lime-sulphur-salt wash used for fruit trees, is calculated to reduce the injury.

THE APPLE TREE MEASURING WORM.

Ennomos subsignaria.

This insect was noticed in Bulletin 116 of this Experiment Station as an enemy of apple trees. It is a serious enemy also of forest and shade trees, notably to elm, but apparently when exceptionally abundant feeding freely upon any of our deciduous fruit and shade trees. At the time the notice of the injury to apple in Kentucky was written no specimens of eggs or larvæ were at hand for description. Both were secured this spring, and the following observations are drawn from fresh material.

Eggs received from Muhlenberg County March 29, had been

placed by the moth in clumps and straggling lengthened patches on the under sides of twigs. They were not arranged symmetrically, though an appearance of curved lines could be made out in places, running across the patches. The largest patch was 1.33 inch long, by about 0.18 inch wide. Another shorter patch measured 0.60 inch long and 0.20 inch wide. Eggs are pouch-shaped, being regularly rounded at the end applied to the bark, the free end rather squarely cut off and with a transverse elliptical area enclosed by a narrow white rim. This enclosed lid is dark in hue, the rest of the shell, greenish olive. They are somewhat flattened, measuring in length, 0.04, in greater diameter, 0.03, and in lesser diameter, 0.02 inch. When isolated they are generally attached by one side of the rounded end, but when crowded stand more erect, and overlap each other. Freshly laid eggs are pale olive-green, with a whitish elliptical line about the free extremity.

They began to hatch April 7, coming out very rapidly, and were all out by the 9th of the month. The minute worms are at first very slender, with rather large head, the presence of only two pairs of fleshy grasping feet at the extreme hind end of the body making necessary the looping motion which gives them their common name. They come out of the egg through the elliptical region mentioned above, and creep about freely at once, spinning a silken thread as they go. When at rest they stand up at an angle, sometimes almost erect, and remain in this position for long periods. The color is green in general, darkest on the back and belly, the head, jointed legs, fleshy legs and a line along the lower part of the sides yellow. If they chance to lose their hold on a leaf, they swing by a silken thread and soon regain their position on the leaf again. When prospecting they sway the body about in an odd fashion, grasping the leaf or twig firmly in the meantime with the claspers at the rear end of the body.

By the 24th of the month the largest larvæ measured just about one inch in length and had changed their hue to one that on casual examination appeared jet black, but really contained

some greenish. The head at this stage is bright reddish brown, as are also in the main, the jointed legs, the tip of the body and the false feet; the neck plate is slightly reddish medially. The anterior false foot is black, with a red spot outside. The posterior false foot is red with a stripe of black outside. Body beneath, between the false legs, greenish. Spiracles pale, the anterior and posterior pairs largest. Clypeus with a white spot, false feet white-tipped; jointed legs, dusky-tipped. Looked at closely these black individuals show a pair of minute pure white specks on the back for each body division. By this time the body is so heavy that the insects hang from beneath the leaves commonly instead of standing erect.

It appears that they are never so incautious as to neglect provision against accidents, and close looking with a magnifier will reveal running from the mouth of each one of the motionless worms, a halter of silk which extends in a direct course to the leaf. The insect can let go its hold on the leaf with its false feet at any moment to escape enemies, trusting to its halter for getting back into the tree when danger is past. Larvæ that have been thus dislodged, climb up again by a sort of hand over hand method, using first the jointed legs for grasping the thread above the head, bending the body around for the purpose, then reaching up and taking hold with the mouth-parts. When disturbed by one another they jerk the head and front part of the body from side to side vigorously, the meaning of which is plainly what we sometimes express by the words, "clear out," or "vamose."

Larvæ just ready to pupate measure 1.75 inch long, and show three pairs of small tubercles on the back, the hindmost being conical and a little larger than the others. At this stage there is an evident reddening of the body, especially the posterior third, while two series of minute yellowish dots appear on the back of some examples just behind the jointed legs, while two others appear above the false legs at the hind end of the body. The first larva to pupate began to fold up a leaf for the purpose, May 1, and the first pupa to be disclosed appeared on May 4,

the period spent in the larva stage being thus 25 days. Adults began to come from these pupæ May 13, giving a period of 9 days spent as a pupa. Eggs were laid on the sides and cover of the jar confining them on May 16.

The injuries of this insect can be dealt with readily enough by using a spray consisting of three pounds of arsenate of lead in fifty gallons of water, or by employing the better known Paris green as for codling moth or canker worm.

AN INSECT INJURY TO CASKS.

In 1897, I received from Warren County, Kentucky, complaints of an injury to vinegar barrels that was so annoying from causing barrels to leak, that it deterred many farmers from utilizing their surplus apples for vinegar. The wood was perforated by small holes, most numerous along the hoops, but occurring also along joints between staves, more rarely in the midst of staves and at the margin of the barrel heads. Thousands of dollars worth of apples were reported as being allowed to rot on ground under the trees because of the discouragement caused by the attacks. One of the vinegar makers most extensively engaged in the business, told me he was accustomed to go over his barrels every day, to plug up holes made by the insects, but that with the closest watching, the great number of beetles appearing, and their small size made it impossible to avoid all loss.

The insects concerned in the injury were two small beetles belonging to the family Scolytidæ,—*Monarthrum fasciatum* and *M. mali,* the former being much the more abundant, outnumbering the latter as ten to one. As far as could be learned, the adult alone was concerned in the mischief, the young of the two beetles being reared elsewhere. The beetles cut small round burrows with blackened walls, working from the outside and following a tolerably direct course to the interior of the barrels. When near a joint between two staves they sometimes cross from one stave to the other before reaching the interior.

Recently a complaint reached the Station from the Lexing-

ton Brewing Company of the same injury to beer kegs, and upon examination in November, 1904, the two beetles were found in the burrows. Mr. John Gund, Jr., President of the Company, states that the injury at the brewery, occurs when the casks are left for any time in the yard. Shipments to Richmond, Kentucky, and other points in the State have suffered injury, from which it appears that the insects are numerous and widely distributed in Kentucky.

This injury is not a new one. It has been known for many years in eastern countries, though there due to other beetles of the family. In the American Entomologist for 1869, Vol. 2, p. 207, is a reference to *Tomicus monographus,* said to do this mischief to casks containing malt liquors in India. The number of holes made in a stave is said to reach a million in some cases, a circumstance indicating that the trouble is more serious even than in this country. Dr. A. S. Packard, in his "Guide to the Study of Insects," 1869, states that a Mr. Huntington, of Kelly's Island, found wine casks rendered useless by the burrows of an American species described by Dr. Fitch, under the name *Tomicus materarius* (now *Gnathotrichus materarius*), but very probably due to the attacks of one or both of the insects injuring casks in Kentucky.

The Beetles Doing the Mischief in Kentucky.

The small size of the beetles makes it difficult to describe them in such a way as to give a very definite idea of them to one not provided with a magnifying glass. The injury, however, is characteristic, and in this country most or all of the mischief will probably be found to be the work of the beetles named above.

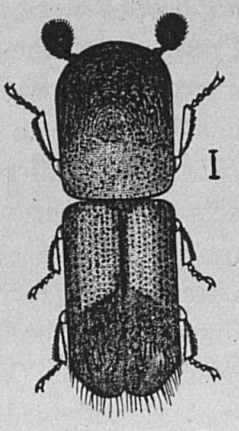


Fig. 3.—Adult of Banded Cask beetle. Enlarged. From Hubbard, by courtesy of F. L. Washburn

The Banded Cask Beetle (*M. fasciatum*) is cylindrical in general shape, and measures from 0.10 to 0.12 inch in length, with a diameter of about 0.04 inch. Its surface is glossy, slightly roughened on the front of the thorax. The head is received in a hood-shaped forward-projecting portion of the thorax. The wing covers are faintly lined with a series of pits, while the tips are excavated obliquely, the surface of the excavated portion with two obscure tubercles, while along the margin of this region are placed rather large yellowish hairs. The general color is brownish yellow, the front and rear of the thorax slightly reddish (ferruginous), the middle portion darker, this region being in some examples almost banded with black. Wing covers with a conspicuous, though not well limited black region at the tips, with a narrow line extending forward from it along the suture to a triangular dusky region enclosing the scutellum at the bases of the wing covers.

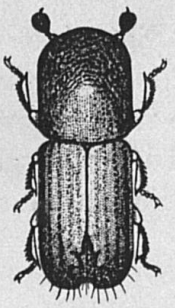


Fig. 4.—Adult of Lesser Cask beetle. Enlarged. From Hubbard, by courtesy of F. L. Washburn.

The Lesser Cask Beetle (*M. mali*) is ochery in color, as seen without a lens, the thorax being uniformly so, while the wing covers show only a slight duskiness at the tips. Specimens in my possession measure about 0.09 inch long by about 0.03 inch in diameter. The antennæ of both species bear knobbed tips. The excavated region at the tips of the wing covers is not noticeably hairy at the margin, and bears two tubercles on each side.

Habits and Food Plants.

The two insects appear to be quite constantly associated, and are sometimes, it is said, found in burrows with a common opening, one or other of them having saved itself labor by making use in part of the excavating done by its relative.

Both insects attack a rather wide range of woody plants. Dr. A. D. Hopkins, who has made a special study of beetles of the family, gives the following trees as attacked by *M. fasciatum*: pine, white oak, black oak, basswood, beech, and hemlock It is known to attack also apple, orange and hickory.

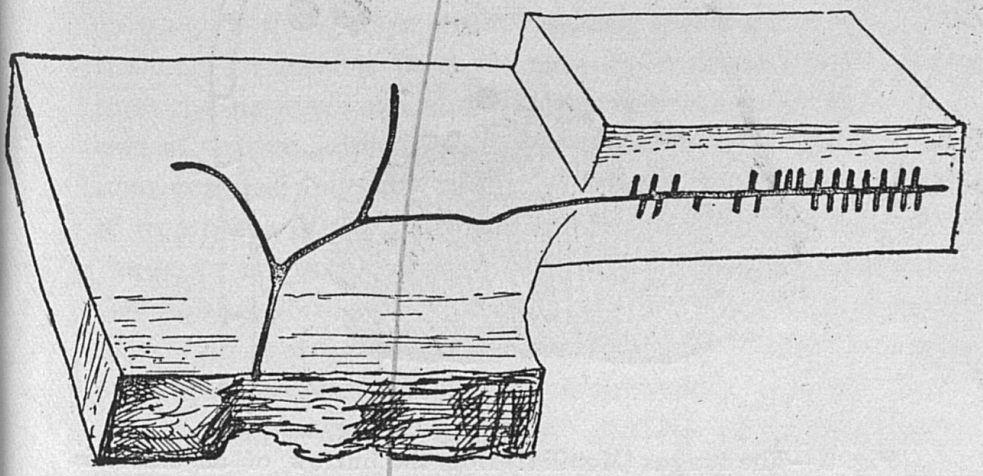


Fig. 5.—Burrow made by the lesser cask-beetle, showing galleries in which young are reared. From Hubbard, by courtesy of F. L. Washburn.

The smaller beetle, *M. mali,* was originally discovered on apple by Dr. Fitch, and was reported by him to injure this tree badly by perforating the trunk so as to cause it to die suddenly, as if from blight. He writes: "I only know this insect from specimens recently sent me from Middlefield, Mass., by Lawrence Smith, Esq., who writes me that he took them July 6th, from the bark of an apple tree ten inches in diameter, which was numerously punctured from the surface of the ground to where the limbs commenced branching off, above which no traces of them were to be found. In another letter he states that this

insect was first noticed in his neighborhood, two years ago, when several nursery trees were riddled by them. Nothing was seen of them last year; but they have reappeared the spring of the present year (1857) in greater abundance, and a number of trees have been ruined by them." This species is known to injure a large number of trees besides apple. Among them the following have been recorded: red oak, white oak, black oak, red cedar, tulip poplar (*Liriodendron tulipifera*), beech and chestnut.

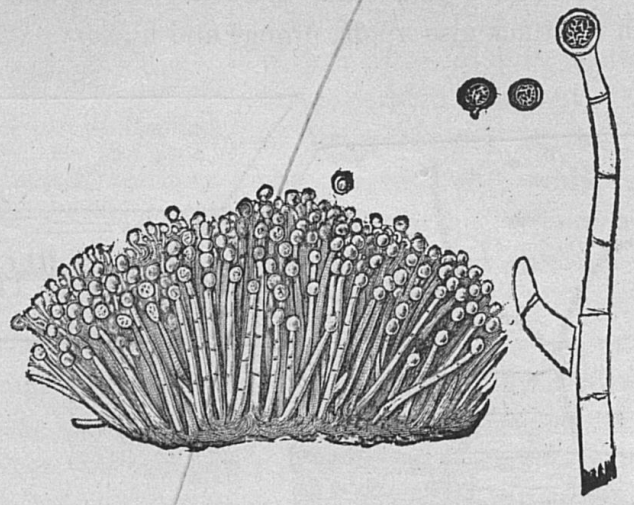


Fig. 6.—The fungus (Monilia?) from the burrow of an ambrosia beetle. From Hubbard, by courtesy of F. L. Washburn.

These insects do not feed upon wood, but bore into it to rear their young, and to make a suitable place for the growth of a mold-like fungus, upon which they are dependent for food. Because of this food habit they have been called, "Ambrosia beetles." It seems not to have been definitely decided whether or not this fungus is the same for all ambrosia beetles, but as far as is known to me, only one species of fungus has thus far been identified from the burrows, namely, *Monilia candida,* which is a near relative of the rot fungus of peaches and plums. It seems to be the fungus that renders the walls of the burrows black. The burrows of some other wood-mining beetles are not so stained.

In the tree trunks where the young are reared the burrows pass through the bark and penetrate deeply into the wood. Here little galleries are constructed on two sides, parallel with the grain, in each gallery an egg being placed and a young beetle reared. The immature insect as well as the adult feeds on the fungus.

Remedial Treatment.

Seeing that the beetles penetrate the barrels in the expectation of finding a suitable place to secure the growth of their food, and possibly to rear their young, and since the fungus upon which both are dependent is quickly destroyed by fungicides, it should be possible to impregnate the wood of barrels so that these insects would not mine it. It may be suggested that a solution of copper sulphate would do this beyond a doubt, though some practical difficulty might arise, such as its corrosive action or iron hoops that would bar it for the purpose.* In the form of Bordeaux mixture, I have found it very effective in preventing the rotting of the underground parts of posts. The lime-sulphur wash used for fruit trees seems to me even more promising, and should do no harm to casks of any sort.

Bisulphite of lime has been used for the purpose, and is claimed to be effective in preventing injury. Any treatment that will prevent the growth of the fungus should prove a complete remedy.

In an article before me written by Mr. Walter W. Froggatt, Government Entomologist of New South Wales, it is stated that scalding** attacked casks with boiling water, then plugging the holes and lime washing the outside, is the only remedy discovered

*I have recently had an opportunity to treat several casks, but at this season of the year the beetles are not active, and a demonstration of the effectiveness of the preparations used will not be forthcoming until next year. The hoops were coated with asphaltum to prevent the corrosive action of one of the preparations used.

**This treatment would not be practicable for beer kegs, however, because of its effect on the coating of pitch with which they are lined.

for the species (*Xyleborus perforans*) which mines casks of beer stored for the use of British soldiers in India. In New South Wales the injury is the work of a species (*Bostrychus cylindricus*) much larger than ours, measuring according to Mr. Froggatt, one-third of an inch in length.

The American beetles appear not to attack casks kept in a dark place. This has been the experience of both brewers and vinegar makers. One of the latter, Mr. J. C. Alexander, of Warren county, wrote me recently that he had suffered no injury since he adopted the plan of storing all his casks in a dark room. Some years ago he secured at Clarksville, Tennessee, one hundred whisky barrels that were stored in an open shed. They appeared to be a splendid lot of barrels, he says, but on examination it proved that the beetles had been working on them, and, to use his words, "They were not worth a cent." This experience illustrates a condition under which the injury is likely to be severe, and points to a simple remedy, namely constructing storage houses with shutters that will exclude the light. Where casks must be exposed, I have no doubt further experimenting will show that they can be protected by some wash such as those already proposed.

THE SEVENTEEN YEAR LOCUST WILL NOT APPEAR IN KENTUCKY THIS YEAR.

The appearance in print recently of a statement to the effect that the writer predicts the coming of a brood of 17-year locusts in Kentucky and certain other states this year leads me to reproduce here some facts from our bulletin No. 107, published in 1903.

Brood VIII. of the locust, or rather cicada, for it is not a true locust, is, according to records gathered at the United States Department of Agriculture, due in 1906 in the following Kentucky counties:

Adair, Allen, Bath, Boyd, Bourbon, Breckinridge, Carter, Casey, Clark, Clinton, Cumberland, Estill, Fayette, Fleming,

Franklin, Greenup, Jackson, Jefferson, Laurel, Lewis, McLean, Madison, Mason, Metcalf, Montgomery, Owsley, Powell, Pulaski, Rockcastle, Russell, Shelby, Trimble, Wayne.

It is also by the same records due in the following states:

Georgia, Illinois, Indiana, Kentucky, Maryland, Massachusetts, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, West Virginia.

Brood XVII., a thirteen-year variety or species of cicada, will by the records appear in 1907 in the following Kentucky counties:

Carlisle, Graves, McCracken, Marshall.

This brood is southern in general distribution, and its shortened life period is thought to be due to the accelerating influence of the relatively high mean temperature of its habitat. It is believed to be an offshoot of the insects with a 17-year period. It will occur in 1907 in the following states:

Alabama, Arkansas, Georgia, Illinois (southern), Indian Territory, Iowa (southern), Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia.

A word or two may be added concerning the reliability of these records. They were gathered with the greatest care by men who knew their subject thoroughly. The writer has had but one opportunity to test their accuracy, and found them as close to the truth as could reasonably be expected. He has confidence in their general correctness.

The injury done by the cicadas consists first, in sucking the sap from the roots of forest and fruit trees during the long period (12 or 16 years) spent in the soil; second, in sucking sap from twigs after becoming adult; and third, in puncturing twigs for the purpose of depositing the eggs, thus causing them to split and die. This last injury is sometimes severe, but on the whole the periodical cicadas are not to be ranked with the Kansas grass-hopper, and a number of other insects well known to the farmers of this country. As time goes on and forest trees become less numerous, these insects are becoming less and less common,

and we may suppose will eventually disappear completely from the earth.

By the records they are not due in Kentucky this year.

BROWN JUNE-BUGS INJURING FOREST TREES.

For several years forest trees in woodland pastures of Blue-grass Kentucky have suffered severely from an injury by these beetles that promises if continued to destroy many of them. Some have already succumbed as a result of the attacks coupled with trying weather. The mischief has been worse, perhaps, in the vicinity of Winchester than elsewhere, and on a recent visit to this place, numerous trees were seen that had but little foliage on the upper branches, while that on the lower ones was very ragged from the gnawing of the insects. Hickory and bur-oak appear to be favorites with the beetles. Walnut is often so denuded that bunches of mistletoe growing on its branches are as plainly visible as they are in mid-winter. Under the injured trees are to be found at the present time two species of the brown beetles, the commoner of which proves to the *Lachnosterna hirticula* of the books. These beetles come up from the soil at night, to feed, flying with a humming noise, and descend again to hide in the soil and under stones during the day. The young are the stout white grubs known to every farmer, and live among the roots of grasses in pastures and meadows, where they do constant, though not commonly a visible, injury. It is because of this habit of living among grasses when immature, that corn and other cultivated crops grown on sodland is likely to be badly injured by the grubs. Young trees in the nursery, also, sometimes have their roots eaten off by them. Strawberry plants are especially subject to injury by the young of brown June-bugs. They live in the soil for two years, and land that has been cultivated longer than this is therefore not likely to be badly infested.

The abundance of the beetles is the result of the prevalence of pasture-land in this region, and so long as grazing is the chief

industry of this part of the State the beetles are likely to prove common and locally troublesome. It may be suggested that the general cultivation of the soil of a neighborhood would lessen the evil.

2. CABBAGE SNAKES.

By H. Garman, Entomologist and Botanist of the Station.

Rumors concerning illnesses due to the eating of cabbage, have become so common of late that it may be worth while to state what facts have come to my knowledge concerning the matter during the fall and winter of 1904-1905. At the outset it may be said that there is no true snake that infests cabbage at any time. But cabbage is infested and more or less injured by a number of insects in Kentucky, twenty-five of which are mentioned and briefly described in our Station Bulletin 114. They are all true insects, however, and are not known to be in any way poisonous to man, though of course one does not care to eat such things. Birds feed freely on most of them when they can get them, which is good evidence that they are not poisonous. But none of these insects is the real "cabbage snake" of popular account. The name seems to have been first applied to a long slender worm, a species of Mermis, known to be a parasite within the bodies of a number of different insect species, and so probably left about cabbage heads by some one of the twenty-five and more cabbage insects. It is their habit to escape from the bodies of insects in the fall of the year when cabbage is rapidly heading up, and shortly before it is cut, so that it is not difficult to account for the presence of this worm about cabbage. Its disposition once free from its host is to work downward and conceal itself in some safe place for the winter, and it appears to be this instinct that leads it to work in among the leaves, until well down in the heads of cabbage. A specimen in my possession measures eight inches in length, and is only one-fiftieth inch in diameter. These worms are white, cylindrical, and show no trace of the ordinary organs for locomotion, or of sense. They are capable of a rather slow wriggling motion, and have no mouth

parts, stings, or other apparatus, by which they can inflict a wound upon anything, even upon the insects upon which they are parasitic. It is not known definitely how they get into the bodies of insects, but they have been observed to hatch from minute eggs in water, and are so very small that they might easily be taken with food, or find their way into the body by way of the breathing pores. They are not restricted to insects that frequent cabbage, but attack the apple worm, and have been found in the center of an apple. Recently in examining some insects received from the Philippine Islands, I noted a preying mantis, an insect belonging to the same order as the common grass-hoppers, with one of these parasitic worms coiled within its body. They are more or less common every year, and occur throughout the country.

As far as we know the hair worms of the genus Mermis are not in any stage of their development parasitic within the bodies of human beings. A dark-hued, firm-bodied species of Gordius, frequently found in water, is believed to pass a part of its life within the alimentary canals of fishes, which probably receive it by eating insects. In 1850, Dr. Joseph Leidy of Philadelphia, described one of these worms under the name *Filaria hominis oris,* as having been taken from the mouth of a child, and questions if it be not the young of the Guinea worm (*F. mendinensis*), a well known parasite of negroes which was in slave times sometimes brought to this country. This species reaches a length of several yards, and Dr. Leidy suggests that its presence in the bodies of Africans may be the result of the insect eating habit, natives of Egypt and Arabia being known to feed upon locusts, (grasshoppers), insects specially subject to these worms, while Guinea negroes are known to eat certain beetles raw. The late C. V. Riley found, years ago, a hair worm in the hind part of the brain of an owl, which he described as very similar to that found in apples. Professor Wyman of Boston, discovered a species coiled on the cerebellum of the Florida snake-bird in 1868, two to eight on the brain of one bird, and named it *Filaria anhingae.* It has been suggested that the species found in the

mouth of a child may have been obtained from an apple, in which case it was probably not a Filaria, but a Mermis, and would perhaps have done no harm.

From these facts it appears that hair worms of the genus Filaria sometimes inhabit the human body and also that of other vertebrate animals. They suggest a possibility of introducing the Mermis of cabbage with the uncooked vegetable into the alimentary canal, and giving it thus access to the tissues of the body. Leidy estimated that a single worm produces 6,624,800 eggs, so that if the young worms could maintain themselves against the digestive juices, they might create disturbances that would seriously affect the health. But it must be added that no member of this genus has ever been found established within the tissues of man.

People who have read of the cabbage snake sometimes search their cabbage before eating it with the result that the hair worm mentioned and several other animals are found. We have had sent to the Station, "cabbage snakes" representing two animal subkingdoms, two separate orders of one of them being represented by specimens, and two classes in the other. Five distinct species in all have been received.

One of the most commonly received snakes is a thousand-legs, known in works on entomology as *Geophilus bipuncticeps*. It is a blind earth-inhabiting animal, of a pale yellow color, measuring in some cases nearly two inches long (1.96 inch, precisely), and only about 0.06 inch in diameter. Its most striking feature of structure is the great number of parts or segments into which the long slender body is divided, and the numerous legs possessed by it, most of the body divisions being provided with a pair. This thousand-legs is a member of the class Myriapoda, differing from true insects not only in the large number of legs, but also in never undergoing any of the marked changes in form and habit, characteristic of true insects. After hatching from the egg, it is myriapod always, and does not change its food-habit, nor acquire wings. Thousand-legs of the group to which this one belongs live in soil. They are very frequently

thrown up when one is working about flower beds, or in gardens, in spring. From its soil-inhabiting habit it is very likely to make its way among the leaves of cabbage that has been buried in the earth, and it is from such cabbage that it has always been secured in the cases with which I am familiar.

Now this thousand-legs is a member of the same group as the centipede of the south and west, but it is a very small animal, provided with sharp jaws it is true, with which it no doubt destroys such insects as it can master, but it can not inflict a wound of any consequence upon man, and the writer has been accustomed for years to handle living specimens, and has never known them even to attempt to use the jaws. They are certainly harmless to man, and moreover, are so easily seen, that there is no danger of serving them with cabbage. *Linotaenia chionophila,* of the books, is a very similar but smaller species with only forty-three pairs of legs, (The larger one has sixty-three pairs.) of which a specimen has recently been sent me from Mt. Olivet, Kentucky.

Columbia, Ky., contributes the grub or larva of a small fly as its idea of a "cabbage-snake." The single example sent me measures just 0.38 inch long and 0.04 inch in diameter. It has no legs, and in the preservative is pure white, though probably somewhat translucent when alive. It is not calculated to be hurtful to man.

The fifth species is an earthworm about 0.60 inch long, of which several specimens were sent to the Station from Sacramento, Ky., in the latter part of October, 1904.

All of these animals have been found about cabbage ever since it was grown here, and so far as can be determined the occasion for the stories of illness coming from "cabbage-snakes" is a sensational notice of a case, the nature of which was not well understood, and upon which some one exercised his imagination.

Figure 10 represents two of the commonest cabbage snakes.

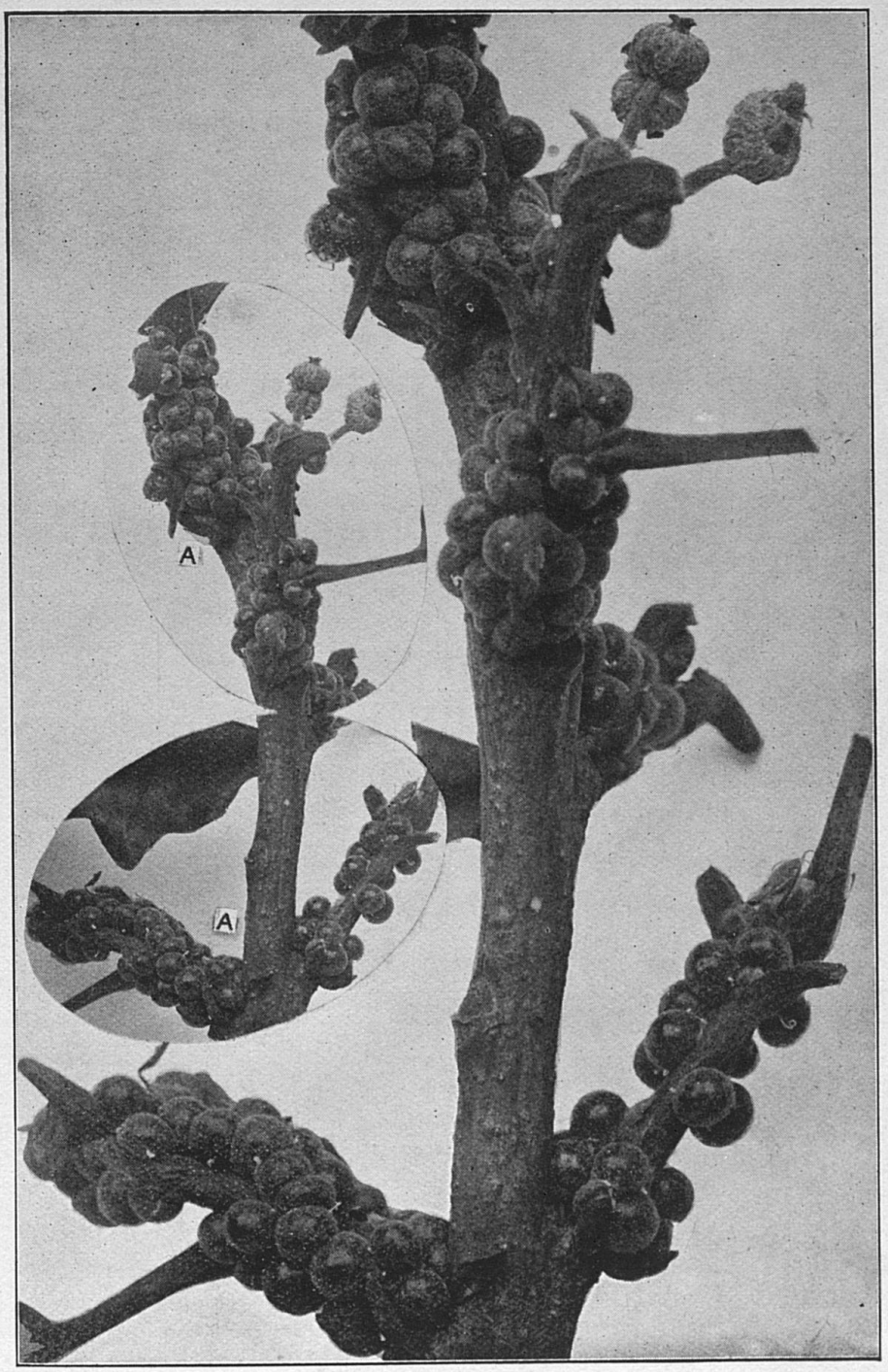


Fig. 7.—The Oak Bark-louse (*Kermes pubescens*). *A*, *A*, natural size.

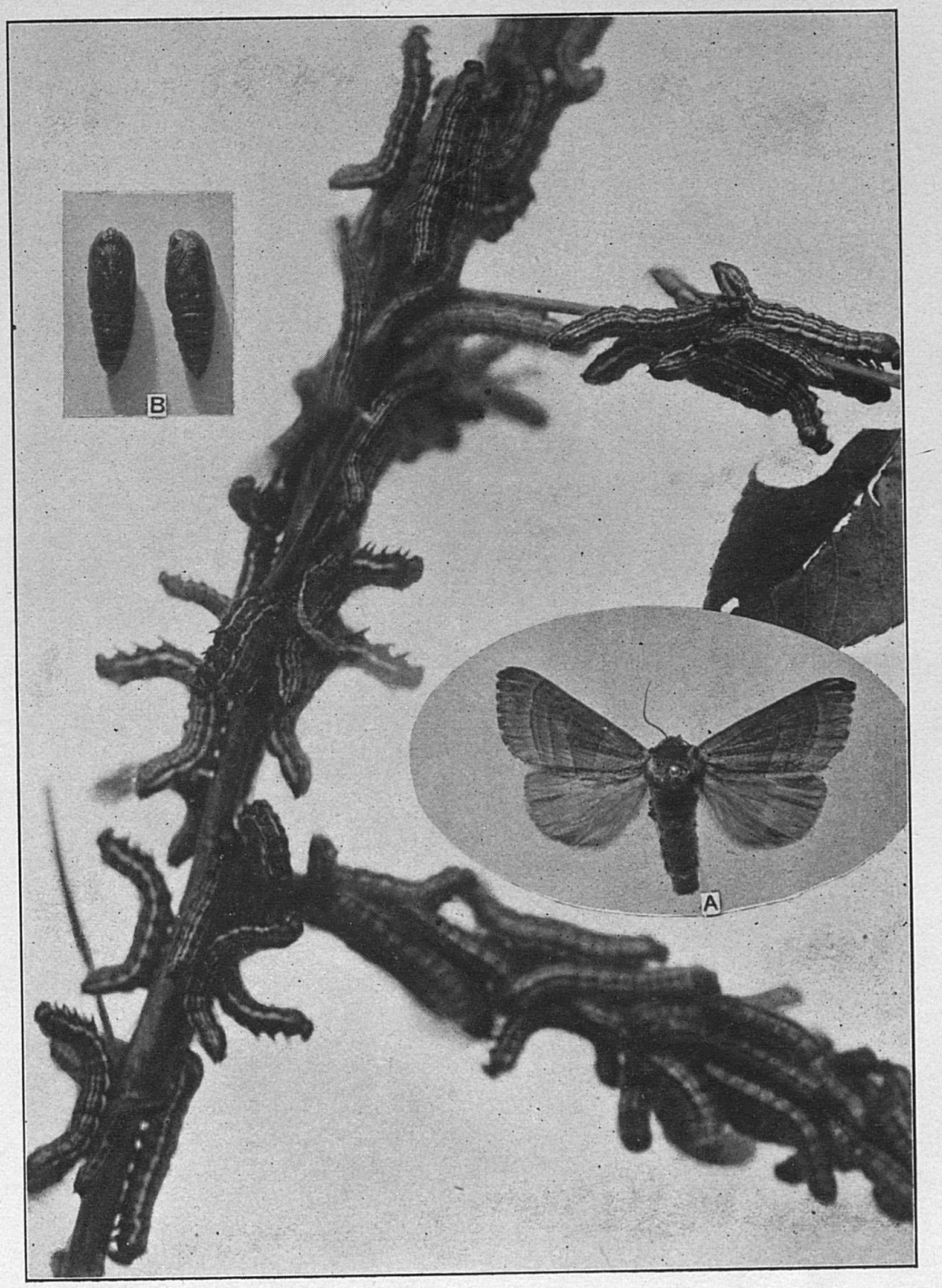


Fig. 8.—The Walnut Worm (*Datana integerrima*). *A*, adult moth; *B*, pupæ—all of natural size.

Fig. 9.—The Apple tree Measuring-worm (*Ennomos subsignaria*). *A*, adult; *B*, eggs; *C*, young larvæ; *D*, pupæ—all natural size. *E*, showing a very faint trace of the silken halter by which larvæ secure themselves to leaves—the larva itself represented of twice its natural length.

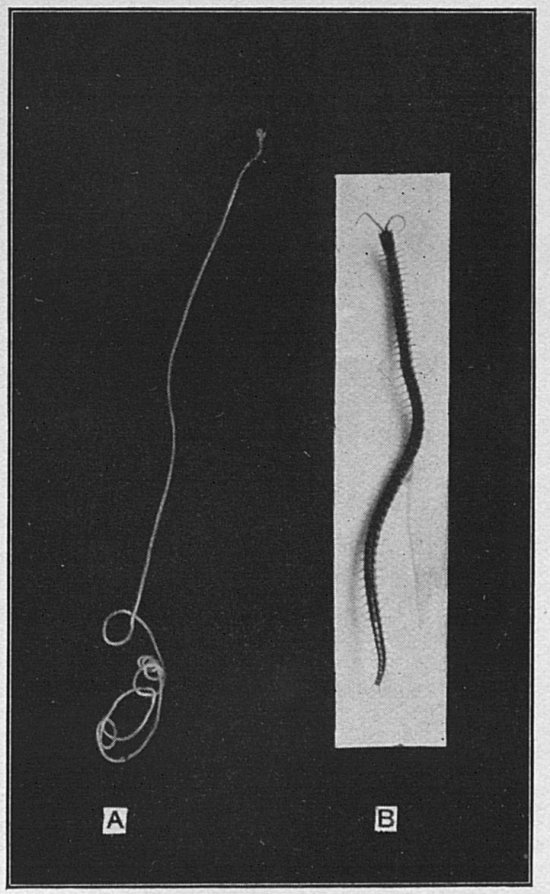


Fig. 10.—Cabbage Snakes. *A*, Mermis sp.; *B*, *Geophilus bipuncticeps*. Natural size.

KENTUCKY

Agricultural Experiment Station

OF THE

State College of Kentucky.

BULLETIN NO. 121.

COMMERCIAL FERTILIZERS.

LEXINGTON, KENTUCKY.
August, 1905.

KENTUCKY

Agricultural Experiment Station

BOARD OF CONTROL.

GEO. B. KINKEAD, Chairman, Lexington, Ky.
D. F. FRAZEE, Lexington, Ky.
C. B. NICHOLS, Lexington, Ky.
J. K. PATTERSON, President of the College.
M. A. SCOVELL, Director, Secretary.

STATION OFFICERS.

M. A. SCOVELL, Director and Chemist.
A. M. PETER, Chemist.
H. E. CURTIS, Chemist, Fertilizers.
H. GARMAN, Entomologist and Botanist.
W. H. SCHERFFIUS, Chemist.
R. M. ALLEN, Secretary, Food Division.
J. D. TURNER, Secretary to the Director.
J. O. LaBACH, Chemist, Food Division.
Miss M. L. DIDLAKE, Ass't Entomologist and Botanist.
S. D. AVERITT, Ass't Chemist.
O. M. SHEDD, Ass't Chemist.
G. N. KELLER, Ass't Entomologist and Botanist.

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. 121

ANALYSES OF COMMERCIAL FERTILIZERS

The matter of plant food is all important in purchasing fertilizers. When a farmer buys a ton of an average commercial fertilizer he buys in reality only about 300 pounds of actual plant food. If he buys a cheaper fertilizer he gets less than this amount. If he buys a high grade fertilizer he may receive as much as 600 pounds. It costs as much to mix a ton of fertilizer containing 300 pounds of plant food as it does one containing 600 pounds. The cost of sacking, hauling, and freighting is the same. Therefore, it is evident that the manufacturer can sell the plant food in a high grade fertilizer cheaper per pound than he can the plant food in a low grade fertilizer. In other words, the higher the grade the cheaper can the plant food be bought. Farmers are advised therefore to purchase only high grade fertilizers.

Attention is called to those brands which have less than two per cent. of ammonia or potash. Less than two per cent. of either of these ingredients is too small a quantity where such ingredients are needed, and where not needed it is useless to purchase them. It is an utter waste of money to purchase potash or ammonia in fertilizers containing less than one per cent. of these ingredients.

Number of brands. There were 332 different brands of commercial fertilizers registered to August 16, 1905. Of these different brands 187 were complete fertilizers, or fertilizers containing all three of the essential ingredients, namely: phosphoric acid, nitrogen, and potash; 44 were acid phosphates, or superphosphates; 2 contained a mixture of acid phosphates and nitrogen compounds only; 50 acid phosphate and potash salts only; 48 were classed as bones or tankage; and 1 contained nitrogen and potash only.

Samples Collected and Analyzed. Ninety-three samples were

collected by deputy inspectors, or were sent by farmers from various parts of the state; 332 samples were those sent in by firms as official samples; of these samples 421 were analyzed by the Station.

Results of the Analyses. The results of the analyses show that of the 421 samples analyzed, 69, representing 67 brands and 26 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 following table gives the names of all manufacturers legally selling fertilizers in the State to August 16, 1905, 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 precentages 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 mimimum 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 Amer. Ag. Chem. Co., Cleveland Dryer Works	6	5	1	4	0	3	1	6	0
The Amer. Ag. Chem. Co.,	2	2	0	2	0	0	0	2	0
American Fertilizer Co.,	3	1	2	3	0	1	1	1	2
American Guano Co.	12	7	5	3	1	9	0	8	4
The Armour Fertilizer Works	23	23	0	18	0	18	1	23	0
Bowker Fertilizer Co.	15	15	0	10	0	11	0	15	0
C. S. Brent	2	1	1	2	0	1	1	2	0
The Burley Loose Tobacco Warehouse Co.	1	1	0	1	0	1	0	1	0
The Cincinnati Phosphate Co.	11	11	0	4	2	6	1	11	0
Continental Fertilizer Co.	15	14	1	10	1	9	2	13	2
The Currie Fertilizer Co.	10	10	0	8	1	8	0	9	1
Duncan Bros. Co.	5	3	2	4	1	4	1	3	2

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 Empire Guano Co.	4	4	0	1	0	3	0	4	0
Fox Chemical Co.,	23	21	2	15	0	17	0	22	1
Globe Fertilizer Co.	35	35	0	26	0	24	2	33	2
The Hardy Packing Co	2	2	0	2	0	2	0	2	0
The Jarecki Chemical Co.	15	14	1	9	3	12	1	15	0
The Jones Fertilizing Co.	16	16	0	12	0	12	0	16	0
Kaufman Fertilizer Co.	9	9	0	7	0	5	2	9	0
Louisville Fertilizer Co.	25	24	1	20	0	16	1	25	0
Michigan Carbon Works	15	15	0	11	0	9	2	15	0
National Fertilizer Co.	25	14	11	14	1	20	1	20	5
North-Western Fertilizing Co.	19	18	1	16	0	13	1	19	0
The Ohio Farmers' Fertilizer Co.	4	4	0	3	0	4	0	4	0

Packers' Fertilizer Association	8	7	1	5	0	6	0	8	0
Pero & Stoecker	2	2	0	2	0	1	0	2	0
The Queen City Fertilizer Co.	4	3	1	3	0	4	0	3	1
Read Phosphate Co.	11	11	0	8	0	9	1	11	0
Smith Brothers	16	16	0	13	0	12	0	16	0
Oliver Smith Co.	2	1	1	2	0	1	1	2	0
Swift & Company	22	17	5	21	0	16	0	21	1
Tennessee Chemical Co.	17	15	2	12	0	13	0	16	1
Tuscarora Fertilizer Co.	13	13	0	9	0	9	0	13	0
Virginia-Carolina Chem. Co.	17	17	0	11	0	13	1	16	1
Wake Fertilizer Co.	1	0	1	1	0	1	0	1	0
Wood, Stubbs & Co.	8	5	2	7	1	6	0	8	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.. from an agent or dealer in Kentucky, for my own use and not for sale.

I further certify that the sample was taken at the time of purchase from at least ten 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 of agent of whom the fertilizer was purchased, and the amount purchased.

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

Signature of Witness:
.....
.....

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 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, with-

out 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.
	The Amer. Ag'r'l Chem. Co. New York	
	Cleveland Dryer Works.	
15145	Horsehead Phosphate	Manufacturer .....
15146	XXX Super Phosphate	Manufacturer .....
15147	Ohio Seed Maker with Potash.	Manufacturer .....
15265		Jno. H. Harned, Big Clifty ....
15148	Phospho Bone	Manufacturer .....
15149	Tobacco, Potato and General Crop Fertilizer	Manufacturer .....
	The Amer. Ag'r'l Chem. Co. New York	
15150	Ground Bone	Manufacturer .....
15151	Special Bone Meal	Manufacturer .....
	American Fertilizer Co., Louisville, Ky.	
15251	F. B. Jones' Brand Raw Bone.	Manufacturer .....
15252	F. B. Jones' Br. Wheat Grower	Manufacturer .....
15253	F. B. Jones' Br. Tobacco and Potato Grower	Manufacturer .....
	American Guano Co., Nashville, Tenn.	
15062	Mule Brand Acid 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.	Estimated Value per Ton.	Station Number.
				10.63	2.05	12.68					$10.63	15145
		8.00	*2.00*	*10.00*		*12.00*					*10.00*	
				13.63	4.00	17.63					13.63	15146
		12.00	*2.00*	*14.00*		*16.00*					*14.00*	
				7.25	3.53	10.78	1.89	2.29	2.56		18.34	15147
				8.97	3.22	12.19	1.87	2.27	1.16		18.82	15265
		5.00	*3.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				10.10	3.28	13.38	1.21	1.47	1.23		18.29	15148
		7.00	*3.00*	*10.00*		*12.00*	*0.82*	*1.00*	*1.00*		*16.26*	
				8.01	2.60	10.61	0.85	1.03	4.49		17.69	15149
		5.00	*3.00*	*8.00*		*10.00*	*0.82*	*1.00*	*4.00*		*16.86*	
17.16	4.84					22.00	2.43	2.95			23.92	15150
						20.00	*2.47*	*3.00*			*19.41*	
20.63	6.52					27.15	1.41	1.71			24.64	15151
						25.00	*1.23*	*1.50*			*18.69*	
12.08	12.07					24.15	4.21	5.11			29.53	15251
						21.50	*3.50*	*4.25*			*23.40*	
				5.89	2.28	8.17	2.15	2.61		2.04	16.88	15252
				8.00		*10.00*	*2.26*	*2.74*		*2.00*	*19.58*	
				7.87	3.17	11.04	3.48	4.22		4.88	27.01	15253
				10.00		*12.00*	*2.88*	*3.50*		*5.50*	*28.04*	
				14.64	2.44	17.08					14.64	15062
		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.
	American Guano Co., Nashville, Tenn.	
15063	Mule Br. Acid Phosphate and Potash	Manufacturer
15064	Mule Br. Klondyke Acid Phos. and Potash	Manufacturer
15065	Mule Br. Blood and Bone	Manufacturer
15066	Mule Br. Cotton, Corn and Wheat Guano	Manufacturer
15210	Mule Brand Potash Formula	Manufacturer
15211	Mule Br. Tobacco and Vegetable Grower	Manufacturer
15212	Mule Br. High Gr. Acid Phos. and Potash No. 1	Manufacturer
15213	Mule Br. High Gr. Dissolved Bone	Manufacturer
15214	Mule Br. Special Vegetable Grower	Manufacturer
15215	Mule Br. High Gr. Acid Phosphate	Manufacturer
15224	Mule Br. Fourteen Four	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.		
				8.71	2.06	10.77			2.10		$13.37	15063
		6.00	*4.00*	*10.00*		*11.00*			*2.00*		*14.40*	
				8.40	2.19	10.59			4.23		15.19	15064
		6.00	*4.00*	*10.00*		*11.00*			*4.00*		*16.40*	
				11.03	4.31	15.34	0.92	1.12	3.39		21.12	15065
		6.00	*4.00*	*10.00*		*11.00*	*0.82*	*1.00*	*1.00*		*15.86*	
				12.70	6.82	19.52	1.94	2.36		2.03	26.23	15066
		5.00	*3.00*	*8.00*		*9.00*	*1.65*	*2.00*	*2.00*		*16.95*	
				10.34	2.06	12.40			2.13		15.36	15210
		8.00	*4.00*	*12.00*		*13.00*			*2.00*		*16.80*	
				10.81	5.10	15.91	1.14	1.38	2.14		20.57	15211
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*	*2.00*		*19.35*	
				10.14	2.55	12.69			3.83		17.02	15212
		8.00	*4.00*	*12.00*		*13.00*			*4.00*		*18.80*	
				15.42	1.57	16.99					15.42	15213
		8.00	*6.00*	*14.00*		*15.00*					*14.00*	
				8.57	3.03	11.60	2.57	3.12	1.54	3.96	25.49	15214
		6.00	*4.00*	*10.00*		*11.00*	*2.47*	*3.00*	*4.00*		*23.81*	
				15.31	4.08	19.39					15.31	15215
		10.00	*6.00*	*16.00*		*17.00*					*16.00*	
				13.56	1.33	14.89			3.80		20.60	15224
		8.00	*6.00*	*14.00*		*15.00*			*4.00*		*21.20*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Armour Fertilizer Works, Chicago, Ill.	
13759 15266	Grain Grower	Manufacturer .... Barren Co. Grocery and Hardware Co., Glasgow .....
13760	Bone, Blood and Potash	Manufacturer .....
13761	White Burley & Black Tobacco	Manufacturer .....
13762 15267	Wheat, Corn & Oat Special..	Manufacturer ..... G. M. DePew, Glasgow .....
13763	Ammoniated Bone with Potash	Manufacturer .....
13764 15268	Tobacco Grower	Manufacturer ..... Barren Co. Grocery and Hdw. Co. .....
13765 15269	Dark Tobacco Special	Manufacturer ..... Slaughterville Mercantile Co., Slaughterville .....
13766	Armour's Champion	Manufacturer .....
13767	High Grade Potato	Manufacturer .....
13768 15270	Record Brand	Manufacturer ..... R. T. Elliott, Somerset .....
13769 15271	Phosphate & Potash	Manufacturer ..... G. M. DePew .....

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.
				8.80	1.15	9.95	1.94	2.36	2.29		$19.13	13759
				9.34	1.55	10.89	1.75	2.12	1.62		18.70	15266
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				8.15	3.25	11.40	4.63	5.62		8.05	34.63	13760
		6.00	*2.00*	*8.00*		*10.00*	*4.12*	*5.00*		*7.00*	*31.16*	
				8.44	3.07	11.51	3.30	4.01		4.62	26.80	13761
		6.00	*2.00*	*8.00*		*10.00*	*2.88*	*3.50*		*4.00*	*23.84*	
				7.97	0.77	8.74	1.30	1.58	1.20		14.97	13762
				7.01	1.45	8.46	0.89	1.08	2.45		14.11	15267
		5.00	*2.00*	*7.00*		*9.00*	*0.82*	*1.00*	*1.00*		*12.66*	
				7.34	1.23	8.57	3.00	3.64		2.49	21.29	13763
		4.00	*2.00*	*6.00*		*8.00*	*2.47*	*3.00*		*2.00*	*17.81*	
				8.81	0.75	9.56	2.04	2.48		5.31	23.36	13764
				10.71	2.11	12.82	1.88	2.28	0.76	3.06	23.76	15268
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*		*5.00*	*21.35*	
				8.15	0.95	9.10	2.04	2.48		4.40	21.56	13765
				9.01	2.57	11.58	1.62	1.97	0.66	3.19	21.19	15269
		5.00	*2.00*	*7.00*		*9.00*	*1.65*	*2.00*		*4.00*	*18.95*	
				10.91	1.06	11.97	1.87	2.27	2.28		21.40	13766
		6.00	*4.00*	*10.00*		*12.00*	*1.65*	*2.00*	*2.00*		*19.75*	
				9.21	0.64	9.85	1.95	2.37	11.06		28.22	13767
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*	*10.00*		*25.35*	
				11.16	0.61	11.77	1.16	1.41	1.32		18.43	13768
				11.66	1.09	12.75	0.70	0.85	1.04		17.57	15270
		6.00	*4.00*	*10.00*		*12.00*	*0.82*	*1.00*	*1.00*		*16.26*	
				10.55	0.72	11.27			2.20		15.15	13769
				10.34	1.46	11.80			1.80		14.79	15271
		6.00	*4.00*	*10.00*		*12.00*			*2.00*		*14.80*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Armour Fertilizer Works, Chicago, Ill.	
13770	Soluble Phosphate & Potash..	Manufacturer ....
13771	Star Phosphate	Manufacturer ....
13772	Cereal Phosphate	Manufacturer ....
13773	Bone Meal	Manufacturer ....
13774	Raw Bone Meal	Manufacturer .....
13775	Bone Meal with Potash	Manufacturer .....
	Bowker Fertilizer Co., Boston, New York, Cincinnati.	
15097	Bowker's Fish Guano	Manufacturer ....
15275		Richeson & Turner, Campbellsville ....
15098	Bowker's Kentucky Special ..	Manufacturer .....
15276		J. W. Gardner, Elizabethtown..
15099	Bowker's Tobacco Grower...	Manufacturer .....
15277		J. W. Gardner .....
15100	Bowker's Harvest Bone	Manufacturer .....
15278		Eads Bros., Science Hill .....
15101	Bowker's Potash Fertilizer...	Manufacturer .....
15279		J. W. Gardner .....

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.		
				10.61	0.74	11.35			4.23		$17.26	13770
		6.00	*4.00*	*10.00*		*12.00*			*4.00*		*16.80*	
				14.89	0.79	15.68					14.89	13771
		10.00	*4.00*	*14.00*		*16.00*					*14.00*	
				10.57	0.83	11.40					10.57	13772
		6.00	*4.00*	*10.00*		*12.00*					*10.00*	
21.67	4.43					26.10	2.73	3.31			28.19	13773
						24.00	*2.47*	*3.00*			*21.81*	
16.56	7.44					24.00	3.71	4.50			28.84	13774
						22.00	*3.71*	*4.50*			*24.33*	
20.73	4.24					24.97	2.71	3.29		3.15	31.03	13775
						23.00	*2.06*	*2.50*	*3.00*		*22.98*	
				8.67	1.39	10.06	0.99	1.20	3.18		17.11	15097
				7.83	3.22	11.05	1.00	1.21	3.14		16.83	15275
				8.00		*10.00*	*0.82*	*1.00*	*3.00*		*15.86*	
				9.57	2.15	11.72	1.41	1.71	5.10		21.67	15098
				9.40	3.06	12.46	1.24	1.51	3.94		20.16	15276
				8.00		*10.00*	*1.23*	*1.50*	*4.00*		*18.09*	
				7.95	3.72	11.67	2.10	2.55	0.82	5.02	24.17	15099
				8.75	1.59	10.34	1.71	2.08	0.82	4.37	22.33	15277
				8.00		*10.00*	*1.65*	*2.00*		*5.00*	*21.35*	
				9.33	2.96	12.29	0.88	1.07	2.21		17.23	15100
				8.48	2.37	10.85	1.06	1.29	1.22		15.53	15278
				8.00		*10.00*	*0.82*	*1.00*	*1.00*		*13.86*	
				10.38	4.45	14.83			5.39		19.63	15101
				9.76	5.03	14.79			4.56		18.28	15279
				10.00		*12.00*			*5.00*		*17.80*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Bowker Fertilizer Co., Boston, New York, Cincinnati.	
15102	Bowker's Dissolved Bone & Potash	Manufacturer
15103	Bowker's Soluble Bone	Manufacturer
15280		Eads Brothers
15104	Bowker's Raw Bone	Manufacturer
15105	Bowker's Bone Meal	Manufacturer
	C. S. Brent, Lexington, Ky.	
15225	Brent's Grain Grower	Manufacturer
15226	Brent's Hemp and Tobacco Special	Manufacturer
	The Burley Loose Tobacco Warehouse Co., Lexington, Ky.	
15187	Special Formula for Burley Tobacco	Manufacturer
	The Cincinnati Phosphate Co., Cincinnati, Ohio.	
15173	Capitol High Grade Guano	Manufacturer
15174	Capitol Grain and Grass Grower	Manufacturer
15175	Capitol Dissolved Bone 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.		
				10.87	2.75	13.62			2.75		$16.89	15102
				10.00		*12.00*			*2.00*		*14.80*	
				15.32	2.74	18.06					15.32	15103
				16.13	2.62	18.75					16.13	15280
				14.00		*15.00*					*14.00*	
17.32	4.33					21.65	2.38	2.89			23.60	15104
						20.00	*2.47*	*3.00*			*19.41*	
18.86	5.32					24.18	2.06	2.50			24.46	15105
						20.00	*1.65*	*2.00*			*16.95*	
				7.27	2.34	9.61	1.51	1.83	2.16		16.35	15225
				8.00		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				6.60	4.07	10.67	4.20	5.10		8.55	32.41	15226
				5.00			*4.00*	*4.86*		*10.00*	*30.00*	
				8.90	0.41	9.31	2.94	3.57		11.17	33.06	15187
		5.00	*3.00*	*8.00*		*9.00*	*3.29*	*4.00*		*10.00*	*31.87*	
				10.06	1.56	11.62	0.67	0.81	1.68		16.38	15173
				10.00		*11.00*	*0.82*	*1.00*	*2.00*		*16.86*	
				10.90	1.28	12.18	0.72	0.87		0.80	16.71	15174
				10.00		*11.00*	*0.82*	*1.00*	*1.00*		*15.86*	
				12.13	2.16	14.29			2.88		18.30	15175
				12.00		*13.00*			*3.00*		*17.80*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Cincinnati Phosphate Co., Cincinnati, Ohio.	
15176	Capitol Alkaline Bone	Manufacturer ....
15177	Capitol Wheat Grower	Manufacturer ....
15178	Capitol Tobacco, Potato and Beet Grower	Manufacturer ....
15281		The Reynolds Co., Waynesburg.
15179	"Bonus" A Humus Phosphate.	Manufacturer ....
15282		The Reynolds Co. .....
15180	Capitol Bone and Phos. Mixture, Wheat Sp'l	Manufacturer ....
15181	Capitol Ground Bone	Manufacturer ....
	Continental Fertilizer Co., Nashville, Tenn.	
13737	Bear Phosphate	Manufacturer ....
13738	Bear Acid Phosphate	Manufacturer ....
13739	Bear Potash Mixture	Manufacturer ....
13740	Bear Special Corn Grower ..	Manufacturer ....
13741	Bear Special Tobacco Grower.	Manufacturer ....
15283		Barren Gro. H'wre Co., Glasgow.
13742	Bear High Grade Tobacco and Potato Grower	Manufacturer ....
15284		A. C. McElroy, Bowling Green.

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.		
				9.88	1.54	11.42			2.20		$14.68	15176
				10.00		*11.00*			*2.00*		*14.40*	
				13.94	1.64	15.58					13.94	15177
				14.00		*15.00*					*14.00*	
				8.78	1.61	10.39	0.75	0.91	3.89		17.32	15178
				9.00	1.18	10.18	0.73	0.89	3.14		16.60	15281
				8.00		*9.00*	*0.82*	*1.00*	*2.00*	*2.00*	*16.86*	
				14.69	1.51	16.20					14.69	15179
				14.25	1.50	15.75					14.25	15282
				14.00		*15.00*					*14.00*	
17.01	3.00					*20.01	1.12	1.36	1.20		19.97	15180
						16.00	*1.65*	*2.00*	*1.00*		*15.55*	
25.37	5.57					30.94	1.42	1.72			27.90	15181
						20.00	*2.47*	*3.00*			*19.41*	
				14.14	0.69	14.83					14.14	13737
		7.00	*5.00*	*12.00*		*13.00*					*12.00*	
				10.97	0.81	11.78					10.97	13738
		6.00	*4.00*	*10.00*		*11.00*					*10.00*	
				11.80	0.49	12.29				1.91	16.65	13739
		6.00	*4.00*	*10.00*		*11.00*			*2.00*		*14.40*	
				8.86	0.79	9.65	1.00	1.21		1.28	15.49	13740
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*		*1.00*	*12.46*	
				9.87	0.58	10.45	0.82	1.00		1.44	16.26	13741
				9.23	1.02	10.25	1.49	1.81		3.56	20.23	15283
		5.00	*3.00*	*8.00*		*9.00*	*0.82*	*1.00*		*1.50*	*14.26*	
				8.19	1.43	9.62	1.95	2.37		4.38	21.51	13742
				6.51	1.84	8.35	1.49	1.81		3.24	16.91	15284
		4.00	*3.00*	*7.00*		*8.00*	*1.65*	*2.00*		*4.00*	*18.55*	

*Contains Soluble Phosphoric Acid.

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Continental Fertilizer Co., Nashville, Tenn.	
15078	Bear Slaughter House Bone..	Manufacturer ....
15079	Bear Special Wheat Grower..	Manufacturer .....
15157	Bear High Grade Dissolved Bone	Manufacturer ....
15158	Bear Bone Meal	Manufacturer ....
15208	Bear Tobacco Grower	Manufacturer .....
15285		A. C. McElroy .....
15209	Bear Beef Blood and Bone..	Manufacturer .....
	The Currie Fertilizer Co., Louisville, Ky.	
15190	Currie's Acid Phosphate	**Manufacturer .....**
15191	Currie's Corn and Wheat Special	Manufacturer ....
15286		C. W. Quiggins, Elizabethtown.
15192	Currie's Soluble Bone	Manufacturer .....
15193	Currie's Dissolved Bone	Manufacturer .....
15194	Currie's Fine Ground Raw Bone Meal	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.		
				9.78	1.41	11.19	1.86	2.26		2.42	$20.78	15078
		5.00	*3.00*	*8.00*		*9.00*	*1.65*	*2.00*		*2.00*	*17.35*	
				9.36	0.41	9.77	0.95	1.15		1.19	15.67	15079
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*		*1.00*	*12.46*	
				15.45	0.72	16.17					15.45	15157
		8.00	*6.00*	*14.00*		*15.00*					*14.00*	
24.54	2.43					26.97	1.19	1.44			24.66	15158
						20.00	*0.82*	*1.00*			*14.46*	
				7.85	1.80	9.65	2.56	3.11		5.99	25.01	15208
				9.20	1.55	10.75	1.86	2.26		4.61	22.77	15285
		5.00	*3.00*	*8.00*		*9.00*	*2.47*	*3.00*		*6.00*	*24.61*	
				11.86	1.47	13.33	1.62	1.97		2.00	22.08	15209
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*		*2.00*	*19.75*	
				13.00	2.03	15.03					13.00	15190
				13.50							*13.50*	
				12.07	0.93	13.00	1.00	1.21		1.09	19.16	15191
				10.38	1.85	12.23	1.15	1.40	1.34		17.99	15286
				10.00		*12.50*	*0.82*	*1.00*		*1.00*	*16.66*	
				9.89	2.28	12.17	1.21	1.47	1.65		18.06	15192
				10 00		*12.00*	*1.03*	*1.25*		*1.50*	*17.69*	
				9.71	2.23	11.94	1.69	2.05	1.76		19.37	15193
				8.00		*10.00*	*1.65*	*2.00*		*2.00*	*17.75*	
11.80	2.94					*14.74	1.23	1.49			14.89	15194
						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., Louisville, Ky.	
15195	Currie's Tobacco and Potato Grower	Manufacturer
15196	Currie's Golden Leaf Tobacco and Potato Grower	Manufacturer
15287		Wm. Leming, Hodgenville
15197	Currie's Climax Tobacco and Potato Grower	Manufacturer
	Duncan Bros. Co., LaGrange, Ky.	
15080	Tiger Tobacco and Potato Grower	Manufacturer
15288		Mfrs. Warehouse
15155	Tiger Brand Corn and Wheat Grower	Manufacturer
15289		Mfrs. Warehouse
15264	Tiger Brand Bone & Phosphate	Manufacturer
	The Empire Guano Co., Nashville, Tenn.	
15237	Empire Acid Phosphate	Manufacturer
15238	Empire Bone & Potash	Manufacturer
15239	Empire Potash Mixture	Manufacturer
15240	Empire Favorite Manure	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.
				7.23	1.73	8.96	1.66	2.02	8.28		$22.63	15195
				7.00		*9.00*	*1.65*	*2.00*		*8.00*	*23.75*	
				8.74	2.33	11.07	1.81	2.20	2.48	1.64	21.30	15196
				8.19	2.10	10.29	1.82	2.21	3.65		19.78	15287
				8.00		*9.50*	*1.65*	*2.00*		*3.50*	*19.35*	
				10.37	2.01	12.38	1.12	1.36	1.44		18.04	15197
				9.50		*12.00*	*1.03*	*1.25*		*1.50*	*17.29*	
				7.78	0.82	8.60	1.99	2.42		5.32	22.02	15080
				10.80	1.07	11.87	1.59	1.93		4.02	22.98	15288
				9.00		*10.00*	*2.47*	*3.00*		*5.00*	*24.61*	
				8.96	1.47	10.43	1.70	2.06		2.48	19.42	15155
				10.43	1.06	11.49	1.75	2.12		2.21	20.84	15289
				10.00		*12.00*	*1.65*	*2.00*		*2.00*	*20.15*	
				11.87	5.68	17.55	1.92	2.33		1.19	23.70	15264
				8.00		*17.00*	*1.23*	*1.50*		*1.00*	*18.09*	
				12.17	0.93	13.10					12.17	15237
				12.00							*12.00*	
				9.82	0.77	10.59			3.45		15.54	15238
				10.00					*2.00*		*14.00*	
				10.95	0.56	11.51			4.54		17.90	15239
				10.00					*4.00*		*16.00*	
				11.82	0.46	12.28	1.33	1.61	3.40		21.75	15240
				10.00			*0.82*	*1.00*	*3.00*		*17.46*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Fox Chemical Co., Branch, Federal Chemical Co., Louisville, Ky.	
15041	Fox Formula	Manufacturer ....
15042	Fox Wheat & Corn Grower ..	Manufacturer ....
15043	Fox Early Bell	Manufacturer ....
15044	Fox Wheat Grower	Manufacturer ....
15045	Fox Wheat and Grain Special.	Manufacturer ....
15046	Fox Bone, Blood and Potash..	Manufacturer ....
15047	Fox Grain Grower	Manufacturer ....
15048	Fox Grain Special	Manufacturer ....
15049	Fox Special Tobacco Grower..	Manufacturer ....
15249		J. G. Bell, Thruston. .....
15050	Fox Tobacco Grower	Manufacturer ....
15290		T. W. Buchanan & Co., Campbellsville ....
15051	Fox High Gr. Tobacco Grower.	Manufacturer ....
15052	Fox Bone Phosphate & Potash	Manufacturer ....
15053	Fox Bone Phosphate	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.		
				10.82	1.83	12.65	0.95	1.15		2.84	$19.97	15041
				11.00		*13.00*	*0.82*	*1.00*		*3.00*	*20.06*	
				9.24	1.19	10.43	2.24	2.72		2.77	21.61	15042
				10.00		*12.00*	*1.65*	*2.00*		*2.00*	*20.15*	
				10.48	0.50	10.98	1.11	1.35	1.10	0.79	18.16	15043
				10.00		*12.00*	*0.82*	*1.00*		*2.00*	*17.66*	
				8.53	2.20	10.73	2.14	2.60		1.85	19.76	15044
				8.00		*10.00*	*1.65*	*2.00*		*2.00*	*17.75*	
				11.86	0.97	12.83	0.86	1.04		0.96	18.35	15045
				12.00		*14.00*	*0.82*	*1.00*		*1.00*	*18.86*	
				12.39	0.19	12.58	0.59	0.72		0.86	17.75	15046
				11.00		*13.00*	*0.41*	*0.50*		*1.00*	*16.43*	
				9.23	1.09	10.32	0.85	1.03		1.03	15.31	15047
				9.00		*11.00*	*0.82*	*1.00*		*1.00*	*15.26*	
				10.04	3.48	13.52	0.49	0.59		1.49	16.70	15048
				9.00		*11.00*	*0.41*	*0.50*		*1.50*	*14.63*	
				8.44	1.45	9.89	2.19	2.66		4.91	23.17	15049
				9.15	1.65	10.80	1.78	2.16		5.54	23.63	15249
				8.00		*10.00*	*1.65*	*2.00*		*5.00*	*21.35*	
				8.52	2.46	10.98	2.13	2.59		2.10	20.11	15050
				8.49	2.92	11.41	1.83	2.22		2.64	20.02	15290
				8.00		*10.00*	*1.65*	*2.00*		*2.00*	*17.75*	
				9.42	1.10	10.52	2.89	3.51		4.27	25.53	15051
				8.00		*10.00*	*3.29*	*4.00*		*4.00*	*25.07*	
				9.55	4.23	13.78			3.76		16.91	15052
				10.00		*12.00*			*4.00*		*16.80*	
				11.21	1.06	12.27			1.90		15.77	15053
				12.00		*14.00*			*2.00*		*17.20*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Fox Chemical Co., Branch, Federal Chemical Co., Louisville, Ky.	
15054	Fox Alkaline Bone	Manufacturer ....
15055	Fox Bone and Potash	Manufacturer ....
15056	Fox High Gr. Acid Phosphate.	Manufacturer ....
15057	Fox Acid Phosphate	Manufacturer ....
15058	Fox Standard Acid Phosphate.	Manufacturer ....
15059	Fox A A Acid Phosphate...	Manufacturer ....
15060	Fox Raw Bone	Manufacturer ....
15061	Fox Ground Bone	Manufacturer ....
	Globe Fertilizer Co., Branch, Federal Chemical Co., Louisville, Ky.	
15012	Braden Formula	Manufacturer ....
15013	Globe Wheat Grower	Manufacturer ....
15014	Progress Corn and Wheat Grower	Manufacturer ....
15291		Dickey & Co., Glasgow .....
15015	Eagle Wheat and Corn Grower	Manufacturer ....
15292		Finley & Plain, 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.		
				9.67	1.11	10.78			1.78		$13.82	15054
				10.00		*12.00*			*2.00*		*14.80*	
				9.01	1.66	10.67			0.93		12.40	15055
				9.00		*11.00*			*1.00*		*12.60*	
				15.95	0.55	16.50					15.95	15056
				16.00							*16.00*	
				14.77	1.14	15.91					14.77	15057
				14.00							*14.00*	
				12.06	0.55	12.61					12.06	15058
				12.00							*12.00*	
				10.04	4.70	14.74					10.04	15059
				10.00							*10.00*	
9.58	12.71					22.29	3.88	4.71			26.93	15060
						22.00	*3.71*	*4.50*			*24.33*	
18.14	7.78					25.92	2.94	3.57			28.00	15061
						22.00	*2.47*	*3.00*			*20.61*	
				11.01	1.59	12.60	0.90	1.09		2.91	20.04	15012
				11.00		*13.00*	*0.82*	*1.00*		*3.00*	*20.06*	
				9.64	0.95	10.59	2.14	2.60		2.91	21.86	15013
				10.00		*12.00*	*1.65*	*2.00*		*2.00*	*20.15*	
				10.36	0.73	11.09	1.09	1.32	1.10	0.92	18.19	15014
				9.96	1.00	10.96	1.24	1.51	1.60		17.67	15291
				10.00		*12.00*	*0.82*	*1.00*		*2.00*	*17.66*	
				8.86	2.01	10.87	2.26	2.74		2.12	20.75	15015
				10.01	1.41	11.42	1.82	2.21		2.10	20.55	15292
				8.00		*10.00*	*1.65*	*2.00*		*2.00*	*17.75*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Globe Fertilizer Co.	
15016	Wheat and Grain Special	Manufacturer ....
15017	Bone and Potash	Manufacturer .....
15293		J. W. Cloyd, Campbellsville ....
15018	Globe Bone Dust	Manufacturer .....
15019	Globe Grain Grower	Manufacturer .....
15294		Dickey & Co .....
15020	Globe Special Tobacco Grower	Manufacturer .....
15295		Wm. Cook, Slaughterville.....
15021	Kentucky Standard Tobacco Grower	Manufacturer .....
15296		Wm. Cook .....
15022	Big Four Tobacco Grower ...	Manufacturer .....
15297		Hill & McElroy, Bowling Green
15023	High Grade Tobacco Grower.	Manufacturer .....
15024	Globe Potato Grower	Manufacturer .....
15025	Golden Harvest Bone Meal..	Manufacturer .....
15026	Bone Phosphate & Potash....	Manufacturer .....
15027	Potash Special	Manufacturer .....
15028	Big Four 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.	Estimated Value per Ton.	Station Number.
				11.70	1.16	12.86	0.92	1.12		0.89	$18.33	15016
				12.00		*14.00*	*0.82*	*1.00*		*1.00*	*18.86*	
				12.11	0.35	12.46	0.57	0.69		0.89	17.45	15017
				14.20	1.77	15.97	0.53	0.64		0.97	20.50	15293
				11.00		*13.00*	*0.41*	*0.50*		*1.00*	*16.43*	
				9.31	1.22	10.53	0.85	1.03		0.96	15.36	15018
				9.00		*11.00*	*0.82*	*1.00*		*1.00*	*15.26*	
				10.13	3.42	13.55	0.49	0.59		1.56	16.87	15019
				8.80	1.50	10.30	0.53	0.64	1.59		14.34	15294
				9.00		*11.00*	*0.41*	*0.50*		*1.50*	*14.63*	
				8.11	1.00	9.11	2.41	2.93		10.80	30.32	15020
				8.15	0.63	8.78	2.16	2.62	10.32		26.83	15295
				8.00		*10.00*	*2.47*	*3.00*		*10.00*	*29.81*	
				8.63	1.60	10.23	2.13	2.59		5.29	23.74	15021
				8.29	1.83	10.12	1.68	2.04	4.52	0.69	21.07	15296
				8.00		*10.00*	*1.65*	*2.00*		*5.00*	*21.35*	
				8.12	2.69	10.81	2.13	2.59		2.09	19.72	15022
				8.33	4.85	13.18	2.26	2.74	0.96	0.46	20.23	15297
				8.00		*10.00*	*1.65*	*2.00*		*2.00*	*17.75*	
				9.11	1.28	10.39	2.87	3.48		4.48	25.43	15023
				8.00		*10.00*	*3.29*	*4.00*		*4.00*	*25.07*	
				9.21	1.24	10.45	2.85	3.46		4.44	25.43	15024
				8.00		*10.00*	*3.29*	*4.00*		*4.00*	*25.07*	
				9.30	2.87	12.17	2.83	3.44			20.80	15025
				10.00		*12.00*	*2.47*	*3.00*			*20.21*	
				9.78	4.22	14.00			3.73		17.16	15026
				10.00		*12.00*			*4.00*		*16.80*	
				10.32	0.90	11.22			1.79		14.53	15027
				10.00		*12.00*			*2.00*		*14.80*	
				8.95	1.73	10.68			1.02		12.45	15028
				8.00		*10.00*			*1.00*		*11.40*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Globe Fertilizer Co.	
15029	Potash Compound	Manufacturer .....
15030	High Grade Acid Phosphate..	Manufacturer .....
15031	Globe Acid Phosphate	Manufacturer .....
15032	Standard Acid Phosphate	Manufacturer .....
15298		I. K. Miller & Sons, Campbellsville .....
15033	A. A. Acid Phosphate	Manufacturer .....
15034	Globe Raw Bone	Manufacturer .....
15035	Acorn Bone Meal	Manufacturer .....
15299		I. K. Miller & Sons .....
15230	Globe Soluble Vegetable Manure	Manufacturer .....
15228		Thos. L. Button, Bedford .....
	The Hardy Packing Co., Chicago, Ill.	
15241	Crop Producer	Manufacturer .....
15242	Corn & Wheat Grower	Manufacturer .....
	The Jarecki Chemical Co., Sandusky & Cincinnati, Ohio.	
15159	Lake Erie Fish Guano	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.		
				11.46	1.00	12.46			1.97		$16.12	15029
				12.00		*14.00*			*2.00*		*17.20*	
				15.63	0.68	16.31					15.63	15030
				16.00							*16.00*	
				14.59	1.18	15.77					14.59	15031
				14.00							*14.00*	
				11.73	0.90	12.63					11.73	15032
				13.45	1.27	14.72					13.45	15298
				12.00							*12.00*	
				10.77	4.75	15.52					10.77	15033
				10.00							*10.00*	
9.46	12.54					22.00	3.83	4.65			26.58	15034
						22.00	*3.71*	*4.50*			*24.33*	
17.49	8.61					26.10	2.85	3.46			27.71	15035
12.41	11.00					23.41	3.59	4.36			27.30	15299
						22.00	*2.47*	*3.00*			*20.61*	
				8.76	1.42	10.18	2.13	2.59		5.16	23.66	15230
				8.92	1.79	10.71	1.92	2.33		4.47	22.54	15228
				8.00		*10.00*	*1.65*	*2.00*		*5.00*	*21.35*	
				8.27	1.79	10.06	0.68	0.83	1.40		14.08	15241
		5.00	*2.00*	*7.00*		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				7.95	0.63	8.58	0.44	0.53	2.72		13.83	15242
		5.00	*3.00*	*8.00*		*9.00*	*0.41*	*0.50*	*2.50*		*13.73*	
				10.58	1.07	11.65	0.69	0.84	1.69		16.89	15159
				10.00		*11.00*	*0.82*	*1.00*	*2.00*		*16.86*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Jarecki Chemical Co.	
15160	Number One Fish Guano	Manufacturer .....
15161	Fish and Potash Grain Special	Manufacturer .....
15162	C. O. D. Phosphate	Manufacturer .....
15163	Square Brand Phosphate and Potash	Manufacturer .....
15164	Raw Bone and Guano Mixture	Manufacturer ....
15300		I. K. Miller & Sons, Campbellsville. ....
15165	Fish and Potash Tobacco and Potato Food	Manufacturer ....
15166	O. K. Fertilizer	Manufacturer ....
15167	Dissolved Bone with Potash..	Manufacturer ....
15168	Ground Bone	Manufacturer ....
15169	Indian Brand Tobacco and Potato Fertilizer	Manufacturer ....
15170	Ind. Br. Ohio Valley Phosphate	Manufacturer ....
15171	Acorn Br. General 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.	Estimated Value per Ton.	Station Number.
				10.49	1.74	12.23	0.70	0.85		0.95	$16.53	15160
				10.00		*11.00*	*0.82*	*1.00*	*1.00*		*15.86*	
				9.77	1.23	11.00	1.14	1.38	1.94		17.57	15161
				9.00		*10.00*	*1.23*	*1.50*	*2.00*		*16.89*	
				13.81	1.82	15.63					13.81	15162
				14.00		*15.00*					*14.00*	
				9.84	1.74	11.58			2.03		14.54	15163
				10.00		*11.00*			*2.00*		*14.40*	
17.26	3.29					*20.55	1.02	1.24	1.26		20.10	15164
14.38	3.15					*17.53	1.16	1.41	1.77		18.64	15300
						16.00	*1.65*	*2.00*	*1.00*		*15.55*	
				9.12	1.29	10.41	0.75	0.91	3.91		17.62	15165
				8.00		*9.00*	*0.82*	*1.00*	*2.00*	*2.00*	*16.86*	
				4.96	1.65	6.61	0.42	0.51		*0.51*	8.48	15166
				6.00		*7.00*	*0.41*	*0.50*	*0.50*		*9.33*	
				11.62	2.41	14.03			2.97		17.87	15167
				12.00		*13.00*			*3.00*		*17.80*	
22.93	6.85					29.78	1.66	2.02			27.43	15168
						20.00	*2.47*	*3.00*			*19.41*	
				9.82	1.98	11.80	2.47	3.00	0.00	4.16	24.97	15169
				9.00		*10.00*	*2.47*	*3.00*	*1.00*	*4.00*	*24.41*	
				10.44	1.38	11.82	1.74	2.11	2.35		20.65	15170
				8.00		*9.00*	*1.65*	*2.00*	*2.00*		*16.95*	
				7.76	1.41	9.17	0.78	0.95		0.71	13.06	15171
				7.00		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	

*Contains Soluble Phosphoric Acid.

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Jarecki Chemical Co.	
15172	Ind. Br. Gilead Phosphate ...	Manufacturer ....
	The Jones Fertilizing Co., Cincinnati, O.	
13743	Jones Corn & Wheat Grower.	Manufacturer ....
15301		Goad Bros., Glasgow .....
13744	Jones Reliable	Manufacturer ....
13745	Jones Special Tobacco Grower	Manufacturer ....
15302		I. K. Miller & Sons, Campbellsville. ....
13746	Jones Tobacco and Potato Grower	Manufacturer ....
13747	Jones Bone Meal	Manufacturer ....
15203	Jones Potash Mixture	Manufacturer ....
15303		Goad Bros. ....
15204	Jones Potato Grower	Manufacturer ....
15205	Jones Phosphate	Manufacturer ....
15206	Jones Miami Valley Phosphate	Manufacturer ....
15207	Jones Slaughter House Bone..	Manufacturer ....
15304		I. K. Miller & Sons .....
15273	Jones High Grade Dissolved Bone	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.		
				8.74	1.24	9.98	0.79	0.96	2.67		$16.03	15172
				8.00		*9.00*	*0.82*	*1.00*	*3.00*		*15.46*	
				8.56	0.60	9.16	0.99	1.20		1.22	14.94	13743
				6.83	0.77	7.60	0.92	1.12	1.39		12.66	15301
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*		*1.00*	*12.46*	
				9.62	0.45	10.07	0.83	1.01		1.53	16.05	13744
		5.00	*3.00*	*8.00*		*9.00*	*0.82*	*1.00*		*1.50*	*14.26*	
				9.56	0.58	10.14	0.82	1.00		1.55	16.02	13745
				8.62	1.45	10.07	0.82	1.00		1.57	15.26	15302
		5.00	*3.00*	*8.00*		*9.00*	*0.82*	*1.00*		*1.50*	*14.26*	
				8.15	1.41	9.56	1.95	2.37		4.29	21.34	13746
		4.00	*3.00*	*7.00*		*8.00*	*1.65*	*2.00*		*4.00*	*18.55*	
25.42	2.21					27.63	1.18	1.43			25.21	13747
						20.00	*0.82*	*1.00*			*14.46*	
				11.75	0.47	12.22			1.98		16.27	15203
				10.94	0.87	11.81			2.35		15.83	15303
		6.00	*4.00*	*10.00*		*11.00*			*2.00*		*14.40*	
				8.24	1.64	9.88	2.58	3.13		6.02	25.51	15204
		5.00	*3.00*	*8.00*		*9.00*	*2.47*	*3.00*		*6.00*	*24.61*	
				13.65	0.64	14.29					13.65	15205
		7.00	*5.00*	*12.00*		*13.00*					*12.00*	
				11.93	1.22	13.15	1.66	2.02		2.01	22.20	15206
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*		*2.00*	*19.75*	
				9.64	1.36	11.00	1.83	2.22		2.31	20.37	15207
				7.50	1.22	8.72	1.59	1.93		3.59	18.57	15304
		5.00	*3.00*	*8.00*		*9.00*	*1.65*	*2.00*		*2.00*	*17.35*	
				15.73	0.35	16.08					15.73	15273
		8.00	*6.00*	*14.00*		*15.00*					*14.00*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Jones Fertilizing Co.	
15274	Jones Raw Bone	Manufacturer ....
	Kaufman Fertilizer Co., Cincinnati, O.	
13786	Half and Half	Manufacturer ....
13787	Special Potato and Tobacco Fertilizer	Manufacturer ....
15305		H. A. Brewer, Eminence .....
13788	Harvest King	Manufacturer ....
13789	Banner Crop Grower	Manufacturer ....
13790	Alkaline Bone and Potash ...	Manufacturer ....
13791	Acid Phosphate	Manufacturer ....
13792	Kentucky Tobacco Grower ..	Manufacturer ....
13793	Pure Bone	Manufacturer ....
	Louisville Fertilizer Co., Louisville, Ky.	
13724	Eagle Guano	Manufacturer ....
13725	Eagle Soluble Bone	Manufacturer ....
15306		Smith & Flora, Campbellsville..
13726	Eagle Slaughter House Bone.	Manufacturer ....
15307		L. S. Brough, Bowling Green...

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.		
21.70	4.45					26.15	2.84	3.45			$28.55	15274
						20.00	*2.47*	*3.00*			*19.41*	
17.36	2.14					*19.50	1.30	1.58	1.02		20.09	13786
						16.00	*1.65*	*2.00*	*2.00*		*16.55*	
				6.71	1.48	8.19	1.74	2.11		6.41	21.55	13787
				7.21	2.17	9.38	1.73	2.10	6.29		21.00	15305
				6.00		*7.00*	*1.65*	*2.00*	*1.00*	*5.00*	*19.55*	
				8.52	1.88	10.40	0.85	1.03		1.60	15.44	13788
				8.00		*9.00*	*1.00*	*1.21*	*2.00*		*15.00*	
				7.86	1.91	9.77	0.80	0.97	1.07		13.66	13789
				7.00		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				11.45	2.43	13.88			1.48		16.19	13790
				10.00		*11.00*			*2.00*		*14.40*	
				14.99	1.96	16.95					14.99	13791
				14.00		*15.00*					*14.00*	
				8.56	2.07	10.63	0.84	1.02		2.02	16.04	13792
				8.00		*9.00*	*1.00*	*1.21*		*2.00*	*15.40*	
23.37	2.60					*25.97	1.43	1.74			24.55	13793
						20.00	*2.47*	*3.00*			*19.41*	
				12.12	1.30	13.42	1.69	2.05		2.15	22.71	13724
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*		*2.00*	*18.75*	
				9.50	0.58	10.08	0.85	1.03		1.56	16.05	13725
				8.71	1.09	9.80	0.88	1.07		1.74	15.62	15306
		5.00	*3.00*	*8.00*		*9.00*	*0.82*	*1.00*		*1.50*	*14.26*	
				9.32	1.46	10.78	1.93	2.34		2.35	20.37	13726
				8.77	1.55	10.32	1.49	1.81		1.96	17.96	15307
		5.00	*3.00*	*8.00*		*9.00*	*1.65*	*2.00*		*2.00*	*17.35*	

*Contains Soluble Phosphoric Acid.

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Louisville Fertilizer Co.	
13727	Eagle Phosphate	Manufacturer
15308		Cochran & Pickens, Marion
13728	Eagle Special Corn Grower	Manufacturer
13729	Eagle Spec. Tobacco Grower.	Manufacturer
15309		Cochran & Pickens
13730	Eagle Tobacco Grower	Manufacturer
15310		L. S. Brough
13731	Eagle Potato Grower	Manufacturer
15182	Eagle High Grade Dissolved Bone	Manufacturer
15183	Eagle Potash Mixture	Manufacturer
15311		J. W. Crume & Bro., Lebanon
15255	Eagle Standard Raw Bone	Manufacturer
15257	Eagle Special Wheat Grower.	Manufacturer
15258	Eagle XX Ground Bone	Manufacturer
15259	Eagle Bone Meal	Manufacturer
15312		Smith & Flora
15260	Eagle Raw Bone	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.
				13.94	0.78	14.72					$13.94	13727
				11.41	1.29	12.70					11.41	15308
		7.00	*5.00*	*12.00*		*13.00*					*12.00*	
				8.54	0.72	9.26	1.02	1.24		1.13	14.96	13728
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*		*1.00*	*12.46*	
				9.96	0.63	10.59	0.83	1.01		1.48	16.47	13729
				8.02	1.93	9.95	0.96	1.17		1.70	15.31	15309
		5.00	*3.00*	*8.00*		*9.00*	*0.82*	*1.00*		*1.50*	*14.26*	
				7.76	2.32	10.08	2.61	3.17		6.17	25.47	13730
				7.61	1.84	9.45	2.49	3.02		5.68	24.16	15310
		5.00	*3.00*	*8.00*		*9.00*	*2.47*	*3.00*		*6.00*	*24.61*	
				7.59	2.26	9.85	2.63	3.19		6.25	25.40	13731
		5.00	*3.00*	*8.00*		*9.00*	*2.47*	*3.00*		*6.00*	*24.61*	
				15.45	0.64	16.09					15.45	15182
		8.00	*6.00*	*14.00*		*15.00*					*14.00*	
				11.73	0.59	12.32				2.00	16.72	15183
				10.21	0.78	10.99			0.86		13.42	15311
		6.00	*4.00*	*10.00*		*11.00*			*2.00*		*14.40*	
14.40	7.76					22.16	3.80	4.61			27.58	15255
						22.00	*3.71*	*4.50*			*24.33*	
				9.48	0.42	9.90	0.98	1.19		1.14	15.86	15257
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*		*1.00*	*12.46*	
				9.32	10.13	19.45	1.45	1.76			19.58	15258
		3.00	*1.00*	*4.00*		*15.00*	*1.23*	*1.50*			*12.89*	
29.90	2.24					32.14	0.83	1.01			27.75	15259
15.05	2.25					17.30	2.17	2.63			19.90	15312
						20.00	*0.82*	*1.00*			*14.46*	
19.90	4.97					24.87	2.66	3.23			26.88	15260
						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.
	Louisville Fertilizer Co.	
15261	Eagle Raw Bone Mixture	Manufacturer ....
15347	Eagle High Grade Tobacco & Potato Grower	Manufacturer ....
15348		L. S. Brough ....
	Michigan Carbon Works, Detroit, Mich.	
15081	Homestead A Bone Black Fertilizer	Manufacturer ....
15313		W. T. Shaw, Hodgenville .....
15082	Homestead Potato and Tobacco Special	Manufacturer ....
15314		J. J. Ramsey & Bro., Shelbyville
15083	Homestead Tobacco Grower..	Manufacturer ....
15315		W. T. Shaw ....
15084	Red Line Crop Grower	Manufacturer ....
15085	Red Line Complete Manure..	Manufacturer ....
15316		W. Lewis & Bro., Greensburg..
15086	Red Line Phosphate with Potash	Manufacturer ....
15317		Bradford Bros., Glasgow .....
15087	Red Line Phosphate	Manufacturer ....
15318		Bradford Bros. ....
15088	Wolverine Pure Ground Bone.	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.
				9.69	6.17	15.86	1.85	2.25		0.66	$20.44	15261
		3.00	*2.00*	*5.00*		*15.00*	*1.65*	*2.00*		*1.00*	*16.15*	
				8.79	1.11	9.90	1.98	2.40		4.15	21.91	15347
				7.46	1.09	8 55	1.41	1.71		4.12	18 56	15348
		4.00	*3.00*	*7.00*		*8.00*	*1.65*	*2.00*		*4.00*	*18.55*	
				10.18	1.05	11.23	2.28	2.77	1.56		21.04	15081
				8.88	0.82	9.70	2.10	2.55	1.76		19.05	15313
				8.00		*9.00*	*2.06*	*2.50*	*1.50*		*17.68*	
				8.87	0.70	9.57	2.07	2.51	4.49		21.62	15082
				8.45	3.24	11.69	1.96	2.38	4.63		21.95	15314
				8.00		*9.00*	*2.06*	*2.50*	*5.00*		*21.18*	
				11.07	0.64	11.71	2.91	3.53	4.11		26.38	15083
				10.43	1.07	11.50	2.90	3.52	3.25		24.90	15315
				10.00		*11.00*	*2.88*	*3.50*	*3.50*		*24.54*	
				8.12	1.96	10.08	1.86	2.26	2.09		18.19	15084
				8.00		*9.00*	*1.65*	*2.00*	*2.00*		*16.95*	
				9.39	0.83	10.22	0.83	1.01	1.32		15.41	15085
				6.94	1.96	8.90	1.02	1.24	1.20		13.37	15316
				7.00		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				9.60	2.35	11.95			1.98		14.44	15086
				10.26	2.60	12.86			1.52		14.87	15317
				10.00		*11.00*			*2.00*		*14.40*	
				14.08	1.73	15.81					14.08	15087
				14.65	2.70	17.35					14.65	15318
				14.00		*15.00*					*14.00*	
23.09	5.77					28.86	2.95	3.58			30.78	15088
						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.
	Michigan Carbon Works	
15089	Desiccated Bone	Manufacturer
	National Fertilizer Co., Nashville, Tenn.	
15067	Old Hickory Brand Acid Phosphate	Manufacturer
15068	O. H. B. High Grade Dissolved Bone	Manufacturer
15069	O. H. B. High Grade Acid Phosphate	Manufacturer
15070	O. H. B. Acid Phosphate and Potash	Manufacturer
15319		Dunagan & Kirtley, Horse Cave.
15071	O. H. B. Anti-Trust Acid Phos. and Potash	Manufacturer
15072	O. H. B. Sadler's Formula	Manufacturer
15073	O. H. B. Fourteen Four	Manufacturer
15074	O. H. B. Rock City Guano	Manufacturer
15075	O. H. B. National Blood and Bone	Manufacturer
15076	O. H. B. National Wheat Grower	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.		
26.63	5.45					32.08	1.39	1.69			$28.74	15089
						25.00	*1.23*	*1.50*			*18.69*	
				14.77	2.47	17.24					14.77	15067
		7.00	*5.00*	*12.00*		*13.00*					*12.00*	
				15.41	1.64	17.05					15.41	15068
		8.00	*6.00*	*14.00*		*15.00*					*14.00*	
				15.55	4.07	19.62					15.55	15069
		9.00	*7.00*	*16.00*		*17.00*					*16.00*	
				8.50	2.23	10.73			2.15		13.24	15070
				9.68	0.81	10.49			2.00		13.94	15319
		7.00	*3.00*	*10.00*		*11.00*			*2.00*		*14.40*	
				8.20	2.34	10.54			4.13		14.91	15071
		7.00	*3.00*	*10.00*		*11.00*			*4.00*		*16.40*	
				10.32	1.91	12.23			2.07		15.21	15072
		8.00	*4.00*	*12.00*		*13.00*			*2.00*		*16.80*	
				13.54	1.38	14.92			3.79		20.59	15073
		9.00	*5.00*	*14.00*		*15.00*			*4.00*		*21.20*	
				12.05	6.86	18.91	1.94	2.36		2.11	25.55	15074
		5.00	*3.00*	*8.00*		*9.00*	*1.65*	*2.00*	*2.00*		*16.95*	
				11.17	4.32	15.49	0.89	1.08	3.40		21.20	15075
		6.00	*4.00*	*10.00*		*11.00*	*0.82*	*1.00*	*1.00*		*15.86*	
				8.23	4.12	12.35	1.70	2.06	2.12		18.75	15076
		6.00	*4.00*	*10.00*		*11.00*	*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.
	National Fertilizer Co.	
15077	O. H. B. National Corn Grower	Manufacturer
15156	O. H. B. Tennessee Guano	Manufacturer
15216	O. H. B. National Tobacco Grower	Manufacturer
15320		Dunagan & Kirtley
15217	O. H. B. National Tobacco Fertilizer	Manufacturer
15218	O. H. B. Nat. Sp'l Tobacco Fert. No. 1	Manufacturer
15219	O. H. B. Nat. Sp'l Tobacco Fert. No. 2	Manufacturer
15321		Dunagan & Kirtley
15220	O. H. B. National Vegetable Grower	Manufacturer
15221	O. H. B. Nat. Sp'l Vegetable Grower No. 1	Manufacturer
15222	O. H. B. Nat. Sp'l Vegetable Grower No. 2	Manufacturer
15223	Miller's Acid Phosphate	Manufacturer
15229	Old Hickory Guano	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.		
				11.09	4.36	15.45	0.89	1.08	3.38		$21.10	15077
		6.00	*4.00*	*10.00*		*11.00*	*0.82*	*1.00*	*1.00*		*15.86*	
				12.56	6.83	19.39	1.92	2.33		2.09	26.07	15156
		5.00	*3.00*	*8.00*		*9.00*	*1.65*	*2.00*	*2.00*		*16.95*	
				10.79	5.10	15.89	1.14	1.38	2.09		20.50	15216
				10.07	2.01	12.08	1.59	1.93	2.25		19.90	15320
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*		*2.00*	*19.75*	
				8.59	2.69	11.28	2.16	2.62		3.79	22.42	15217
		6.00	*4.00*	*10.00*		*11.00*	*2.06*	*2.50*		*3.00*	*22.18*	
				6.92	5.16	12.08	2.55	3.10		8.51	28.22	15218
		5.00	*3.00*	*8.00*		*9.00*	*2.47*	*3.00*		*10.00*	*29.41*	
				6.94	4.41	11.35	2.22	2.70		5.37	23.19	15219
				8.04	1.87	9.91	1.48	1.80	5.78		20.62	15321
		5.00	*3.00*	*8.00*		*9.00*	*1.65*	*2.00*		*5.00*	*20.95*	
				6.63	5.59	12.22	2.49	3.02	3.40		21.07	15220
		6.00	*4.00*	*10.00*		*11.00*	*2.47*	*3.00*	*2.00*		*21.81*	
				8.67	3.29	11.96	3.21	3.90		5.83	28.35	15221
		6.00	*4.00*	*10.00*		*11.00*	*3.29*	*4.00*	*4.00*		*26.27*	
				8.56	3.06	11.62	2.65	3.22	1.56	3.93	25.72	15222
		6.00	*4.00*	*10.00*		*11.00*	*2.47*	*3.00*	*4.00*		*23.81*	
				11.35	2.20	13.55					11.35	15223
		7.00	*3.00*	*10.00*		*11.00*					*10.00*	
				12.28	6.86	19.14	1.95	2.37		2.10	25.85	15229
		5.00	*3.00*	*8.00*		*9.00*	*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.
	National Fertilizer Co.	
15248	Twentieth Century	Manufacturer ....
	North-Western Fertilizing Co., Chicago, Ill.	
15122	Horse Shoe Brand Quick Acting Phosphate	Manufacturer ....
15123	H. S. B. Bone and Potash..	Manufacturer ....
15322		Watkins & Co., Elizabethtown..
15124	H. S. B. Success Corn Grower.	Manufacturer ....
15323		Watkins & Co. .....
15125	H. S. B. Cap Sheaf Wheat Grower	Manufacturer ....
15126	H. S. B. Dark Tobacco Grower	Manufacturer ....
15127	H. S. B. Acidulated Bone and Potash	Manufacturer ....
15128	H. S. B. Corn and Wheat Grower	Manufacturer ....
15129	H. S. B. Kentucky Tobacco Grower	Manufacturer ....
15324		T. W. Buchanan & Co., Campbellsville ....
15130	H. S. B. Challenge Corn Grower	Manufacturer ....
15131	H. S. B. Tobacco 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.
				10.24	2.53	12.77			3.96		$17 26	15248
		8.00	*4.00*	*12.00*		*13.00*			*4.00*		*18.80*	
				10.18	2.55	12.73					10.18	15122
		8.00	*2.00*	*10.00*		*12.00*					*10.00*	
				9.99	3.40	13.39			2.11		15.46	15123
				10.26	1.23	11.49			1.75		14.55	15322
		7.00	*3.00*	*10.00*		*12.00*			*2.00*		*14.80*	
				6.52	2.90	9.42	1.11	1.35	1.54		13.85	15124
				7.21	2.33	9.54	1.06	1.29	1.02		13.78	15323
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				6.40	3.08	9.48	1.09	1.32	1.49		13.67	15125
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				6.82	2.80	9.62	1.05	1.27	1.50		13.95	15126
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				9.64	3.88	13.52	1.13	1.37	1.22		17.73	15127
		7.00	*3.00*	*10.00*		*12.00*	*0.82*	*1.00*	*1.00*		*16.26*	
				7.28	3.67	10.95	1.88	2.28	2.61		18.46	15128
		5.00	*3.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				7.36	3.58	10.94	1.81	2.20	2.70		18.39	15129
				8.49	3.74	12.23	1 66	2.02	1.52		18.19	15324
		5.00	*3.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				7.42	3.88	11.30	2.35	2.85	1.64		19.14	15130
		5.00	*3.00*	*8.00*		*10.00*	*2.06*	*2.50*	*1.50*		*18.08*	
				7.71	4.09	11.80	2.37	2.88	5.20		23.20	15131
		5.00	*3.00*	*8.00*		*10.00*	*2.06*	*2.50*	*5.00*		*21.58*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	North-Western Fertilizing Co.	
15132	H. S. B. Special Potato Grower	Manufacturer
15133	H. S. B. Raw Bone and Superphosphate Mixture	Manufacturer
15134	H. S. B. Pure Ground Bone	Manufacturer
15135	H. S. B. Special Bone Meal	Manufacturer
15136	H. S. B. Fine Raw Bone	Manufacturer
15325		E. P. Barnes & Bro., Beaver Dam
	The Ohio Farmer's Fertilizer Co., Columbus, O.	
15243	Soluble Bone and Potash	Manufacturer
15244	General Crop Fish Guano	Manufacturer
15245	Corn, Oats and Wheat Fish Guano	Manufacturer
15246	Tobacco Grower	Manufacturer
	Packer's Fertilizer Association, Chicago, Ill.	
15137	Boar's Head Brand Sp'l Tobacco Grower	Manufacturer
15138	B. H. B. Corn and Wheat Grower	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.		
				8.05	3.44	11.49	2.35	2.85	5.14		$23.23	15132
		5.00	*3.00*	*8.00*		*10.00*	*2.06*	*2.50*	*5.00*		*21.58*	
				6.52	7.07	13.59	2.79	3.39	1.29		20.31	15133
		4.00	*3.00*	*7.00*		*13.00*	*2.47*	*3.00*	*0.50*		*18.71*	
17.12	4.83					21.95	2.37	2.88			23.71	15134
						20.00	*2.47*	*3.00*			*19.41*	
19.53	7.59					27.12	1.37	1.66			24.28	15135
						25.00	*1.23*	*1.50*			*18.69*	
18.65	2.79					21.44	3.66	4.44			27.57	15136
20.26						20.26	4.08	4.95			28.45	15325
						22.00	*3.29*	*4.00*			*23.07*	
				11.23	2.74	13.97			3.01		17.59	15243
		8.00	*2.00*	*10.00*		*11.00*			*2.00*		*14.40*	
				8.15	1.82	9.97	0.62	0.75	1.23		13.60	15244
		5.00	*2.00*	*7.00*		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				8.47	2.57	11.04	1.28	1.55	2.05		17.08	15245
		5.00	*3.00*	*8.00*		*9.00*	*1.23*	*1.50*	*2.00*		*15.69*	
				9.24	2.03	11.27	0.90	1.09	6.94		21.54	15246
		5.00	*3.00*	*8.00*		*9.00*	*0.82*	*1.00*	*4.00*		*16.46*	
				6.94	4.00	10.94	1.82	2.21	2.70		18.09	15137
		5.00	*3.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				7.45	3.40	10.85	1.88	2.28	2.65		18.59	15138
		5.00	*3.00*	*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.
	Packers Fertilizer Association.	
15139	B. H. B. World-of-Good Pot. and Tob. Grower	Manufacturer ....
15140	B. H. B. World-of-Good Superphosphate	Manufacturer ....
15141	B. H. B. Kentucky Potash Mixture	Manufacturer ....
15142	B. H. B. Soluble Phosphate...	Manufacturer ....
15143	B. H. B. Potash Phosphate...	Manufacturer ....
15144	B. H. B. Chicago Bone Meal.	Manufacturer ....
	Pero & Stoecker, Louisville, Ky.	
15188	Pure Potato Grower	Manufacturer ....
15189	Pure Animal Matter Corn and Wheat Grower	Manufacturer ....
	The Queen City Fertilizer Co., Cincinnati, O.	
15199	Miami Valley Grain Grower..	Manufacturer ....
15200	Tobacco and Potato Grower..	Manufacturer ....
15201	Valley Gem Phosphate	Manufacturer ....
15202	High Gr. Corn and Wheat Grower with 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.	Estimated Value per Ton.	Station Number.
				7.84	3.81	11.65	2.40	2.91	5.31		$23.44	15139
		5.00	*3.00*	*8.00*		*10.00*	*2.06*	*2.50*	*5.00*		*21.58*	
				8.07	3.25	11.32	2.40	2.91	1.66		19.84	15140
		5.00	*3.00*	*8.00*		*10.00*	*2.06*	*2.50*	*1.50*		*18.08*	
				9.71	3.77	13.48			2.16		15.32	15141
		7.00	*3.00*	*10.00*		*12.00*			*2.00*		*14.80*	
				9.78	2.92	12.70					9.78	15142
		8.00	*2.00*	*10.00*		*12.00*					*10.00*	
				10.11	3.07	13.18			4.91		18.27	15143
		7.00	*3.00*	*10.00*		*12.00*			*4.00*		*16.80*	
16.86	5.04					21.90	2.52	3.06			24.07	15144
						20.00	*2.47*	*3.00*			*19.41*	
12.58	3.97					16.55	3.26	3.96		7.10	30.74	15188
						10.00	*3.50*	*4.25*		*6.00*	*23.70*	
12.38	5.82					18.20	4.15	5.04			25.84	15189
						10.00	*3.50*	*4.25*			*16.50*	
				8.91	2.30	11.21	0.82	1.00	1.69		15.76	15199
				10.00		*11.00*	*0.82*	*1.00*		*2.00*	*17.26*	
				8.81	1.51	10.32	0.78	0.95	3.80		17.31	15200
				8.00		*9.00*	*0.82*	*1.00*		*4.00*	*17.26*	
				10.47	1.80	12.27	0.72	0.87		0.98	16.62	15201
				10.00		*11.00*	*0.82*	*1.00*		*1.00*	*16.06*	
				10.42	1.18	11.60			2.21		15.18	15202
				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.
	Read Phosphate Co., Nashville, Tenn.	
15090	Read's High Grade Tobacco Grower	Manufacturer
15326		**Farmer's Supply Co., Madisonville**
15091	Read's High Grade Tobacco Special	Manufacturer
15092	Read's Blood and Bone No. 1	Manufacturer
15327		Farmer's Supply Co.
15093	Read's Farmer's Spc. Manure.	Manufacturer
15094	Read's Corn Grower Special	Manufacturer
15095	Read's Alkaline Bone	Manufacturer
15328		Wells & Powell, Glasgow
15096	Read's XXX Dissolved Bone.	Manufacturer
15232	Read's Soluble Bone	Manufacturer
	Smith Bros., Louisville, Ky.	
13748	Special Tobacco Grower	Manufacturer
13749	Standard Tobacco Grower	Manufacturer
13750	Kentucky Tobacco Grower	Manufacturer
13751	Corn and Wheat Grower	Manufacturer
15329		J. G. Trent, Big Clifty

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.
				8.26	1.48	9.74	2.04	2.48	0.84	3.28	$21.40	15090
				8.84	2.33	11.17	1.49	1.81	1.34	1.98	19.73	15326
				8.00			*1.65*	*2.00*		*4.00*	*19.35*	
				8.07	1.10	9.17	2.06	2.50	1.46	6.62	25.70	15091
				8.00			*1.65*	*2.00*		*8.00*	*24.15*	
				8.16	1.33	9.49	1.87	2.27	2.52		18.45	15092
				8.00	2.43	10.43	2.02	2.45	2.24		18.87	15327
				8.00			*1.65*	*2.00*	*2.00*		*16.55*	
				10.21	0.95	11.16	1.28	1.55	2.75		19.22	15093
				10.00			*0.82*	*1.00*	*3.00*		*17.46*	
				9.73	1.34	11.07	1.20	1.46	1.49		17.31	15094
				10.00			*0.82*	*1.00*	*1.00*		*15.46*	
				10.11	1.37	11.48			2.48		15.16	15095
				11.06	1.85	12.91			1.96		15.97	15328
				10.00					*2.00*		*14.00*	
				12.65	1.54	14.19					12.65	15096
				13.00							*13.00*	
				7.79	3.53	11.32	0.54	0.66	2.35		14.73	15232
				8.00			*0.82*	*1.00*	*2.00*		*14.06*	
				8.86	1.34	10.20	2.91	3.53		4.27	25.02	13748
		6.00	*2.00*	*8.00*		*10.00*	*2.47*	*3.00*		*4.00*	*22.61*	
				8.61	1.34	9.95	2.11	2.56		2.14	19.77	13749
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*		*2.00*	*17.75*	
				7.97	1.25	9.22	2.13	2.59		4.23	21.53	13750
		5.00	*2.00*	*7.00*		*9.00*	*1.65*	*2.00*		*4.00*	*18.95*	
				8.61	1.25	9.86	2.11	2.56		2.47	20.12	13751
				9.33	2.41	11.74	1.60	1.94	2.44		19.40	15329
		6.00	*2.00*	*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.
	Smith Bros., Louisville, Ky.	
13752	High Grade Potato Grower...	Manufacturer
15234		C. J. Fischer, Anchorage
13753	Grain Special	Manufacturer
13754	Success Crop Grower	Manufacturer
15330		J. G. Trent
13755	Bone and Potash	Manufacturer
15331		J. G. Trent
13756	Soluble Phosphate	Manufacturer
13757	Pure Raw Bone	Manufacturer
13758	Pure Bone Meal	Manufacturer
15332		J. G. Trent
	Oliver Smith Co., Wilmington, N. C.	
15231	Genuine Imported Peruvian Guano	Manufacturer
15236		S. A. Halcomb, Franklin
	Swift & Company, Chicago, Ill.	
13794	Swift's Pure Kentucky Tobacco Grower	Manufacturer
15333		C. E. Owen, Madisonville
13795	Swift's Pure Special Tobacco Fertilizer	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.		
				8.63	1.50	10.13	2.89	3.51		6.18	$27.05	13752
				8.59	1.34	9.93	2.63	3.19	0.94	5.06	25.75	15234
		6.00	*2.00*	*8.00*		*10.00*	*2.47*	*3.00*		*6.00*	*25.01*	
				10.72	0.90	11.62	1.07	1.30	2.17		18.60	13753
		6.00	*4.00*	*10.00*		*12.00*	*0.82*	*1.00*	*2.00*		*17.26*	
				7.97	0.70	8.67	1.30	1.58	1.24		14.98	13754
				8.02	2.48	10.50	1.04	1.26	1.30		15.03	15330
		5.00	*2.00*	*7.00*		*9.00*	*0.82*	*1.00*	*1.00*		*12.66*	
				10.45	0.81	11.26			2.24		15.10	13755
				11.82	1.25	13.07			2.10		16.78	15331
		6.00	*4.00*	*10.00*		*12.00*			*2.00*		*14.80*	
				15.04	0.77	15.81					15.04	13756
		10.00	*4.00*	*14.00*		*16.00*					*14.00*	
17.63	6.19					23.82	3.67	4.46			28.82	13757
						22.00	*3.71*	*4.50*			*24.33*	
22.38	4.26					26.64	2.67	3.24			28.47	13758
26.13	3.22					29.35	2.13	2.59			29.22	15332
						24.00	*2.47*	*3.00*			*21.81*	
				13.18	11.41	24.59	3.03	3.68	3.97		33.44	15231
				12.11	9.98	22.09	2.75	3.34	3.76		30.53	15236
						23.00	*2.97*	*3.60*		*4.25*	*27.81*	
				8.53	3.83	12.36	1.76	2.14		1.99	19.44	13794
				10.20	1.16	11.36	2.42	2.94	1.28	1.76	23.35	15333
				10.00		*13.00*	*1.65*	*2.00*		*2.00*	*20.55*	
				8.08	5.07	13.15	2.32	2.82		3.19	22.52	13795
				10.00		*13.00*	*2.47*	*3.00*		*3.00*	*24.21*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Swift & Company	
13796 15334	Swift's Pure Superphosphate.	Manufacturer ..... Wells & Powell, Glasgow .....
13797 15335	Swift s Pure Complete Fertilizer	Manufacturer ..... Smith Bros., Princeton .....
13798 15336	Swift's Pure Raw Bone Meal..	Manufacturer ..... Overstreet & Snyder, LaGrange.
13799	Swift's Pure Bone Meal	Manufacturer .....
13800	Swift's Pure Ammoniated Bone	Manufacturer .....
15001	Swift's Pure Ammoniated Bone and Potash	Manufacturer .....
15002	Swift's Pure Bone and Potash.	Manufacturer .....
15003 15337	Swift's Pure Vegetable and Tobacco Grower	Manufacturer ..... L. W. Irvin, Greenville .....
15004	Swift's Pure Special Phosphate and Potash	Manufacturer .....
15005	Swift's Pure Champion Wheat and Corn Grower	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.		
				7.40	3.21	10.61	1.65	2.00	2.12		$17.23	13796
				8.22	3.20	11.42	1.62	1.97	1.26	0.79	18.21	15334
				8.00		*12.00*	*1.65*	*2.00*	*2.00*		*18.15*	
				7.29	2.65	9.94	1.14	1.38	0.64	0.52	14.49	13797
				9.23	0.86	10.09	1.41	1.71	1.01		16.66	15335
				8.00		*11.00*	*1.03*	*1.25*	*1.00*		*14.89*	
19.87	4.97					24.84	4.34	5.27			31.90	13798
12.04	12.04					24.08	4.09	4.97			29.12	15336
						23.00	*3.71*	*4.50*			*24.93*	
21.68	4.44					26.12	2.80	3.40			28.40	13799
						25.00	*2.47*	*3.00*			*22.41*	
16.74	2.73					19.47	5.00	6.07			30.03	13800
						17.00	*4.94*	*6.00*			*25.02*	
15.80	3.01					18.81	4.42	5.37	3.78		31.49	15001
						16.00	*4.74*	*5.75*	*3.00*		*26.82*	
19.53	4.29					23.82	2.65	3.22	4.73		30.87	15002
						23.50	*2.47*	*3.00*	*3.00*		*24.51*	
				6.73	4.02	10.75	2.57	3.12		10.68	30.22	15003
				8.63	1.77	10.40	2.84	3.45		10.57	32.27	15337
				8.00		*10.00*	*2.47*	*3.00*		*10.00*	*29.81*	
				9.47	1.19	10.66			1.04	1.12	14.22	15004
				10.00		*11.00*			*2.00*		*14.40*	
				11.51	5.07	16.58	1.53	1.86	2.18		22.61	15005
				12.00			*1.65*	*2.00*	*2.00*		*21.35*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Swift & Company.	
15006	Swift's Pure Onion, Potato & Tobacco	Manufacturer
15233		Chas. J. Fischer, Anchorage
15338		Wells & Powell
15007	Swift's Pure Bone Meal and Blood	Manufacturer
15198	Swift's Special Bone Meal	Manufacturer
	Tennessee Chemical Co., Nashville, Tenn.	
13732	Ox Special Corn Grower	Manufacturer
15339		G. W. Richardson, Somerset
13733	Ox Special Tobacco Guano	Manufacturer
15340		Barren Co. Grocery & Hdw Co., Glasgow
13734	Ox High Grade Tobacco and Potato Grower	Manufacturer
13735	Ox Slaughter House Bone	Manufacturer
15341		G. W. Richardson
13736	Ox Alkaline Bone	Manufacturer
15120	Ox Potash Mixture	Manufacturer
15121	Ox Special Wheat and Corn Guano	Manufacturer
15342		Barren Co. Grocery & Hdw. Co.

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.
				6.77	3.08	9.85	1.66	2.02		7.16	$22.92	15006
				8.56	1.11	9.67	1.97	2.39	0.94	6.83	25.76	15233
				8.76	2.29	11.05	1.64	1.99		7.39	25.22	15338
				8.00		*11.00*	*1.65*	*2.00*		*7.00*	*24.15*	
19.69	4.92					24.61	3.55	4.31			29.35	15007
						23.00	*3.71*	*4.50*			*24.93*	
28.52	4.64					33.16	0.98	1.19			28.54	15198
						27.50	*0.82*	*1.00*			*18.96*	
				8.79	0.79	9.58	1.00	1.21		1.14	15.24	13732
				7.39	2.69	10.08	1.10	1.34	1.30	0.77	15.47	15339
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*		*1.00*	*12.46*	
				12.05	1.51	13.56	1.72	2.09		2.07	22.70	13733
				11.29	0.93	12.22	1.49	1.81	1.73		20.12	15340
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*		*2.00*	*18.75*	
				8.29	1.61	9.90	1.98	2.40		4.24	21.62	13734
		4.00	*3.00*	*7.00*		*8.00*	*1.65*	*2.00*		*4.00*	*18.55*	
				9.51	1.71	11.22	1.93	2.34		2.24	20.57	13735
				9.14	1.87	11.01	1.41	1.71	1.36	0.52	17.93	15341
		5.00	*3.00*	*8.00*		*9.00*	*1.65*	*2.00*		*2.00*	*17.35*	
				13.67	0.61	14.28				2.56	19.71	13736
		7.00	*5.00*	*12.00*		*13.00*			*2.00*		*16.80*	
				12.15	0.22	12.37				1.82	16.85	15120
		6.00	*4.00*	*10.00*		*11.00*			*2.00*		*14.40*	
				14.29	0.56	14.85	0.96	1.17		0.96	21.40	15121
				9.80	1.69	11.49	1.11	1.35	0.44	0.75	17.11	15342
		7.00	*5.00*	*12.00*		*13.00*	*0.82*	*1.00*	*1.00*		*18.26*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Tennessee Chemical Co.	
15184	Ox Phosphate	Manufacturer ....
15185	Ox Special Wheat Grower....	Manufacturer ....
15186	Ox Bone Meal	Manufacturer ....
15343		G. W Richardson .....
15254	Ox Potash Formula	Manufacturer ....
15272	Ox High Grade Dis. Bone...	Manufacturer ....
	Tuscarora Fertilizer Co., Chicago, Ill.	
13776	Ammoniated Phosphate	Manufacturer ....
15344		G. C. Cundiff, Somerset .....
13777	Tuscarora Standard	Manufacturer ....
15345		G. C. Cundiff ....
13778	Tuscarora Trucker	Manufacturer ....
13779	Big Four	Manufacturer ....
13780	Corn and Wheat Grower	Manufacturer ....
13781	Bone and Potash	Manufacturer ....
13782	Acid Phosphate	Manufacturer ....
13783	Tuscarora Bone Phosphate ..	Manufacturer ....

Table of Analyses.

Pounds in the Hundred.													
Phosphoric Acid.										Potash.		Estimated Value per Ton.	Station Number.
In Fine Bone.	In Medium Bone.	Soluble.	Reverted.	Available.	Insoluble.	Total.	Nitrogen.	Equivalent to Ammonia.	From Muriate.	From Sulphate.			
				13.34	1.01	14.35						$13.34	15184
		7.00	*5.00*	*12.00*		*13.00*						*12.00*	
				8.60	0.59	9.19	0.99	1.20		1.20		14.97	15185
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*		*1.00*		*12.46*	
24.55	2.14					26.69	1.16	1.41				24.40	15186
13.87	2.25					16.12	1.55	1.88				17.10	15343
						20.00	*0.82*	*1.00*				*14.46*	
				10.26	0.84	11.10				4.99		18.64	15254
		6.00	*4.00*	*10.00*		*11.00*			*4.00*			*16.40*	
				15.51	0.56	16.07						15.51	15272
		8.00	*6.00*	*14.00*		*15.00*						*14.00*	
				8.03	0.73	8.76	1.24	1.51	1.14			14.79	13776
				7.81	1.80	9.61	0.90	1.09	1.51			14.30	15344
		5.00	*2.00*	*7.00*		*9.00*	*0.82*	*1.00*	*1.00*			*12.66*	
				8.94	1.06	10.00	1.91	2.32	2.31			19.19	13777
				9.39	1.02	10.41	1.72	2.09	2.64			19.48	15345
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*			*17.35*	
				8.16	3.28	11.44	4.67	5.67		8.12		34.85	13778
		6.00	*2.00*	*8.00*		*10.00*	*4.12*	*5.00*		*7.00*		*31.16*	
				7.95	1.04	8.99	2.10	2.55	4.53			20.79	13779
		5.00	*2.00*	*7.00*		*9.00*	*1.65*	*2.00*		*4.00*		*18.95*	
				10.86	1.06	11.92	1.17	1.42	1.23			18.19	13780
		6.00	*4.00*	*10.00*		*12.00*	*0.82*	*1.00*	*1.00*			*16.26*	
				10.54	0.87	11.41			2.07			15.07	13781
		6.00	*4.00*	*10.00*		*12.00*			*2.00*			*14.80*	
				15.46	0.84	16.30						15.46	13782
		10.00	*4.00*	*14.00*		*16.00*						*14.00*	
				11.07	0.79	11.86						11.07	13783
		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.
	Tuscarora Fertilizer Co.	
13784	Tuscarora Raw Bone Meal	Manufacturer
13785	Animal Bone	Manufacturer
15256	Tuscarora Alkaline	Manufacturer
	Virginia-Carolina Chemical Co., Memphis Division, Memphis, Tenn.	
15106	Beef, Blood and Bone Fertilizer	Manufacturer
15263		Geo. Lucas, Constantine
15107	Scott's State Standard Guano	Manufacturer
15108	Royal High Grade Guano	Manufacturer
15109	National Tobacco Fertilizer	Manufacturer
15346		B. F. & J. H. Bryant, Shelbyville
15110	Gold Leaf Tobacco Fertilizer	Manufacturer
15111	Royal Tobacco Grower	Manufacturer
15112	Champion Corn and Wheat Grower	Manufacturer
15113	V. C. C. Ammoniated Fertilizer	Manufacturer
15114	Royal Grain 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.
15.84	8.52					24.36	3.69	4.48			$28.85	13784
						22.00	*3.71*	*4.50*			*24.33*	
22.05	4.51					26.56	2.69	3.27			28.42	13785
						24.00	*2.47*	*3.00*			*21.81*	
				10.87	0.40	11.27				4.82	18.98	15256
		8.00	*2.00*	*10.00*		*12.00*				*5.00*	*18.80*	
				9.53	1.52	11.05	1.91	2.32	2.18		19.96	15106
				9.35	0.99	10.34	1.65	2.00	2.03		18.60	15263
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				9.20	1.55	10.75	1.81	2.20	2.43		19.52	15107
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				11.68	1.28	12.96	1.83	2.22	2.20		22.22	15108
		8.00	*2.00*	*10.00*		*12.00*	*1.65*	*2.00*	*2.00*		*19.75*	
				8.10	1.52	9.62	2.12	2.57	1.60	2.39	21.16	15109
				6.45	0.78	7.23	1.75	2.12		3.11	17.03	15346
		5.00	*2.00*	*7.00*		*9.00*	*1.65*	*2.00*		*4.00*	*18.95*	
				8.93	1.15	10.08	1.83	2.22		4.22	21.73	15110
		5.00	*2.00*	*7.00*		*9.00*	*1.65*	*2.00*		*4.00*	*18.95*	
				9.71	1.34	11.05	1.79	2.17	1.52	3.11	22.81	15111
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*		*5.00*	*21.35*	
				9.38	1.57	10.95	1.01	1.23	2.07		16.99	15112
		6.00	*2.00*	*8.00*		*10.00*	*0.82*	*1.00*	*2.00*		*14.86*	
				11.52	1.73	13.25	1.05	1.27	2.91		20.57	15113
		7.00	*3.00*	*10.00*		*12.00*	*0.82*	*1.00*	*3.00*		*18.26*	
				10.80	1.88	12.68			4.06		17.77	15114
		8.00	*2.00*	*10.00*		*12.00*			*4.00*		*16.80*	

TABLE OF ANALYSES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Virginia-Carolina Chemical Co.	
15115	Capital Bone and Potash Compound	Manufacturer
15116	Royal Compound	Manufacturer
15117	Royal Dissolved Bone	Manufacturer
15118	Capital Dissolved S. C. Bone	Manufacturer
15119	Pure Raw Animal Bone	Manufacturer
15262	Royal Potash Compound	Manufacturer
	Wake Fertilizer Co., Adairville, Ky.	
15227	Old Kentucky Tobacco Grower	Manufacturer
	Wood, Stubbs & Co., Louisville, Ky.	
15036	Acme Brand Special Truckers Fertilizer	Manufacturer
15037	Acme Br. Wheat and Corn Fertilizer	Manufacturer
15038	Acme Br. Potato and Tobacco Fertilizer	Manufacturer
15039	Acme Br. Blood, Bone 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.		
				10.77	2.24	13.01			2.33		$16.15	15115
		8.00	*2.00*	*10.00*		*12.00*			*2.00*		*14.80*	
				11.18	1.89	13.07			2.24		16.42	15116
		8.00	*2.00*	*10.00*		*12.00*			*2.00*		*14.80*	
				15.56	1.51	17.07					15.56	15117
		12.00	*2.00*	*14.00*		*16.00*					*14.00*	
				13.69	2.34	16.03					13.69	15118
		10.00	*2.00*	*12.00*		*14.00*					*12.00*	
18.79	1.86					20.65	3.23	3.92			25.84	15119
						20.00	*3.29*	*4.00*			*21.87*	
				11.68	1.55	13.23			3.99		18.63	15262
		8.00	*2.00*	*10.00*		*12.00*			*4.00*		*16.80*	
				5.23	0.35	5.58	4.19	5.09		12.16	33.58	15227
				6.25			*3.09*	*3.75*		*8.00*	*26.37*	
				8.94	1.41	10.35	2.38	2.89		2.53	21.47	15036
				8.00		*10.00*	*2.47*	*3.00*		*2.00*	*20.21*	
				10.36	0.78	11.14	1.06	1.29	1.08	0.76	17.91	15037
				10.00		*12.00*	*0.82*	*1.00*		*2.00*	*17.66*	
				8.80	1.19	9.99	2.47	3.00		5.98	25.63	15038
				8.00		*10.00*	*2.47*	*3.00*		*6.00*	*25.01*	
				9.17	1.33	10.50	2.25	2.73		2.80	21.64	15039
				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.
	Wood, Stubbs & Co.	
15040	Acme Br. High Grade Vegetable Fertilizer	Manufacturer ....
15152	Acme Br. Raw Bone Meal ...	Manufacturer ....
15153	Acme Br. Steamed Bone Meal.	Manufacturer ....
15154	Acme Br. Pulverized Tobacco Stems	Manufacturer ....

August 16, 1905.

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.		
				10.76	0.92	11.68	2.51	3.05		4.93	$26.73	15040
				10.00		*12.00*	*3.29*	*4.00*		*4.00*	*27.47*	
11.03	11.03					22.06	4.03	4.89			27.53	15152
						22.00	*3.29*	*4.00*			*23.07*	
22.16	3.61					25.77	3.13	3.80			29.29	15153
						28.00	*2.47*	*3.00*			*24.21*	
							2.91	3.53		9.54	20.18	15154
							2.47	*3.00*		*10.00*	*19.41*	

M. A. SCOVELL, Director and Chemist.
H. E. CURTIS, Chemist, Fertilizers.
W. H. SCHERFFIUS, Chemist.
O. M. SHEDD, Ass't Chemist.

KENTUCKY

Agricultural Experiment Station

OF THE

State College of Kentucky.

BULLETIN NO. 122.

CORN.

1. A METHOD OF SELECTING SEED CORN.
2. A CHEMICAL STUDY OF THE COMPOSITION OF A NUMBER OF VARIETIES OF KENTUCKY CORN.

LEXINGTON, KENTUCKY.
December, 1905.

KENTUCKY

Agricultural Experiment Station

BOARD OF CONTROL.

GEO. B. KINKEAD, Chairman, Lexington, Ky.
D. F. FRAZEE, Lexington, Ky.
C. B. NICHOLS, Lexington, Ky.
J. K. PATTERSON, President of the College.
M. A. SCOVELL, Director, Secretary.

STATION OFFICERS.

M. A. SCOVELL, Director and Chemist.
A. M. PETER, Chemist.
H. E. CURTIS, Chemist, Fertilizers.
H. GARMAN, Entomologist and Botanist.
W. H. SCHERFFIUS, Chemist.
R. M. ALLEN, Secretary, Food Division.
J. D. TURNER, Secretary.
J. O. LaBACH, Chemist, Food Division.
Miss M. L. DIDLAKE, Ass't Entomologist and Botanist.
S. D. AVERITT, Ass't Chemist.
O. M. SHEDD, Ass't Chemist.
H. W. TAYLOR, Ass't to Entomologist and Botanist.

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. 122

1. A METHOD OF SELECTING SEED CORN.
2. A CHEMICAL STUDY OF THE COMPOSITION OF A NUMBER OF VARIETIES OF KENTUCKY CORN.

By W. H. SCHERFFIUS, Chemist.

Introduction—The results contained in this Bulletin represent a series of experiments dealing with different phases of the subject, the object being to illustrate the need and suggest methods to increase the yield and improve the varieties of corn grown in different sections of the State. This work is only the beginning of a series of experiments which we hope will be of benefit to the farming public. In undertaking this line of work, we found it necessary to call to our assistance farmers in different sections of the State, and, in this way we obtained those samples of corn which were most commonly grown in their respective communities. The immediate response to all letters asking them to assist in these investigations, the collecting and sending of samples, all indicate their desire to improve this branch of their vocation. We learned on receiving these samples that some of them had been cultivated for many years by the farmers from whom they were obtained. No doubt some of these varieties have been cross-bred until they have lost their original identity and are now known only by some local name. New phases of the subject presented themselves as the work progressed which will be seen from the tables that follow.

1. A METHOD OF SELECTING SEED CORN.

The time was, when the farmers all went to their "cribs" at planting-time and selected their seed, but that day has passed. Land is more expensive, labor higher and competition keener. To meet these demands, we must get the maximum production for the minimum expense. The successful farmer is the one who adopts scientific as well as pratical business methods. We have two principal objects in view when we carefully select our seed corn, namely: increasing the yield and improving the variety. The place and time to select our seed is in the field in the early fall before the regular husking. Go into the field, select good stalks with good ears, medium height from the ground, with medium size spur or boot just long enough to give the ear a nice droop, husk and hang up in open shed where the air will dry out thoroughly, then transfer to the attic or dry cellar before the freezes begin. Test the vitality of each year of corn intended for seed. This is done by means of a germinating box, simple in construction. Make this box any convenient size, about two inches deep. Cover the bottom about an inch deep with moist soil or sawdust, sawdust preferred. Spread a piece of white cloth that has been previously marked off both ways into checks about one and one-half inches in width, checker-board fashion, over this soil or sawdust. Number the checks beginning in one corner 1, 2, 3, etc. Place the ears of corn to be tested along in a row and number the cars 1, 2, 3, etc. Take a pocket knife and pry out a half dozen grains from each ear, and from different rows and different whorls on the ear to insure a fair representation of the ear. Place the grains from ear No. 1 in check No. 1, those from ear No. 2 in check No. 2, etc. After all the checks are filled, spread another cloth over and down on the grains in the checks, put another inch of moist soil or sawdust on top of this and set it away in the house or flower pit where it will not get too cold. In about five days take off the top layer of soil or sawdust, then remove the cloth from over the grains and make a careful study of your experiment. See plate 1.

Some of the checks will have grains with strong, vigorous stem sprouts; others will have little, short, weak stem sprouts; while others will have grains that have no stem sprouts at all. This means that some are from strong parents and will give strong stalks to produce ears of corn, while others are from weak parents and will give barren stalks and stalks with "nubbins." Those that failed to have a stem sprout, will give missing hills. We want to throw away those weaklings and those that show no vitality; because one such ear means a thousand missing hills or barren stalks.

It is a good policy to select, after the germinating test has been applied, a few of the nicest shaped ears and plant them on, say an acre, then we may select our seed from this acre for the following year. It is best to plant these choice ears on the south or west side of the corn field, since most of our winds blow from those directions; however, if our neighbor on the south or west side plants corn near us, then it is best to plant the select ears as far from him as possible, else our corn may be badly mixed with the wind-blown pollen from his corn field. We can further improve this crop by going into this "seed acre" before the pollen on the tassels gets ripe, and cut out all the small, weak stalks. That will prevent them from cross breeding into the ears on the stronger ones.

To get the best results we must have a "good stand." This can be accomplished by following the above method for the selection of our seed ears, and can be further improved by discarding the butts and nubs, also by hand picking out the blasted and rotten grains. It is also important to adjust the planter to give you exactly the number of stalks desired in each hill. If every farmer in the State would test each ear of his seed corn next March, before planting time, it would increase Kentucky's yield of corn thousands of bushels. Any farmer planting from twenty to fifty acres of corn can prepare and test enough ears in one day to plant his entire crop; and that one day's work may be worth more to him than a month's time later in the season, if he neglects it.

Poor "seed corn" has reduced the stand in Kentucky to

approximately sixty-five per cent. by actual count. We have examined a good number of corn fields in different parts of the State, and while some gave a higher percentage than the above figure, a great many fell below this, and some far below. Leaving the seed corn out in the field, or cribbing it while it is full of moisture to take the freezes is another cause of a "bad stand."

By referring to the descriptions of samples tested and the tables of analyses, we are impressed with the need of some uniformity of type and improvement that will increase the feeding value of many of our strains of corn.

2. A CHEMICAL STUDY OF THE COMPOSITION OF A NUMBER OF VARIETIES OF KENTUCKY CORN.

In the following descriptions, one will notice great differences in the physical appearance, not only in the several varieties, but these differences are readily noticeable in samples of the same variety. Different climatic conditions, soil conditions and cross-breeding have, no doubt, all had their influence on many of these strains of corn. In view of these facts, one would expect to find some variation in the chemical composition, even in different specimens of the same variety grown in the same field.

14625 McFarland and Willis.

This sample was obtained from George Brown, Boydsville, Graves County, Kentucky. Matures in about 114 days, very sound corn, grows on large stalk and high from the ground. There are 50 whorls, 18 rows of grains on the ear examined; ear is white; cob is light red; weighs 65 grams; crop, 1903. The soil on which it was grown is sandy bottom.

14630 Gourd Seed.

This sample was obtained from Ed. Mielke, Hopkinsville, Christian County, Kentucky. Color, white; Weight, 343

grams; circumference near butt, 7 1-4 inches; number of whorls, 48; number of rows, 18; cob is white; crop of 1903. The soil on which it was grown is red clay.

14632 Garrett.

This sample of Garrett, probably mixed with Willis, was obtained from G. L. Campbell, Russellville, Logan County, Kentucky. Color of cob and corn is white; weight, 341 grams; length, 8 1-2 inches; circumference near butt, 7 1-4 inches; number of whorls, 54; number of rows, 14; crop of 1903. The soil on which it was grown is limestone.

14642 Farmer's Interest.

This sample was obtained from George Brown, Boydsville, Graves County, Kentucky. Matures in about 100 days and is said to weigh 60 pounds to the bushel. The ear grows near the ground on small stalk; weighs 322 grams; ear is white, 7 1-2 inches long; circumference near the butt, 7 1-4 inches; number of whorls, 44; number of rows, 16; crop of 1903. The soil on which it was grown is sandy bottom.

14645 Little Willis.

This sample was obtained from Ed. Mielke, Hopkinsville, Christian County, Kentucky. The ear and cob are white; weight, 278 grams; length, 9 inches; circumference near the but, 6 1-4 inches; number of whorls, 48; number of rows, 14; crop of 1903. The nub end was imperfectly filled out especially on one side. The soil on which it was grown is red clay.

14661 Hannah

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. Ear is white; weight, 288 grams; length, 7 inches; circumference near the butt, 7 inches; number of whorls, 39; number of rows, 14; red cob; crop of 1904. This corn was grown on limestone soil.

14662 Cocke Prolific.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. The ear is white; weight, 298 grams; length, 7 3-4 inches; circumference near the butt, 6 3-4 inches; number of whorls, 44; number of rows, 14; white cob; crop of 1904. Grown on limestone soil.

14663 Iowa Silver Mine.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. Ear is white; weight, 200 grams; length, 6 inches; circumference near the butt, 6 1-4 inches; number of whorls 39; number of rows, 16; white cob; crop of 1904. Grown on limestone soil.

14664 McMackins Gourd Seed.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. Ear is white; weight, 320 grams; length, 8 inches; circumference near the butt, 7 1-4 inches; number of whorls, 51; number of rows, 18; white cob; crop of 1904. Grown on limestone soil.

14665 Mosby's Prolific.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. Ear is white; weight, 195 grams; length, 7 1-2 inches; circumference near the butt, 5 3-4 inches; number of whorls, 53; number of rows, 12; white cob; crop of 1904. Grown on limestone soil.

14666 Boone County Special.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. Ear is white; weight, 355 grams; length, 8 inches; circumference near the butt, 7 inches; number of whorls, 45; number of rows, 20; white cob; crop of 1904. Grown on limestone soil.

14667 Boone County White.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. Ear is white; weight, 301 grams; length, 7 1-2 inches; circumference near the butt, 7 inches; number of whorls, 46; number of rows, 18; cob is white; crop of 1904. Seed came from Tennessee. Grown on limestone soil.

14668 Boone County White.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. Ear is white; weight, 284 grams; length, 8 inches; circumference near the butt, 6 3-4 inches; number of whorls, 50; number of rows, 14; white cob; crop of 1904. Seed came from Indiana. Grown on limestone soil.

14669 Champion White Pearl.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. Ear is white; weight, 345 grams; length, 8 inches; circumference near the butt, 7 3-4 inches; number of whorls, 55; number of rows, 16; white cob; crop of 1904. Grown on limestone soil.

14670 Roseland White.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. Ear is white; weight, 289 grams; length, 7 1-4 inches; circumference near the butt, 7 1-4 inches; number of whorls, 44; number of rows, 12; white cob; crop of 1904. Grown on limestone soil.

14671 Saunders' Improved.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. Ear is white; weight, 288 grams; length, 8 1-4 inches; circumference near the butt, 6 1-4 inches; number of whorls, 53; number of rows, 14; white cob; crop of 1904. Grown on limestone soil.

14672 U. S. P. B. Selection No. 77.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. Ear is white; weight, 317 grams; length, 7 3-4 inches; circumference near the butt, 6 3-4 inches; number of whorls, 45; number of rows, 18; white cob; crop of 1904. Grown on limestone soil.

14673 Reid Yellow Dent.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. Ear is yellow; weight, 276 grams; length, 8 inches; circumference near the butt, 6 1-4 inches; number of rows of grains, 20; number of whorls, 43; red cob; crop of 1904. Grown on limestone soil. The ear was considerably mixed with white tipped grains which had a lighter color than the yellow grains.

14674 Leaming Yellow.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. Ear is yellow; weight, 203 grams; length, 7 inches; circumference near the butt, 6 1-4 inches; number of whorls, 46; number of rows, 18; red cob; crop of 1904. Grown on limestone soil. The ear was considerably mixed with white tipped grains which were of a lighter color than the yellow ones.

14675 Riley's Favorite.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. Ear is yellow; weight, 263 grams; length, 7 1-2 inches; circumference near the butt, 6 1-2 inches; number of rows, 14; number of whorls, 50; cob is red; crop of 1904. Grown on limestone soil. The ear was considerably mixed with white tipped grains, which were of a lighter color than the yellow grains.

14685 Roseland.

Obtained from J. N. Harper, grown at the Experiment Station, Fayette County, Kentucky. A small sample of shelled corn, broad, white grains; crop of 1904. Grown on limestone soil.

14686 Red Corn.

This sample was obtained from E. F. Dean, Iron Hill, Crittenden County, Kentucky. Ear is dark red, nub end broken off; remainder is 9 1-4 inches long; circumference near the butt, 7 inches; has 53 grains in one row which weighs 26 grams; cob is reddish.

14687 Red Corn.

This sample was obtained from E. F. Dean, Iron Hill, Crittenden County, Kentucky. Ear is red, has 3 inches of nub shelled off, length, 9 3-4 inches; circumference near the butt, 7 inches; has 45 grains remaining in each row; one row weighs 15 grams; cob is red.

14688 Mixed Corn.

This sample was obtained from E. F. Dean, Iron Hill, Crittenden County, Kentucky. A portion of an ear of mixed corn, mixed from a variety of red and a variety of yellow; grains, reddish with yellow tips; cob is red. Mr. Dean had it marked, "fine color." This represents three years' mixing.

14689 Mixed Corn.

This sample was obtained from E. F. Dean, Iron Hill, Crittenden County, Kentucky. Ear is red with yellowish tips; length 9 1-2 inches; circumference near the butt, 7 1-2 inches; 1 1-2 inches of the nub had been shelled off; cob is red; crop of 1904.

14690 Mixed Corn.

This sample was obtained from E. F. Dean, Iron Hill, Crittenden County, Kentucky. Ear is light red with yellow tipped grains; length, 9 1-2 inches; circumference near the butt, 6 1-2 inches; has 58 grains in one row, weighing 22 grams; one inch of the nub had been shelled off; cob is white; crop of 1904.

14691 Yellow Corn.

This sample was obtained from E. F. Dean, Iron Hill, Crittenden County, Kentucky. Length of ear, 10 inches; circum-

ference near the butt, 7 1-4 inches; two inches of the nub had been shelled off; cob is red; crop of 1904.

14692 Yellow Corn.

This sample was obtained from E. F. Dean, Iron Hill, Crittenden County, Kentucky. Ear measures 9 1-2 inches in length; circumference near the butt, 6 3-4 inches; one inch of the nub had been shelled off; cob is white; crop of 1904. Mr. Dean took the crop from which 14691 and 14692 came, and mixed them with 14686 and 14687 by shelling them together and planting the mixed seed; as a result he obtained 14688, 14689 and 14690.

14693 Yellow Corn.

This sample was obtained from J. S. Yankey, Springfield, Washington County, Kentucky. Four ears of corn which will be designated by a, b, c, and d.

14693a Measures 9 1-2 inches in length; circumference, near the butt, 8 inches; weight, 409 grams; has 52 whorls; 14 rows; one row of grains weighs 21 grams; cob is white.

14693b Measures 9 1-2 inches in length; circumference near the butt, 8 inches; weight, 415 grams; one row of grains weighs 21 grams; number of rows, 16; number of whorls, 56; cob is red; crop of 1904.

14693c Measures 9 1-2 inches in length; circumference near the butt, 8 1-4 inches; weight, 434 grams; one row of grains weighs 21 grams; number of rows, 14; number of whorls, 52; cob is red; crop of 1904.

14693d Measures 10 1-2 inches in length; circumference near the butt, 8 1-4 inches; weight, 489 grams, one row of grains weighs 24 grams; number of rows, 18; number of whorls, 54; crop of 1904.

14696 Yellow Corn.

This sample consists of two ears of corn from R. S. Jackson, Hickory Flat, Simpson County, Kentucky. Matures in about 90 days. Grown on red clay soil.

14696a Measures 8 1-2 inches in length; circumference near the butt, 6 1-2 inches; weight, 267 grams; one row of grains weighs 1° grams; number of whorls, 52; cob is red.

14696b Measures 9 1-2 inches in length; circumference near butt, 6 1-2 inches; weight, 294 grams, one row of grains weighs 21 grams; number of whorls, 52; cob is red.

14697 Red Cob Willis.

This sample consists of two ears of corn obtained from Isaiah Bowden, Sedalia, Graves County, Kentucky. Yields 60 to 65 bushels per acre. Grown on bottom land, soil about twelve inches deep, heavy, no sand; dark red sub-soil.

14697a Measures 8 3-4 inches in length; circumference near the butt, 7 inches; weight, 318 grams, one row of grains weighs 20 grams; number of whorls, 62.

14697b Measures 9 1-2 inches in length; circumference near the butt, 7 inches; weight, 390 grams; one row of grains weighs 25 grams; number of whorls, 52.

14698 Red Cob Willis.

This sample consists of two ears of corn obtained from J. C. Colly, Sedalia, Graves County, Kentucky. Yield, 60 bushels per acre; grown on black soil, red sub-soil.

14698a Measures 8 inches in length; circumference near the butt, 6 1-2 inches; weight, 348 grams, one row of grains weighs 19 grams; number of whorls, 53.

14698b Measures 8 3-4 inches in length; circumference near the butt, 7 inches; weight, 332 grams, one row of grains weighs 20 grams; number of whorls, 50.

14706 Hickory King.

This sample consists of three ears of corn obtained from J. W .Kelly, Hickory Flat, Simpson County, Kentucky. Matures in about 110 days; 8 rows to the ear; small white cob; grown on red clay soil.

14706a Measures 7 inches in length; circumference

near the butt, 6 inches; weighs 253 grams, one row of grains weighs 27 grams; number of whorls, 44.

14706b Measures 7 1-4 inches in length; circumference near the butt, 5 1-2 inches.

14706c Measures 7 1-2 inches in length; circumference near the butt, 5 3-4 inches; weight, 243 grams, one row weighs 26 grams; number of whorls, 49.

14707 Garrett.

This sample consists of four ears of corn obtained from J. W. Kelly, Hickory Flat, Simpson County, Kentucky. Matures in about 110 days; grown on red clay soil.

14707a Measures 8 1-2 inches in length; circumference near the butt, 6 1-2 inches; weighs 328 grams, one row of grains weighs 20 grams; number of rows, 14; number of whorls, 50; cob is red.

14707b Measures 9 inches in length; circumference near the butt, 6 inches; weighs 305 grams; one row of grains weighs 25 grams; number of rows, 10; number of whorls, 52; cob is white.

14707c Measures 9 3-4 inches in length; circumference near the butt, 7 3-4 inches; weighs 506 grams; one row of grains weighs 24 grams; number of rows, 18; number of whorls, 56; cob is white.

14707d Measures 9 inches in length; circumference near the butt, 6 1-4 inches; weighs 346 grams, one row of grains weighs 26 grams; number of rows, 12; number of whorls, 58; cob is white.

14709 Mixed Corn.

This sample consists of two ears of corn obtained from E. F. Dean, Iron Hill, Crittenden County, Kentucky. Mr. Dean has grown this mixed corn for three years.

14709a Measures 10 1-2 inches in length; circumference ence near the butt, 6 1-2 inches; weighs 389 grams, one row of grains weighs 26 grams; number of rows, 12; number of whorls, 53; grains red with yellowish tips; cob is light red; crop of 1904.

14709b Measures 10 3-4 inches in length; circumference near the butt, 7 inches; weighs 414 grams; one row of grains weighs 23 grams; number of rows, 14; number of whorls, 59; grains dark red with yellowish tips; cob is red; crop of 1904.

14710 McFarland.

This sample consists of two ears of corn obtained from Frank Pittman, Fulton, Fulton County, Kentucky.

14710a Measures 9 1-4 inches in length; circumference near the butt, 7 1-4 inches; weighs 370 grams; one row of grains weighs 20 grams; number of rows, 16; number of whorls, 53; cob is white; crop of 1904; grains were brownish at the base and emitted a disagreeable odor; grown on black loam.

14710b Measures 9 1-4 inches in length; circumference near the butt, 8 1-4 inches; weighs 509 grams; one row of grains weighs 24 grams; number of rows, 18; number of whorls, 51; cob is white; crop of 1904; grains were very slightly brownish at the base; grown on black loam.

14711 McFarland.

This sample consists of two ears of corn obtained from Phillip Howard, Fulton, Fulton County, Kentucky. Grown every year by Mr. Howard for forty years; crop of 1904; cob is white.

14711a Measures 8 inches in length; circumference near the butt, 8 1-4 inches; weighs 426 grams; one row of grains weighs 20 grams; number of rows, 18; number of whorls, 50.

14711b Measures 8 1-2 inches in length; circumference near the butt, 7 3-4 inches; weighs 404 grams, one row of grains weighs 21 grams; number of rows, 16; number of whorls, 56.

14716 Boone County White.

This sample consists of two ears of corn obtained from Allen Reid, Owensboro, Daviess County, Kentucky. Cob is white; crop of 1904.

14716a Measures 9 1-2 inches in length; circumference near the butt, 8 1-2 inches; weighs 550 grams, one row of grains weighs 20 grams; number of rows, 24; number of whorls, 55. These grains were slightly brownish at base.

14716b Measures 9 3-4 inches in length; circumference near the butt, 8 1-4 inches; weighs 509 grams, one row weighs 22 grams; number of rows, 20; number of whorls, 53.

14717 Boone County White.

This sample was obtained from Charles Caldwell, Danville, Boyle County, Knetucky. Measures 10 inches in length; circumference near the butt, 8 inches; weighs 526 grams; one row weighs 25 grams; number of rows, 20; number of whorls, 60; cob is white; crop of 1904.

14718 Robinson County Corn.

This sample consists of two ears of corn obtained from R. M. Mann, Mt. Olivet, Robinson County, Kentucky. The seed was obtained originally from T. B. Mills, New York, about ten years ago. Heavy yield, stands drouth, slow to mature.

14718a Measures 11 1-4 inches in length; circumference near the butt, 7 inches; weighs 464 grams; one row weighs 31 grams; number of rows, 12; number of whorls, 61; cob is white; crop of 1904.

14718b Measures 10 1-2 inches in length; circumference near the butt, 7 1-4 inches; weighs 436 grams, one row weighs 24 grams; number of rows, 14; number of whorls, 59; cob is red; crop of 1904.

14750 Big White.

This sample was obtained from Nimrod Morrow, Morrow, Wayne County, Kentucky. From crop planted about the 6th of May, 1904. The stalks grew to the height of 12 to 14 feet and produced from one to two ears to the stalk, the yield being about 50 bushels per acre. No fertilizer had ever been used on the land. The soil is black loam, river bottom. The three ears are designated as a, b, and c.

14750a This ear is 8 1-2 inches long, circumference near the butt, 8 1-4 inches; number of rows of grains, 18; number of whorls, 55; weighs 492 grams, one row weighs 23 grams; color of cob, red; color of grains at base, brownish indicating that they are damaged.

14750b This ear is 8 inches long, circumference near the butt, 8 inches; number of rows of grains, 18; number of whorls, 44; weighs 382 grams, one row of grains weighs 16 grams; color of cob, dark red; color of grains at the base, brownish, indicating that they are damaged.

14750c This ear is 8 inches long, circumference near the butt, 7 3-4 inches; number of rows of grains, 18; number of whorls, 53; weighs 333 grams, one row of grains weighs 15 grams.

14751 Red Corn.

This sample was obtained from A. T. Biggs, Corydon, Henderson County, Kentucky. Color, light red with yellow tips; cob is white; cultivated on botom land, which has been cultivated in corn continuously for the past 20 years; yield 55 to 60 bushels per acre; crop of 1904.

14751a Measures 8 1-4 inches in length; circumference near the butt, 7 1-4 inches; number of rows, 16; number of whorls, 49; weighs 336 grams, one row weighs 17 grams.

14751b Measures 8 1-2 inches in length; circumference near the butt, 6 1-2 inches; number of rows, 12; number of whorls, 47; weighs 306 grams, one row weighs 19 grams.

14752 Yellow Corn.

This sample was obtained from A. T. Biggs, Corydon, Henderson County, Kentucky. Color, yellow; yield, 50 bushels per acre; crop of 1904; cob, red; grown on ridge land following wheat.

14752a Measures 9 1-2 inches in length; circumference near the butt, 7 inches; number of rows, 16; number of whorls, 52; weighs 367 grams, one row weighs 20 grams.

14752b Measures 9 inches in length; circumference

near the butt, 7 inches; number of rows, 18; number of whorls, 50; weighs 340 grams, one row weighs 14 grams; grains appeared to be damaged at the base.

14753 White Corn.

This sample was obtained from A.T. Biggs, Corydon, Henderson County, Kentucky. Color, white; yield, 55 bushels per acre; crop of 1904; cob, white; grown on bottom land.

14753a Measures 9 1-4 inches in length; circumference near the butt, 9 inches; number of rows, 18; number of whorls, 54; weighs 506 grams, one row weighs 22 grams.

14753b Measures 7 3-4 inches in length; circumference near the butt, 7 1-2 inches; number of rows, 14; number of whorls, 50; weighs 374 grams, one row weighs 23 grams.

14778 Yellow Corn.

This sample was obtained from J. W. McFarlin, Franklin, Simpson County, Kentucky. Color, yellow; red cob; crop of 1904; grown on red clay soil; measures 9 1-4 inches in length; circumference near the butt, 6 3-4 inches; number of rows, 14; number of whorls, 59; weighs 388 grams; one row weighs 24 grams.

14779 White Corn.

This sample was obtained from J. W. McFarlin, Franklin, Simpson County, Kentucky. Color of corn and cob, white; crop of 1904; grown on red clay soil; measures 10 3-4 inches in length; circumference near the butt, 8 inches, number of rows, 18; number of whorls, 61, weighs 527 grams, one row weighs 24 grams.

14780 Gourd Seed and McFarland Mixed.

This sample was obtained from William Scherffius, Lynnville, Graves County, Kentucky. Color of corn and cob, white; crop of 1904; grown on creek bottom land; yield, 60 bushels per acre; measures 9 3-4 inches in length; circumference near the butt, 7 1-2 inches; number of rows, 14; number of whorls, 54; weighs 477 grams, one row weighs 28 grams.

14781 Yard Long.

This sample was obtained from H. W. Parton, Lynnville, Graves County, Kentucky. Color, yellow; red cob; crop of 1904; grown on third year, ridge land; yield, 57 1-2 bushels per acre; measures 10 1-4 inches in length; circumference near the butt, 7 1-4 inches; number of rows, 16; number of whorls, 56; weighs 455 grams, one row weighs 26 grams.

14782 McFarland.

This sample was obtained from G. W. Brown, Boydsville, Graves County, Kentucky. Color of corn and cob, white; crop of 1904; grown on sandy bottom land; yield, 50 bushels per acre; measures 9 1-2 inches in length; circumference near the butt, 7 1-4 inches; number of rows, 14; number of whorls, 59; weighs 397 grams, one row weighs 24 grams; towards the nub end damaged.

14783 Farmers' Interest.

This sample was obtained from G. W. Brown, Boydsville, Graves County, Kentucky. Color of corn and cob, white; crop of 1904; grown on sandy bottom land; yield, 50 bushels per acre; measures 8 1-4 inches in length; circumference near the butt, 8 inches; number of rows, 18; number of whorls, 50; weighs 410 grams, one row weighs 20 grams.

14784 The Illinois Yellow.

This sample consisting of three ears was obtained from T. E. Conley, Rankin, Wayne County, Kentucky. Color, yellow; cob, red; crop of 1904; grown on loose black loam; yield, 90 bushels per acre.

14784a Measures 10 1-2 inches in length; circumference near the butt, 7 inches; number of rows, 16; number of whorls, 63; weighs 392 grams, one row of grains weighs 23 grams.

14784b Measures 9 3-4 inches in length; circumference near the butt, 6 3-4 inches; number of rows, 12; number of whorls, 62; weighs 323 grams, one row of grains weighs 22 grams.

14784c Measures 9 1-2 inches in length; circumference near the butt, 6 3-4 inches; number of rows, 14; number of whorls 58; weighs 389 grams, one row weighs 25 grams.

14785 Indiana Yellow.

This sample, consisting of three ears, was obtained from W. M. and Dr. J. B. Eads, Eadsville, Wayne County, Kentucky. Color, yellow; cob, pale red; crop of 1904; grown on thin, sandy land; yield, 30 bushels per acre.

14785a Measures 7 1-2 inches in length; circumference near the butt, 7 inches; number of rows, 12.

14785b Measures 7 1-2 inches in length; circumference near the butt, 7 inches; number of rows, 14; number of whorls, 48; weighs 313 grams, one row weighs 18 grams.

14785c Measures 7 1-2 inches in length; circumference near the butt, 7 inches; number of rows, 12; number of whorls, 47; weighs 248 grams, one row weighs 17 grams; grains near the butt of the ear were damaged.

14786 Gourd Seed.

This sample, consisting of three ears, was obtained from W. M. and Dr. J. B. Eads, Eadsville, Wayne County, Kentucky. Color, white; crop of 1904; grown on black sandy loam; yield, 50 bushels per acre.

14786a Measures 10 1-4 inches in length; circumference near the butt, 7 1-2 inches; number of rows, 16; number of whorls, 60; weighs 454 grams, one row weighs 25 grams; color of cob, white.

14786b Measures 9 inches in length; circumference near the butt, 8 1-2 inches; number of rows, 22; number of whorls, 53; weighs 550 grams, one row weighs 23 grams; color of cob, red.

14786c Measures 8 3-4 inches in length; circumference near the butt, 7 3-4 inches; number of rows, 16; number of whorls, 50; one row weighs 24 grams; color of cob, red.

14820 White Corn.

This sample was obtained from E. D. Bourne, Taylorsville, Spencer County, Kentucky. Color of corn, white; cob, red; number of rows, 18; number of whorls, 46; weighs 392 grams, one row weighs 17 grams.

Table number 1 gives the percentage of germination in each sample of corn used in these experiments. These germination tests were made by Mr. G. N. Keller of the Department of Entomology and Botany of the Experiment Station. Fifty grains from usually one, sometimes two longitudinal rows were taken for each test. The usual laboratory method was used. It will be seen from the table that the percentage of germination in these samples is generally high, yet, when we consider the fact that they were selected and sent as representative ears, it is surprising that so many of them fell short, and some far short, of perfect germination. A number of the samples, however, that gave 100 per cent germination were slow to sprout, indicating low vitality, and should be rejected as seed. On examination it was found that most of those specimens giving a low percentage of germination were unsound, the grains being brownish near the base, and, in some instances, emitting a disagreeable odor. These results should impress us with the importance of selecting, curing and testing our seed corn according to the method previously described.

TABLE NO. 1.

Showing Percentage of Germination.

No.	Per Cent. of Germination	No.	Per cent. of Germination
14630	100	14707b	100
14632	100	14707c	100
14642	88	14707d	100
14645	100	14709a	100
14661	100	14709b	100
14662	100	14710a	76
14663	100	14710b	100
14664	100	14711a	92
14665	100	14711b	100
14666	100	14716a	100
14667	100	14716b	100
14668	100	14717	100
14669	100	14718a	100
14670	94	14718b	100
14671	100	14750a	100
14672	100	14750b	100
14673	100	14750c	100
14674	100	14751a	100
14675	100	14751b	98
14686	100	14752a	100
14687	100	14752b	70
14688	82	14753a	90
14689	100	14753b	100
14690	100	14778	100
14691	90	14779	74
14692	100	14780	94
14693a	100	14781	70
14693b	100	14782	84
14693c	100	14783	100
14693d	100	14784a	88
14696a	100	14784b	100
14696b	100	14784c	100
14697a	100	14785a	90
14697b	100	14785b	94
14698a	98	14785c	58
14698b	100	14786a	74
14706a	100	14786b	100
14706b	100	14786c	100
14706c	100	14820	100
14707a	100		

Table No. 2 gives complete analyses of all the samples studied, being complete only in the sense of a corn meal or feeding stuff analysis. This table shows the extreme variation in the composition of corns commonly grown in all parts of the State, which suggests the sad need of new methods of improving our corns by careful breeding. Throughout this work we employed the official methods adopted by the Association of Official Agricultural Chemists, making slight changes only for the sake of convenience. In all of this work we used the factor, 6.25, in converting the nitrogen to protein.

TABLE No 2.

In The Air-Dry Material.

Number.	Water.	Ash.	Nitrogen.	Protein.	Fat.	Fiber.	Nitrogen Free Extract.
14625	9.39	1.41	1.30	8.13	5.34	1.91	73.90
14630	9.77	1.48	1.36	8.50	5.58	1.99	72.68
14632	9.50	1.03	1.44	9.00	5.36	1.77	73.34
14642	8.84	1.32	1.36	8.50	5.65	1.94	73.75
14645	9.52	1.22	1.26	7.88	5.41	2.24	73.73
14661	8.26	1.46	2.03	12.69	5.04	2.01	70.54
14662	7.72	1.61	1.85	11.57	4.45	1.88	72.77
14663	7.16	1.55	1.81	11.31	3.96	2.39	73.63
14664	7.16	1.62	1.36	8.50	4.46	1.75	76.51
14665	7.40	1.18	1.53	9.57	4.90	1.95	75.00
14666	7.39	1.39	1.65	10.31	4.86	1.99	74.06
14667	7.23	1.24	1.59	9.94	5.33	1.97	74.29
14668	7.22	1.35	1.66	10.38	5.20	2.01	73.84
14669	7.12	1.22	1.67	10.44	5.54	2.25	73.43
14670	7.45	1.39	1.62	10.13	5.66	1.82	73.55
14671	7.05	1.29	1.41	8.81	5.61	1.72	75.52
14672	7.24	1.29	1.47	9.19	5.04	2.25	74.99
14673	6.80	1.40	1.63	10.19	4.79	2.52	74.30
14674	6.90	1.34	1.49	9.32	4.72	2.32	75.40
14675	6.52	1.31	1.73	10.82	4.54	1.91	74.90
14685	10.48	1.32	1.66	10.37	4.66	1.86	71.31
14686	11.18	1.20	1.41	8.81	4.85	1.81	72.15

TABLE NO. 2.—Continued.

Number.	Water.	Ash.	Nitrogen.	Protein.	Fat.	Fiber.	Nitrogen. Free Extract.
14687	10.11	1.10	1.12	7.00	4.55	1.94	65.30
14688	11.94	1.13	1.45	9.06	4.18	1.77	71.92
14689	9.45	1.09	1.37	8.56	5.04	1.65	74.21
14690	10.61	1.04	1.37	8.56	5.26	1.90	72.63
14691	10.93	1.12	1.49	9.31	4.10	1.63	72.91
14692	10.82	1.28	1.65	10.31	5.04	1.85	70.70
14693a	6.75	1.65	1.88	11.75	5.55	1.55	72.75
14693b	7.13	1.13	1.41	8.81	5.10	1.52	76.29
14693c	6.78	1.20	1.45	9.06	5.73	1.55	75.68
14693d	6.89	1.30	1.44	9.00	5.31	1.66	75.84
14696a	6.38	1.10	1.44	9.00	4.24	1.84	77.44
14696b	6.50	.85	1.49	9.31	4.22	1.62	78.50
14697a	6.60	1.33	1.94	12.13	5.43	1.86	72.65
14697b	6.78	1.28	1.71	10.69	5.02	2.00	74.26
14698a	6.81	1.18	1.64	10.25	5.19	1.97	74.60
14698b	6.87	1.48	1.81	11.31	4.86	1.84	73.64
14706a	6.68	1.17	1.45	9.06	4.99	1.39	76.71
14706b	6.36	1.03	1.17	7.32	3.87	1.88	79.54
14706c	6.36	1.45	1.77	11.06	5.08	1.99	74.06
14707a	6.37	1.21	1.27	7.94	4.41	1.59	78.48
14707b	6.61	1.31	1.54	9.63	5.06	2.07	74.72
14707c	6.41	1.28	1.76	11.00	5.22	1.82	74.02
14707d	6.38	1.23	1.63	10.19	4.24	1.89	76.07
14709a	7.36	1.01	1.12	7.00	4.03	1.62	78.98
14709b	7.09	1.12	1.68	10.50	4.48	1.77	75.04
14710a	7.16	1.43	1.33	8.32	4.73	2.39	75.97
14710b	7.57	1.19	1.63	10.19	4.14	1.82	75.09
14711a	7.44	1.36	1.69	10.56	5.63	2.15	71.86
14711b	7.55	1.18	1.27	7.94	4.28	2.13	76.92
14716a	9.65	1.21	1.77	11.06	4.78	1.82	71.48
14716b	9.67	1.31	1.42	8.88	4.86	1.70	73.58
14717	9.41	1.44	1.85	11.57	4.72	2.09	70.77
14718a	8.96	1.38	1.86	11.63	4.72	2.00	71.31
14718b	8.81	1.32	1.68	10.50	5.35	2.26	71.76
14750a	9.78	1.07	1.38	8.63	4.65	1.80	74.07
14750b	9.88	1.11	1.21	7.56	4.41	1.92	75.12
14750c	9.45	1.10	1.50	9.38	5.32	2.06	72.69
14751a	9.81	1.28	1.30	8.13	4.85	1.97	73.96

TABLE NO. 2.—Continued.

Number.	Water.	Ash.	Nitrogen.	Protein.	Fat.	Fiber.	Nitrogen. Free Extract.
14751b	9.69	1.18	1.31	8.19	4.98	1.49	74.47
14752a	9.62	.83	1.33	8.31	4.22	1.85	75.17
14752b	9.54	1.21	1.19	7.44	3.97	2.12	75.72
14753a	10.33	1.22	1.33	8.31	3.83	1.66	74.65
14753b	10.27	1.03	1.03	6.44	4.52	1.82	75.87
14778	10.20	1.10	1.56	9.75	4.69	1.81	72.45
14779	11.10	1.05	1.49	9.31	4.41	1.70	72.43
14780	11.22	1.33	1.60	10.00	5.00	2.35	70.10
14781	10.67	1.51	1.31	8.19	4.25	1.85	73.52
14782	10.66	1.44	1.69	10.56	4.95	1.68	70.71
14783	10.33	1.26	1.05	6.56	4.96	1.65	75.24
14784a	10.41	1.29	1.69	10.56	4.09	1.61	72.04
14784b	10.33	1.02	1.25	7.81	4.60	1.75	74.49
14784c	9.79	1.28	1.77	11.06	4.69	1.57	71.61
14785a	10.20	1.33	1.48	9.25	4.71	1.56	72.95
14785b	9.74	1.16	1.30	8.13	5.34	1.65	73.98
14785c	9.76	1.12	1.13	7.06	4.50	1.73	75.83
14786a	10.19	1.18	1.58	9.88	5.52	2.05	71.18
14786b	10.19	1.03	1.30	8.13	5.06	1.88	73.71
14786c	10.20	1.30	1.85	11.56	4.60	2.01	70.33
14820	10.78	1.35	1.66	10.38	4.48	2.26	70.75
Ave.	8.51	1.25	1.51	9.42	4.83	1.88	73.86
Max.	11.94	1.65	2.03	12.69	5.73	2.53	79.54
Min.	6.52	.83	1.03	6.44	3.83	1.39	65.30

Table No. 3 contains the same analyses as No. 2, calculated to a moisture-free basis and rearranged by counties.

TABLE No. 3.

Calculated to Water-Free Substance.

County Where Grown.	Station No.	Ash.	Nitrogen.	Protein.	Fat.	Fiber.	Nitrogen Free Extract.
Boyle	14717	1.59	2.04	12.75	5.21	2.31	75.76
Christian	14630	1.64	1.51	9.44	6.18	2.25	80.49
	14645	1.35	1.39	8.69	5.98	2.48	81.50
	14689	1.20	1.51	9.44	5.57	1.82	81.97
Crittenden	14686	1.35	1.59	9.94	5.46	2.04	81.21
	14687	1.22	1.25	7.81	5.06	2.16	83.75
	14688	1.28	1.65	10.31	4.75	2.01	81.65
	14690	1.16	1.53	9.57	5.88	2.13	79.73
	14691	1.26	1.67	10.44	4.60	1.83	81.87
	14692	1.44	1.85	11.56	5.65	2.07	79.28
	14709a	1.09	1.21	7.56	4.35	1.75	85.25
	14709b	1.21	1.81	11.31	4.82	1.91	80.75
Daviess	14716a	1.34	1.96	12.25	5.29	2.01	79.11
	14716b	1.45	1.57	9.81	5.38	1.88	81.48
Fayette	14661	1.59	2.21	13.81	5.49	2.19	76.92
	14662	1.74	2.01	12.57	4.82	2.04	78.83
	14663	1.67	1.95	12.19	3.72	2.58	79.84
	14664	1.74	1.46	9.12	4.80	1.89	82.45
	14665	1.27	1.65	10.32	5.29	2.10	81.02
	14666	1.50	1.78	11.12	5.25	2.15	79.98
	14667	1.34	1.71	10.69	5.75	2.12	80.10
	14668	1.46	1.79	11.19	5.60	2.17	79.58
	14669	1.31	1.80	11.25	5.96	2.42	79.06
	14670	1.50	1.75	10.94	6.12	1.97	79.47
	14671	1.39	1.52	9.50	6.04	1.85	81.22
	14672	1.39	1.58	9.87	5.43	2.42	80.89
	14673	1.50	1.75	10.94	5.01	2.70	79.85

TABLE NO. 3.—Continued.

County Where Grown.	Station No.	Ash.	Nitrogen.	Protein.	Fat.	Fiber.	Nitrogen. Free Extract.
	14674	1.44	1.60	10.00	5.07	2.49	81.00
	14675	1.40	1.85	11.56	4.86	2.04	80.14
	14685	1.48	1.85	11.56	5.21	2.08	79.67
Fulton	14710a	1.54	1.43	8.94	5.10	2.57	81.85
	14710b	1.29	1.76	11.00	4.48	1.97	81.26
	14711a	1.47	1.83	11.44	6.08	2.32	78.69
	14711b	1.28	1.37	8.56	4.63	2.30	83.23
Graves	14625	1.56	1.43	8.94	5.89	2.11	81.50
	14642	1.45	1.49	9.32	6.20	2.13	81.04
	14697a	1.42	2.08	13.00	5.81	1.99	77.78
	14697b	1.37	1.83	11.44	5.38	2.15	79.66
	14698a	1.27	1.76	11.00	5.57	2.11	80.05
	14698b	1.59	1.94	12.13	5.22	1.98	79.08
	14780	1.50	1.80	11.25	5.63	2.65	78.97
	14781	1.69	1.47	9.23	4.76	2.07	82.25
	14782	1.61	1.89	11.81	5.54	1.88	79.16
	14783	1.41	1.17	7.31	5.33	1.84	84.11
Henderson	14751a	1.42	1.44	9.00	5.38	2.18	82.02
	14751b	1.31	1.45	9.06	5.51	1.65	82.47
	14752a	.92	1.47	9.19	4.67	2.05	83.17
	14752b	1.34	1.31	8.19	4.39	2.34	83.74
	14753a	1.36	1.48	9.25	4.27	1.85	83.27
	14753b	1.20	1.15	7.19	5.04	2.03	84.54
Logan	14632	1.14	1.59	9.94	5.92	1.96	81.04
Robertson	14718a	1.52	2.04	12.75	5.18	2.20	75.91
	14718b	1.45	1.84	11.50	5.87	2.48	78.70
Simpson	14696a	1.18	1.54	9.63	4.53	1.97	82.69
	14696b	.91	1.59	9.94	4.47	1.70	82.98
	14706a	1.25	1.55	9.69	5.35	1.49	82.22
	14706b	1.10	1.25	7.81	4.13	2.01	84.95
	14706c	1.55	1.89	11.81	5.43	2.12	79.09
	14707a	1.29	1.36	8.50	4.71	1.70	83.80
	14707b	1.40	1.65	10.31	5.42	2.22	80.65
	14707c	1.37	1.88	11.75	5.58	1.94	79.36

TABLE NO. 3.—Continued.

County Where Grown.	Station No.	Ash.	Nitrogen.	Protein.	Fat.	Fiber.	Nitrogen. Free Extract.
	14707d	1.31	1.74	10.88	4.53	2.02	81.26
	14778	1.22	1.74	10.87	5.22	2.01	80.68
	14779	1.18	1.68	10.50	4.96	1.91	81.45
Spencer	14820	1.51	1.86	11.63	5.02	2.53	79.31
Washington	14693a	1.77	2.02	12.63	5.95	1.66	77.99
	14693b	1.22	1.52	9.51	5.49	1.64	82.14
	14693c	1.29	1.55	9.69	6.15	1.66	81.21
	14693d	1.40	1.54	9.63	5.70	1.78	81.49
Wayne	14750a	1.19	1.52	9.51	5.15	2.00	82.15
	14750b	1.23	1.34	8.38	4.89	2.13	83.37
	14750c	1.21	1.66	10.37	5.88	2.27	80.27
	14784a	1.44	1.89	11.81	4.57	1.80	80.38
	14784b	1.14	1.39	8.68	5.13	1.95	83.10
	14784c	1.42	1.96	12.25	5.20	1.74	74.39
	14785a	1.48	1.65	10.31	5.24	1.74	81.23
	14785b	1.28	1.44	9.00	5.92	1.83	81.97
	14785c	1.24	1.25	7.81	4.99	1.92	84.04
	14786a	1.31	1.76	11.00	6.15	2.28	79.26
	14786b	1.15	1.45	9.06	5.63	2.09	82.07
	14786c	1.45	2.06	12.88	5.12	2.24	78.31
Average		1.37	1.66	10.37	5.27	2.06	80.91
Maximum.		1.77	2.21	13.81	6.20	2.70	85.25
Minimum		.91	1.15	7.19	3.72	1.49	75.76

Table number four gives a comparison of the percentages of nitrogen in the grains from different whorls, beginning at the butt and designating the whorls by the letters of the alphabet. There was found to be no material difference in the per cent. of nitrogen until after the middle of the ear was passed, then there was a gradual decrease in each whorl until the nub grains were reached; here a remarkable variation was observed; in some instances these grains contained the highest per-

centage of nitrogen found in any part of the ear, while in others they contained the lowest.

On one sample we made 15 analyses, taking two adjacent whorls for each determination, on others, 10, while most of them have only 5 determinations, but in every case the analyses are distributed throughout the ear. See Plate 2.

It is our purpose to carry this experiment further by growing crops of corn from those whorls near the butt, and another separate crop from those whorls near the tip of the ear, and ascertain if those differences in percentage of nitrogen in the parent ear will remain relatively the same in the succeeding crops.

TABLE NO. 4.

		In the Air-Dry Material.		Calculated to Water-Free Substance.	
No.		Nitrogen.	Protein.	Nitrogen.	Protein.
14625	a	1.30	8.13	1.43	8.94
	c	1.33	8.31	1.47	9.23
	e	1.35	8.44	1.49	9.31
	g	1.34	8.38	1.48	9.25
	i	1.33	8.31	1.47	9.18
	k	1.33	9.31	1.47	9.18
	m	1.30	8.13	1.43	8.94
	o	1.33	8.31	1.47	9.18
	q	1.29	8.06	1.42	8.88
	s	1.28	8.00	1.41	8.81
	u	1.25	7.81	1.38	8.62
	v	1.18	7.38	1.30	8.13
	w	1.21	7.56	1.34	8.37
	x	1.20	7.50	1.32	8.25
	y	1.42	8.88	1.57	9.81
14630	a	1.41	8.81	1.56	9.75
	b	1.41	8.81	1.56	9.75
	c	1.44	9.00	1.60	10.00
	d	1.40	8.75	1.55	9.69
	e	1.41	8.81	1.56	9.75
	f	1.35	8.44	1.50	9.38
	g	1.31	8.19	1.45	9.13
	h	1.30	8.13	1.44	9.07
	i	1.23	7.69	1.36	8.50
	j	1.23	7.69	1.36	8.50

TABLE NO. 4.—Continued.

No.		In the Air Dry Material. Nitrogen.	Protein.	Calculated to Water-Free Substance Nitrogen.	Protein.
14632	a	1.41	8.81	1.56	9.75
	b	1.14	9.00	1.59	9.94
	c	1.46	9.13	1.61	10.07
	d	1.46	9.13	1.61	10.07
	e	1.44	9.00	1.59	9.94
	f	1 49	9.32	1.65	10.32
	g	1.43	8.94	1.58	9.88
	h	1.41	8.81	1.56	9.75
	i	1.38	8.62	1.52	9.50
	j	1.43	8.94	1.58	9.88
	k	1.44	9.00	1.59	9.94
14642	a	1.36	8.50	1.49	9.31
	b	1.39	8.69	1.52	9.50
	c	1.37	8.56	1.50	9.38
	d	1.36	8.50	1.49	9.32
	e	1.37	8.56	1.50	9.38
	f	1.35	8.44	1.48	9.25
	g	1.34	8.38	1.47	9.19
	h	1.31	8.19	1.44	9.00
	i	1.29	8.06	1.42	8.88
	j	1.36	8.50	1.49	9.31
14645	a	1.29	8.06	1.43	8.94
	b	1.32	8.25	1.46	9.13
	c	1.34	8.38	1.48	9.25
	d	1.35	8.44	1.49	9.31
	e	1.36	8.50	1.50	9.37
	f	1.31	8.19	1.45	9.06
	g	1.28	8.00	1.41	8.82
	h	1.20	7.50	1.33	8.32
	i	1.20	7.50	1.33	8.32
	j	.96	6.00	1.06	6.63
14661	a	1.91	11.94	2.08	13.00
	b	2.04	12.75	2.22	13.87
	c	2.08	13.00	2.27	14.18
	d	2.05	12.81	2.23	13.93
	e	2.15	13.44	2.34	14.62
14662	a	1.87	11.69	2.03	12 69
	b	1.87	11.69	2.03	12.69
	c	1.86	11.63	2.02	12.63
	d	1.79	11.19	1.94	12.13

TABLE NO. 4.—Continued.

		In the Air Dry Material.		Calculated to Water-Free Substance.	
No.		Nitrogen.	Protein.	Nitrogen.	Protein.
	e	1.80	11.25	1.95	12.19
14663	a	1.78	11.13	1.92	12.00
	b	1.87	11.69	2.01	12.56
	c	1.79	11.19	1.93	12.06
	d	1.73	10.81	1.86	11.63
	e	1.89	11.81	2.04	12.75
14664	a	1.30	8.13	1.40	8.75
	b	1.43	8.94	1.54	9.62
	c	1.35	8.44	1.45	9.06
	d	1.31	8.19	1.41	8.81
	e	1.36	8.50	1.46	9.12
14665	a	1.57	9.81	1.70	10.63
	b	1.58	9.88	1.71	10.69
	c	1.54	9.63	1.66	10.38
	d	1.46	9.13	1.58	9.88
	e	1.49	9.31	1.61	10.06
14666	a	1.64	10.25	1.77	11.06
	b	1.73	10.81	1.87	11.69
	c	1.59	9.94	1.72	10.75
	d	1.60	10.00	1.73	10.81
	e	1.78	11.13	1.92	12.00
14667	a	1.56	9.75	1.68	10.50
	b	1.60	10.00	1.72	10.75
	c	1.60	10.00	1.72	10.75
	d	1.56	9.75	1.68	10.50
	e	1.70	10.63	1.83	11.44
14668	a	1.66	10.38	1.79	11.19
	b	1.72	10.76	1.85	11.56
	c	1.65	10.31	1.78	11.13
	d	1.59	9.94	1.75	10.94
	e	1.53	9.57	1.65	10.32
14669	a	1.71	10.69	1.84	11.50
	b	1.71	10.69	1.84	11.50
	c	1.66	10.38	1 79	11.19
	d	1.63	10.19	1.75	10.94
	e	1.57	9.81	1.69	10.56
14670	a	1.58	9.87	1.71	10.69
	b	1.62	10.13	1.75	10.94
	c	1.63	10.19	1.76	11.00
	d	1.63	10.19	1.76	11.00

TABLE NO. 4.—Continued.

		In the Air Dry Material.		Calculated to Water-Free Substance.	
No.		Nitrogen.	Protein.	Nitrogen.	Protein.
	e	1.79	11.19	1.93	12.06
14671	a	1.43	8.94	1.54	9.63
	b	1.47	9.19	1.58	9.88
	c	1.40	8.75	1.51	9.44
	d.	1.35	8.44	1.45	9.07
	e	1.27	7.94	1.37	8.56
14672	a	1.45	9.06	1.56	9.75
	b	1.53	9.56	1.65	11.31
	c	1.47	9.19	1.58	9.87
	d	1.41	8.81	1.52	9.50
	e	1.36	8.50	1.47	9.19
14673	a	1.72	10.76	1.85	11.56
	b	1.71	10.69	1.83	11.44
	c	1.60	10.00	1.72	10.75
	d	1.54	9.62	1.65	10.31
	e	1.58	9.87	1.70	10.63
14674	a	1.55	9.68	1.66	10.38
	b	1.55	9.68	1.66	10.38
	c	1.48	9.25	1.59	9.94
	d	1.43	8.94	1.54	9.63
	e	1.41	8.81	1.51	9.44
14675	a	1.75	10.93	1.87	11.69
	b	1.73	10.82	1.85	11.56
	c	1.74	10.88	1.86	11.63
	d	1.70	10.63	1.82	11.38
	e	1.64	10.25	1.75	10.94

Table number five gives analyses of longitudinal rows of grains, on opposite sides of the ear, showing that there is no material difference in the percentage of nitrogen when the rows are taken longitudinally. The two rows on each sample are represented in the table by "a" and "b."

TABLE No. 5.

No.		In the Air-Dry Material. Nitrogen	Protein	Calculated to Water-Free Substance. Nitrogen	Protein
14686	a	1.40	8.75	1.53	9.88
	b	1.43	8.94	1.61	10.06
14687	a	1.10	6.88	1.22	7.63
	b	1.13	7.06	1.26	7.88
14688	a	1.45	9.06	1.65	10.31
	b	1.45	9.06	1.65	10.31
14689	a	1.37	8.56	1.51	9.44
	b	1.36	8.50	1.50	9.38
14690	a	1.34	8.38	1.50	9.37
	b	1.39	8.69	1.56	9.75
14691	a	1.49	9.31	1.67	10.44
	b	1.48	9.25	1.66	10.38
14692	a	1.65	10.31	1.85	11.56
	b	1.65	10.31	1.85	11.56
14693 (1)	a	1.90	11.88	2.04	12.75
	b	1.85	11.57	1.98	12.38
14693 (2)	a	1.48	8.94	1.54	9.63
	b	1.39	8.69	1.50	9.38
14693 (3)	a	1.46	9.12	1.56	9.75
	b	1.44	9.00	1.53	9.50
14693 (4)	a	1.43	8.94	1.53	9.50
	b	1.44	9.00	1.54	9.63

The analyses in table No. 6 were made for the purpose of comparing the composition of grains which were supposed to have been cross-fertilized with adjacent grains on the same ear, presumedly not cross-fertilized. The three samples of yellow corn grown at the Station farm showed grains of a lighter color scattered throughout the ear. As the yellow corn had grown near white corn, it was supposed that these grains may have been pollinated by the white corn. The grains in question were not entirely white, but were decidedly whitish at the tips and distinctly lighter colored throughout than the grains next to them. The samples for analyses were prepared by taking together all the light colored grains from each ear, designating

them as "a" and, for comparison, an equal number of yellow grains were taken next to the whitish ones and designated as "b". See Plate 3. The analyses showed no material difference in the percentage of nitrogen. Of course, it is not certain that this was a case of cross-fertilization, and it it proposed to make further experiments along this line, under conditions that can be controlled.

TABLE No. 6.

		In the Air-Dry Material.		Calculated to Water-Free Substance.	
No.		Nitrogen	Protein	Nitrogen	Protein
14673	a	1.64	10.25	1.76	11.00
	b	1.64	10.25	1.76	11.00
14674	a	1.52	9.50	1.63	10.19
	b	1.51	9.44	1.62	10.13
14675	a	1.68	10.50	1.80	11.35
	b	1.70	10.63	1.82	11.38

SUMMARY.

In the foregoing pages we have given analyses of a number of samples of corn grown in different sections of the State, and, by comparison, some interesting variations in their composition may be observed which suggest the importance of improving our corn. We have shown by a series of experiments on a number of ears of corn that the percentage of nitrogen does not differ materially in the individual whorls of grains on each ear, beginning at the butt, until after the middle of the ear is passed, then there is a gradual falling off in the percentage until the nub or tip end is reached. Here a rather remarkable variation occurs; in some instances these grains at the tip contained the highest per cent. of nitrogen obtained in any part of the ear, while in other cases they gave the lowest. In three samples of yellow corn which had white tipped grains scattered about over the ears, presumably cross-fertilized by white corn, an-

alyses of these white tipped grains and of the yellow ones adjacent, showed no material difference, indicating that there is no change in the percentage of nitrogen from the first year's cross-fertilization.

We have shown that longitudinal rows of grains on opposite sides of ears of corn give approximately the same percentage of nitrogen. We have also tested the vitality of the samples of corn used in these experiments, and, while the percentage of germination is high, some samples showed a falling off to 58 per cent. A number of those showing perfect germination were slow to sprout, indicating low vitality, and should be discarded as seed.

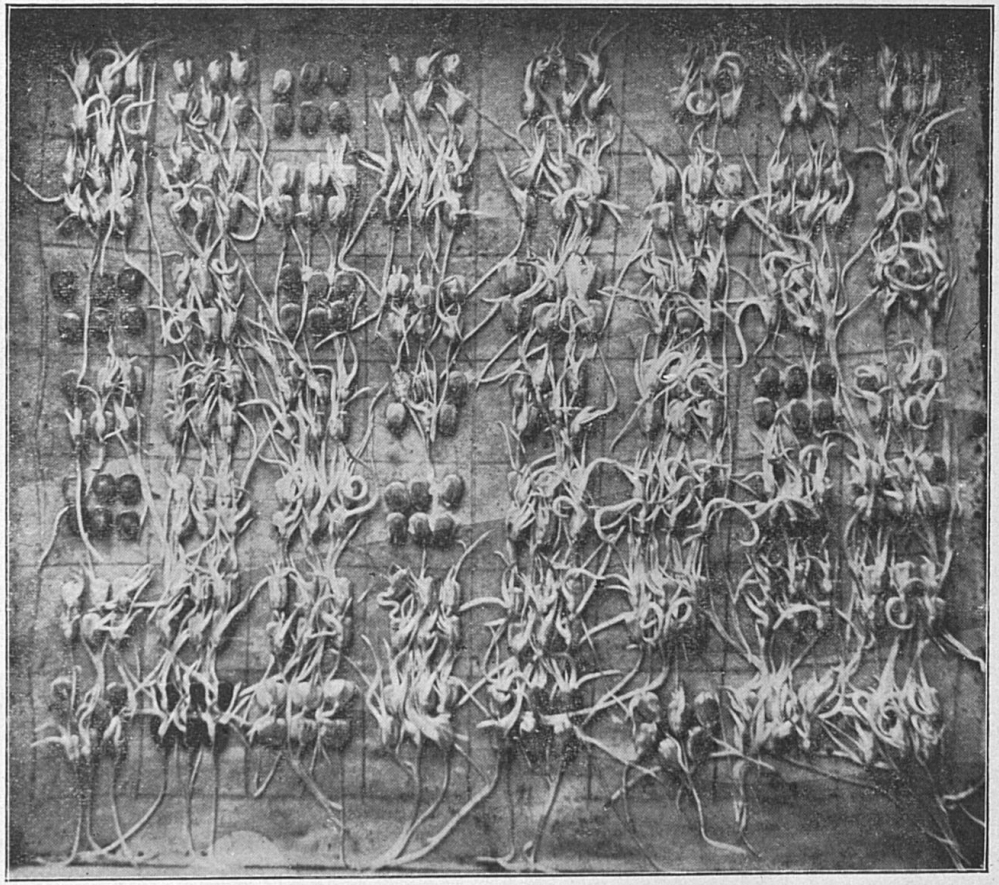


PLATE I.—Germinating box for testing vitality of individual ears, photographed five days after planting.

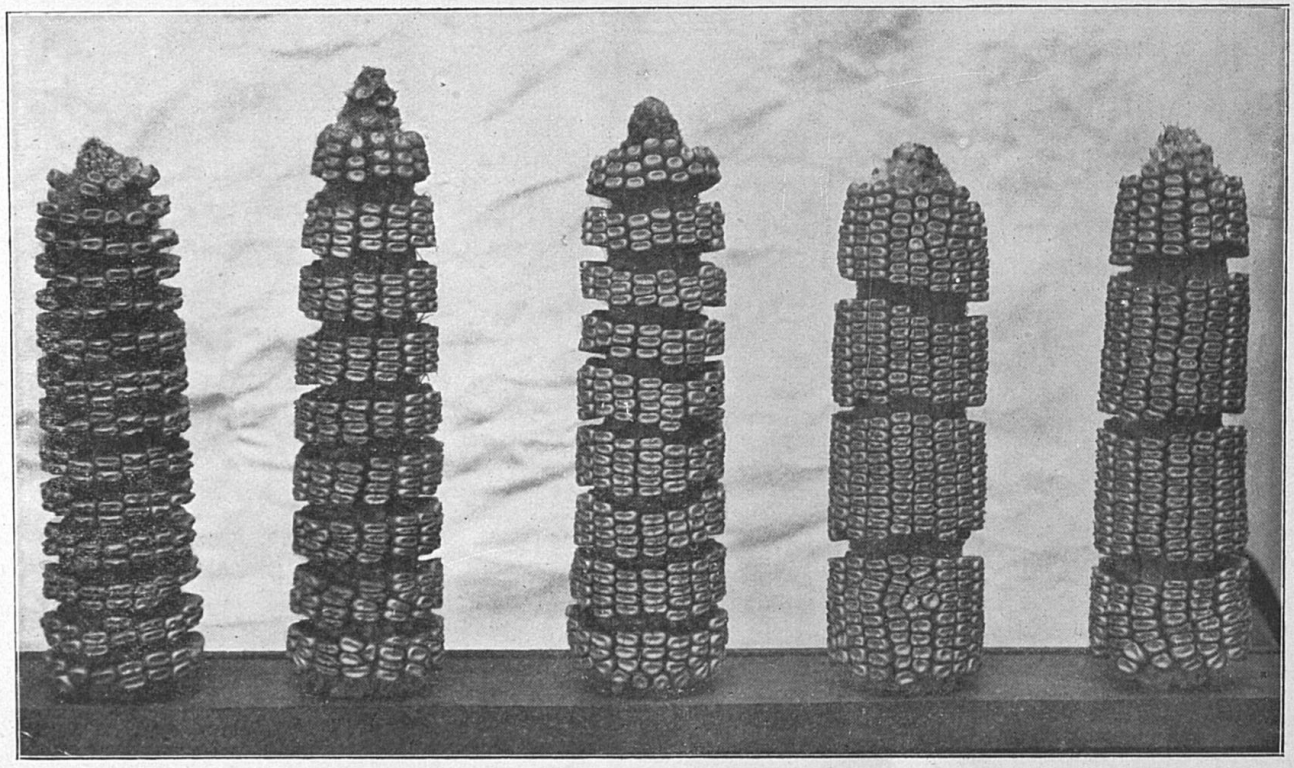


PLATE II.—Showing where whorls have been taken for analysis, to compare the protein content in different parts of the ear.

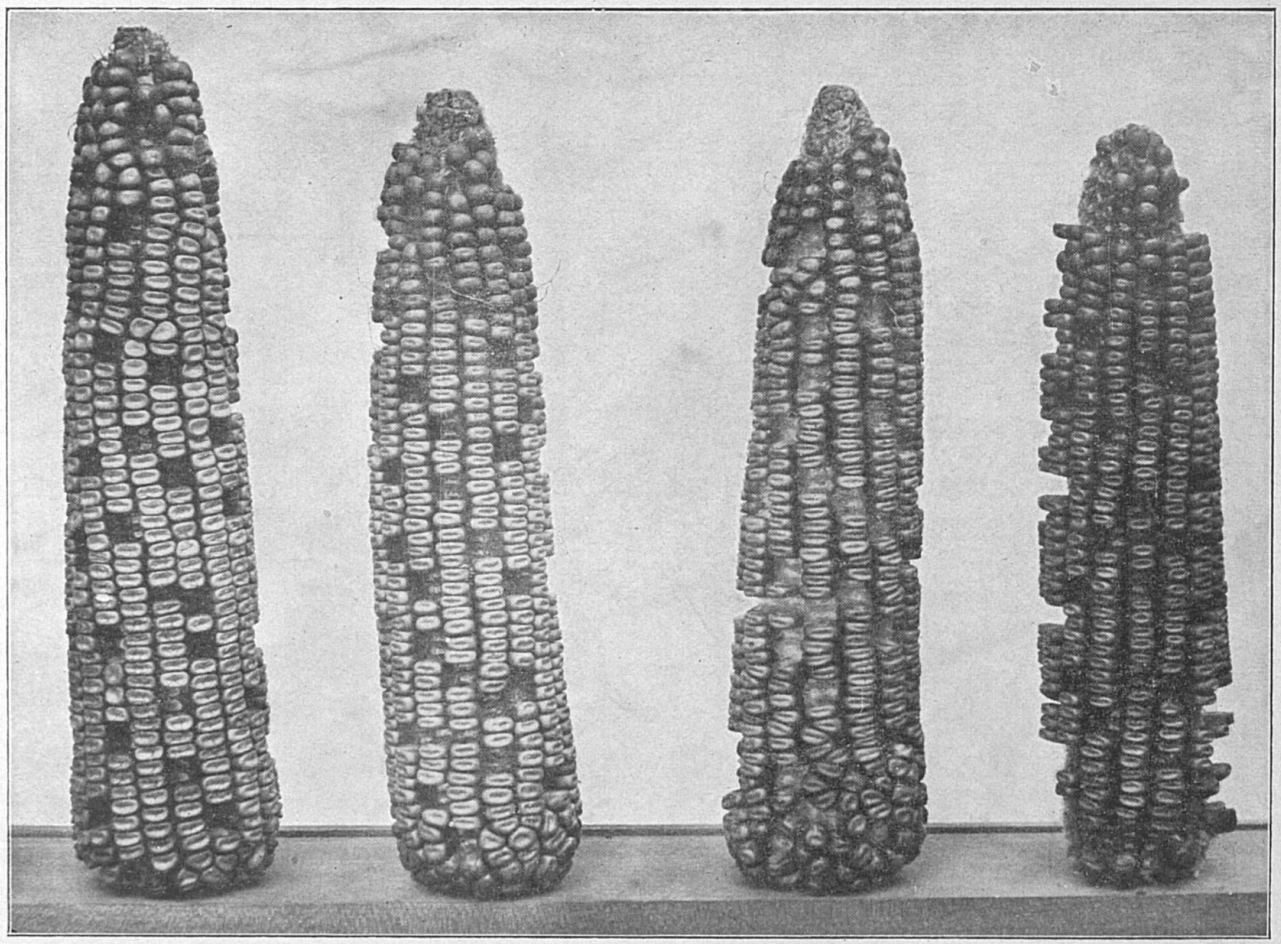


PLATE III.—Ears of yellow corn mixed with white grains, gaps show where white and yellow grains were taken side by side to compare their protein content.

KENTUCKY

Agricultural Experiment Station

OF THE

State College of Kentucky.

BULLETIN No. 123.

COMMERCIAL FERTILIZERS.

LEXINGTON, KENTUCKY.
December 31, 1905.

191

KENTUCKY

Agricultural Experiment Station

BOARD OF CONTROL.

GEO. B. KINKEAD, Chairman, Lexington, Ky.
D. F. FRAZEE, Lexington, Ky.
C. B. NICHOLS, Lexington, Ky.
J. K. PATTERSON, President of the College.
M. A. SCOVELL, Director, Secretary.

STATION OFFICERS.

M. A. SCOVELL, Director and Chemist.
A. M. PETER, Chemist.
H. E. CURTIS, Chemist, Fertilizers.
H. GARMAN Entomologist and Botanist.
W. H. SCHERFFIUS, Chemist.
R. M. ALLEN, Secretary, Food Division.
J. D. TURNER, Secretary.
J. O. LaBACH, Chemist, Food Division.
Miss M. L. DIDLAKE, Ass't Entomologist and Botanist.
S. D. AVERITT, Ass't Chemist.
O. M. SHEDD, Ass't Chemist.
H. WOOSLEY, Supt. of Farm Experiments.
MISS LILLIE LISTON, Librarian.
H. W. TAYLOR, Ass't Entomologist and Botanist.
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. 123

ANALYSES OF COMMERCIAL FERTILIZERS

Number of Brands. There were 358 different brands of commercial fertilizers registered during the year 1905. Of these 201 were complete fertilizers, or fertilizers containing all three of the essential ingredients, namely: phosphoric acid, nitrogen and potash; 44 were acid phosphates; 2 contained a mixture of acid phosphate and nitrogen compounds only; 52 acid phosphates and potash salts only; 58 were classed as bones or tankage; and 1 contained nitrogen and potash only.

Samples Collected and Analyzed. Two hundred and thirty-eight samples were collected by deputy inspectors or sent by farmers from various parts of the State and 358 were sent in by firms as official samples; of these samples, 574 have been analyzed by the Station. Many of these analyses have already been published in Bulletin No. 121. and are not repeated here.

Results of the Analyses. The results of the analyses show that of the 151 samples analyzed since the publication of Bulletin No. 121, 37, representing 31 brands and 18 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 69 samples reported in Bulletin No. 121, we have 106 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 following table gives the manufacturers who have registered fertilizers in this State since August 16, 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 Value Per Ton.	
		No. Acceptable.	No. Too Low	No. Acceptable.	No. Too Low.	No. Acceptable.	No. Too Low.	No. Acceptable.	No. Too Low.
The Amer. Ag. Chem. Co., Cleveland Dryer Works	3	3	0	2	0	2	0	3	0
The Amer. Ag. Chem. Co.,	1	1	0	1	0	0	0	1	0
American Fertilizer Co.,	1	0	1	1	0	1	0	0	1
American Guano Co.,	3	1	2	2	1	2	1	2	1
The Armour Fertilizer Works	13	13	0	9	0	6	0	13	0
Bowker Fertilizer Co.,	8	8	0	6	0	5	0	8	0
The Cincinnati Phosphate Co.,	2	2	0	2	0	2	0	2	0
Continental Fertilizer Co.,	2	2	0	2	0	2	0	2	0
The Currie Fertilizer Co.,	4	4	0	3	1	4	0	4	0
Duncan Bros. Co.	9	6	3	9	0	5	0	9	0
Empire Carbon Works	2	0	2	2	0	0	0	2	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.
The Empire Guano Co.,	4	1	3	3	0	4	0	4	0
Fox Chemical Co.,	4	4	0	3	0	2	1	4	0
Globe Fertilizer Co.,	9	8	1	6	1	7	2	8	1
The Jarecki Chemical Co.,	3	2	1	2	0	2	0	3	0
The Jones Fertilizing Co.,	1	1	0	1	0	0	0	1	0
Kaufman Fertilizer Co.,	4	4	0	2	0	2	1	4	0
Louisville Fertilizer Co.,	7	7	0	6	0	6	0	7	0
Michigan Carbon Works	5	5	0	5	0	3	0	5	0
National Fertilizer Co.,	4	1	3	2	0	2	0	2	2
North-Western Fertilizing Co.,	9	7	2	7	0	6	0	9	0
The Ohio Farmers' Fertilizer Co.,	2	2	0	0	1	2	0	2	0

Packers' Fertilizer Association	1	1	0	1	0	0	0	1	0
Pero & Stoecker	3	2	1	3	0	0	0	3	0
Price Ray	2	1	1	0	2	0	0	1	1
Read Phosphate Co.,	9	6	3	8	0	6	1	9	0
Singer & Johnson Fertilizer Co.,	5	5	0	4	0	2	0	5	0
Smith Brothers	2	2	0	2	0	2	0	2	0
Swift & Company	9	9	0	8	0	6	0	9	0
Tennessee Chemical Co.,	6	6	0	3	1	4	0	6	0
Tennessee Valley Fertilizer Co.,	4	3	1	1	3	2	2	3	1
Tuscarora Fertilizer Co.,	6	6	0	5	0	2	0	6	0
Virginia-Carolina Chem. Co.	2	2	0	2	0	2	0	2	0
Wake Fertilizer Co.,	2	2	0	2	0	2	0	2	0

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. When 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 American Agrl Chem. Co., New York.	
	Cleveland Dryer Works.	
15483	XXX Superphosphate	J. M. Harned, Big Clifty .....
15484	Ohio Seed Maker with Potash	J. M. Harned ....
15485	Phospho Bone	J. M. Harned ....
	The American Agr'l Chem. Co., New York.	
15486	Ground Bone	J. M. Harned ....
	American Fertilizer Co., Louisville Ky.	
15386	F. B. Jones' Brand Wheat Grower	W. B. Dowell, Dick .....
	American Guano Co., Nashville, Tenn.	
15390	Mule Brand Cotton, Corn and Wheat Guano	Frank X. Merkley, Campbellsville ....
15360	Mule Br. Wheat Grower	Manufacturer ....
15391		Frank X. Merkley ....
	The Armour Fertilizer Works, Chicago, Ill.	
15392	Grain Grower	Ovesen Burba Co., Hodgenville .
15393	Wheat, Corn and Oat Special.	Barren Co. Gro. & Hdw. Co., Glasgow ....
15394	Ammoniated Bone with Potash	Gardner & Stone, Elizabethtown

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.
				16.02	1.24	17.26					$16.02	15483
		12.00	*2.00*	*14.00*		*16.00*					*14.00*	
				10.09	2.65	12.74	1.47	1.78	2.04		19.62	15484
		5.00	*3.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				10.85	3.48	14.33	1.01	1.23	0.97		18.41	15485
		7.00	*3.00*	*10.00*		*12.00*	*0.82*	*1.00*	*1.00*		*16.26*	
15.12	8.88					24.00	2.95	3.58			26.28	15486
						20.00	*2.47*	*3.00*			*19.41*	
				5.13	3.24	8.37	2.93	3.56		1.78	18.39	15386
				8.00		*10.00*	*2.26*	*2.74*		*2.00*	*19.58*	
				8.62	1.46	10.08	1.29	1.57	1.57		16.36	15390
		5.00	*3.00*	*8.00*		*9.00*	*1.65*	*2.00*	*2.00*		*16.95*	
				8.36	4.18	12.54	1.67	2.03	2.08		18.79	15360
				7.97	3.21	11.18	1.56	1.89	2.26		17.78	15391
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*	*2.00*		*19.35*	
				9.29	5.36	14.65	2.25	2.73	2.33		22.37	15392
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				6.73	1.62	8.35	1.07	1.30	1.59		13.53	15393
		5.00	*2.00*	*7.00*		*9.00*	*0.82*	*1.00*	*1.00*		*12.66*	
				6.91	1.10	8.01	2.53	3.07	2.17		18.49	15394
		4.00	*2.00*	*6.00*		*8.00*	*2.47*	*3.00*		*2.00*	*17.81*	

TABLE OF ANALYSES.

Station Number	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Armour Fertilizer Works,	
15396	Armour's Champion	A. H. Smithern, Eubank .....
15381	Phosphate and Potash	R. L. Roberts, Waverly .....
15407		M. B. Gill, Olmstead .....
15380	Star Phosphate	R. L. Roberts ....
15382		S. L. Clements, Flournoy .....
15395	Bone Meal	Gardner & Stone .....
15363	Raw Bone Meal	E. B. Riley, Olmstead .....
15378		H. W. Gill, Olmstead .....
15379		E. J. Riley, Olmstead ....
15384		Felix Kerrick, Louisville .....
	Bowker Fertilizer Co., Boston-New York-Cincinnati.	
15397	Bowker's Fish Guano	Eads Bros., Science Hill .....
15398	Bowker's Kentucky Special...	J. W. Gardner, Elizabethtown..
15366	Bowker's Tobacco Grower ...	Henry Traub, Waynesburg ....
15488	Bowker's Harvest Bone	Troutman Bros., Shepherdsville.
15399	Bowker's Potash Fertilizer ..	Eads Bros. ....
15489	Bowker's Soluble Bone	Troutman Bros. ....
15400	Bowker's Raw Bone	J. W. Gardner ....

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.		
				11.97	2.32	14.29	1.73	2.10	2.24		$22.72	15396
		6.00	*4.00*	*10.00*		*12.00*	*1.65*	*2.00*	*2.00*		*19.75*	
				11.86	1.16	13.02			2.10		16.79	15381
				10.76	1.10	11.86			3.18		16.53	15407
		6.00	*4.00*	*10.00*		*12.00*			*2.00*		*14.80*	
				14.29	1.83	16.12					14.29	15380
				13.58	1.77	15.35					13.58	15382
		10.00	*4.00*	*14.00*		*16.00*					*14.00*	
21.28	1.85					23.13	3.77	4.58			29.44	15395
						24.00	*2.47*	*3.00*			*21.81*	
21.05	2.87					23.92	3.53	4.29			29.15	15363
22.15	1.93					24.08	3.42	4.15			29.14	15378
21.40	1.86					23.26	3.57	4.33			28.95	15379
13.15	11.21					24.36	3.89	4.72			28.92	15384
						22.00	*3.71*	*4.50*			*24.33*	
				8.96	3.68	12.64	1.08	1.31	3.42		18.88	15397
				8.00		*10.00*	*0.82*	*1.00*	*3.00*		*15.86*	
				9.38	3.16	12.54	1.51	1.83	4.42		21.47	15398
				8.00		*10.00*	*1.23*	*1.50*	*4.00*		*18.09*	
				9.29	2.99	12.28	1.73	2.10	0.72	4.25	23.36	15366
				8.00		*10.00*	*1.65*	*2.00*		*5.00*	*21.35*	
				9.94	2.94	12.88	0.96	1.17	1.28		17.27	15488
				8.00		*10.00*	*0.82*	*1.00*	*1.00*		*13.86*	
				9.57	3.26	12.83			4.78		17.56	15399
				10.00		*12.00*			*5.00*		*17.80*	
				16.41	2.24	18.65					16.41	15489
				14.00		*15.00*					*14.00*	
15.48	6.63					22.11	3.45	4.19			26.71	15400
						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.
	Bowker Fertilizer Co.	
15401	Bowker's Bone Meal	D. E. Patterson, Hodgenville ..
	The Cincinnati Phosphate Co., Cincinnati, Ohio.	
15403	Capitol High Grade Guano...	The Reynolds Co., Waynesburg.
15404	Capitol Grain & Grass Grower	The Reynolds Co. .....
	Continental Fertilizer Co., Nashville, Tenn.	
15405	Bear Special Wheat Grower..	Barren Co. Gro. & Hdw. Co., Glasgow ....
15479	Bear Potato Grower	Manufacturer ....
	The Currie Fertilizer Co., Louisville, Ky.	
15406	Currie's Corn & Wheat Special	M. T. Crawford, Somerset .....
15490	Currie's Soluble Bone	Chas. Ratliff, Princeton .....
15361	Currie's Wheat Grower	Manufacturer ....
15362	Currie's Butchertown Raw Bone Meal	Manufacturer ....
	Duncan Bros. Co., Lagrange, Ky.	
15383	Tiger Brand Bone and Phosphate	Jno. M. Flood, Cropper .....

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.
13.08	12.56					25.64	1.48	1.80			$22.44	15401
						20.00	*1.65*	*2.00*			*16.95*	
				10.24	1.62	11.86	0.70	0.85	1.84		16.88	15403
				10.00		*11.00*	*0.82*	*1.00*	*2.00*		*16.86*	
				10.43	2.20	12.63	0.79	0.96		0.99	16.96	15404
				10.00		*11.00*	*0.82*	*1.00*	*1.00*		*15.86*	
				9.26	1.75	11.01	1.57	1.91	0.64	0.78	18.10	15405
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*		*1.00*	*12.46*	
				8.66	1.42	10.08	2.61	3.17		6.21	26.24	15479
		5.00	*3.00*	*8.00*		*9.00*	*2.47*	*3.00*		*6.00*	*24.61*	
				9.84	1.74	11.58	1.18	1.43	1.10		17.15	15406
				10.00		*12.50*	*0.82*	*1.00*		*1.00*	*16.66*	
				10.15	2.03	12.18	1.26	1.53	1.64		18.41	15490
				10.00		*12.00*	*1.03*	*1.25*		*1.50*	*17.69*	
				10.23	2.05	12.28	1.06	1.29	1.90		18.18	15361
				10.00		*12.50*	*1.03*	*1.25*		*1.50*	*17.89*	
10.37	4.66					*15.03	1.18	1.43	1.42		16.06	15362
						15.00	*1.65*	*2.00*		*0.75*	*14.85*	
				9.90	7.11	17.01	1.78	2.16		0.81	21.03	15383
				8.00		*17.00*	*1.23*	*1.50*		*1.00*	*18.09*	

*Contains Soluble Phosphoric Acid.

TABLE OF ANALYSES.

Station Number	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained
	Duncan Bros. Co.	
15352	Tiger Br. Bone Meal	Manufacturer ....
15491		Mfrs. Warehouse ....
15353	Tiger Br. Raw Bone Meal ...	Manufacturer ....
15492		Mfrs. Warehouse ....
15354	Tiger Br. Grain Grower	Manufacturer ....
15493		Mfrs. Warehouse ....
15355	Tiger Br. Big Four Grain Grower	Manufacturer ....
15494		Mfrs. Warehouse ....
	The Empire Guano Co., Nashville, Tenn.	
15408	Empire Bone and Potash	Durham, Blakeman & Cantrell, Greensburg. ... .
15409	Empire Favorite Manure	Durham, Blakeman & Cantrell..
15374	Empire Wheat & Corn Grower	Manufacturer ....
15410		Durham, Blakeman & Cantrell.
	Empire Carbon Works, National Stock Yards, Ill.	
15359	Empire Raw Bone Meal	Manufacturer ....
15444		O. P. Frye & Bros., Christiansburg ....
	Fox Chemical Co., Branch, Federal Chemical Co., Louisville, Ky.	
15411	Fox Formula	Dickey & Co., Glasgow .....

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.
17.42	5.20					22.62	3.24	3.93			$26.78	15352
20.20	1.29					21.49	3.89	4.72			28.60	15491
						24.00	*2.06*	*2.50*			*20.58*	
19.83						19.83	3.88	4.71			27.50	15353
19.04	1.66					20.70	3.84	4.66			27.75	15492
						22.00	*3.71*	*4.50*			*24.33*	
				13.41	1.30	14.71	1.21	1.47		1.21	21.69	15354
				14.20	1.20	15.40	1.17	1.42		0.80	21.99	15493
				14.00		*15.00*	*0.82*	*1.00*		*1.00*	*20.86*	
				9.13	3.84	12.97	3.07	3.73	0.70	1.50	24.01	15355
				8.80	4.44	13.24	2.89	3.51		1.62	22.95	15494
				5.00		*11.00*	*2.47*	*3.00*		*2.00*	*18.21*	
				9.38	1.75	11.13			1.97		13.93	15408
				10.00					*2.00*		*14.00*	
				9.09	1.77	10.86	1.01	1.23	3.77		18.42	15409
				10.00			*0.82*	*1.00*	*3.00*		*17.46*	
				9.60	2.76	12.36	1.26	1.53	1.78		18.18	15374
				9.40	1.91	11.31	0.93	1.13	1.33		16.16	15410
				10.00			*0.82*	*1.00*	*1.00*		*15.46*	
18.64	0.98					19.62	3.69	4.48			26.57	15359
17.84	1.14					18.98	3.95	4.80			26.80	15444
						22.00	*3.29*	*4.00*			*23.07*	
				10.78	1.46	12.24	0.99	1.20	2.36	0.73	19.73	15411
				11.00		*13.00*	*0.82*	*1.00*		*3.00*	*20.06*	

TABLE OF ANALYSES.

Station Number	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained
	Fox Chemical Co.	
15412	Fox Grain Special	Dickey & Co. ....
15413	Fox Alkaline Bone	Dickey & Co. ....
15414	Fox Ground Bone	T. W. Buchanan, Campbellsville
	Globe Fertilizer Co., Branch, Federal Chemical Co., Louisville, Ky.	
15415	Braden Formula	Hill & McElroy, Bowling Green
15416	Progress Corn & Wheat Grower	Dickey & Co., Glasgow.....
15417	Eagle Wheat & Corn Grower.	Warren Implement Co., Elizabethtown ....
15418	Bone and Potash	J. W. Cloyd, Campbellsville ....
15419	Globe Bone Dust	C. M. Langdon, Science Hill ...
15420	Globe Grain Grower	Hill & McElroy ....
15421	Big Four Tobacco Grower....	I. K. Miller & Sons, Campbellsville ....
15422	Bone Phosphate and Potash..	C. M. Langdon ... .
15423	Potash Special	Dickey & Co. ....

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.
				9.23	1.57	10.80	0.47	0.57		1.31	$14.69	15412
				9.00		*11.00*	*0.41*	*0.50*		*1.50*	*14.63*	
				10.62	1.05	11.67			1.57		14.73	15413
				10.00		*12.00*			*2.00*		*14.80*	
22.94	5.03					27.97	2.16	2.62			27.85	15414
						22.00	*2.47*	*3.00*			*20.61*	
				12.71	0.90	13.61	0.83	1.01	2.38		20.48	15415
				11.00		*13.00*	*0.82*	*1.00*		*3.00*	*20.06*	
				8.65	1.24	9.89	0.79	0.96	1.97		15.22	15416
				10.00		*12.00*	*0.82*	*1.00*		*2.00*	*17.66*	
				7.69	1.78	9.47	1.76	2.14		2.11	17.75	15417
				8.00		*10.00*	*1.65*	*2.00*		*2.00*	*17.75*	
				11.48	1.91	13.39	0.63	0.76	1.09		17.52	15418
				11.00		*13.00*	*0.41*	*0.50*		*1.00*	*16.43*	
				9.92	5.42	15.34	0.99	1.20		1.61	18.97	15419
				9.00		*11.00*	*0.82*	*1.00*		*1.00*	*15.26*	
				10.90	1.45	12.35	0.58	0.70		1.83	17.60	15420
				9.00		*11.00*	*0.41*	*0.50*		*1.50*	*14.63*	
				8.94	2.60	11.54	1.27	1.54	1.68		17.26	15421
				8.00		*10.00*	*1.65*	*2.00*		*2.00*	*17.75*	
				12.40	4.45	16.85			2.78		19.44	15422
				10.00		*12.00*			*4.00*		*16.80*	
				9.90	1.27	11.17			1.92		14.31	15423
				10.00		*12.00*			*2.00*		*14.80*	

TABLE OF ANALYSES.

Station Number	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained
	The Jarecki Chemical Co., Sandusky and Cincinnati, Ohio	
15424	Lake Erie Fish Guano	I. K. Miller & Sons, Campbellsville ....
15425	C. O. D. Phosphate	M. B. Hines, Science Hill ....
15377	Raw Bone and Guano Mixture	S. Y. Allen, Gold City .....
	The Jones Fertilizing Co., Cincinnati, O.	
15402	Jones' Bone Meal	Jno. W. Smith, Hodgenville ...
	Kaufman Fertilizer Co., Cincinnati, O.	
15495	Harvest King	Farmers Supply Co., Madisonville
15496	Banner Crop Grower	Farmers' Supply Co. .....
15497	Alkaline Bone and Potash...	H. A. Moore, Big Clifty .....
15498	Acid Phosphate	H. A. Moore ....
	Louisville Fertilizer Co., Louisville, Ky.	
15427	Eagle Guano	J. W. Crume & Bro., Lebanon..
15428	Eagle Soluble Bone	Smith & Flora, Campbellsville..

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.		
				9.44	2.21	11.65	0.84	1.02	1.64		$16.37	15424
				10.00		*11.00*	*0.82*	*1.00*	*2.00*		*16.86*	
				15.30	1.42	16.72					15.30	15425
				14.00		*15.00*					*14.00*	
14.58	3.65					*18.23	2.03	2.46	0.95		20.89	15377
						16.00	*1.65*	*2.00*	*1.00*		*15.55*	
17.76	2.89					20.65	1.22	1.48			19.60	15402
						20.00	*0.82*	*1.00*			*14.46*	
				9.21	2.57	11.78	1.03	1.25	1.18		16.35	15495
				8.00		*9.00*	*1.00*	*1.21*	*2.00*		*15.00*	
				8.84	1.88	10.72	0.89	1.08	1.02		15.05	15496
				7.00		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				10.95	2.74	13.69			1.81		16.05	15497
				10.00		*11.00*			*2.00*		*14.40*	
				14.14	1.75	15.89					14.14	15498
				14.00		*15.00*					*14.00*	
				10.31	1.87	12.18	1.60	1.94		1.80	20.08	15427
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*		*2.00*	*19.75*	
				10.06	0.95	11.01	0.82	1.00		1.36	16.54	15428
		5.00	*3.00*	*8.00*		*9.00*	*0.82*	*1.00*		*1.50*	*14.26*	

*Contains Soluble Phosphoric Acid.

TABLE OF ANALYSES.

Station Number	Name and Address of Manufacturer and Name of Brand	From Whom Obtained
	Louisville Fertilizer Co.	
15429	Eagle Slaughter House Bone..	L. S. Brough, Bowling Green ...
15430	Eagle Potash Mixture	J. W. Crume & Bro. ....
15431	Eagle Special Wheat Grower.	L. S. Brough ....
15432	Eagle Bone Meal	J. W. Crume & Bro. .....
15433	Eagle High Grade Tobacco & Potato Grower	J. W. Crume & Bro. .....
	Michigan Carbon Works, Detroit, Mich.	
15435	Homestead A Bone Black Fertilizer	D. H. Hatter, Franklin .....
15436	Red Line Crop Grower	Norris & Lockett, Henderson ..
15437	Red Line Complete Manure ..	Norris & Lockett ....
15438	Wolverine Pure Ground Bone.	W. Lewis, Greensburg .....
15439	Desiccated Bone	J. W. Bearce & Co., Bowling Green ....
	National Fertilizer Co., Nashville, Tenn.	
15441	Old Hickory Brand Acid Phosphate	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.		
				8.15	1.75	9.90	1.82	2.21		1.79	$18.09	15429
		5.00	*3.00*	*8.00*		*9.00*	*1.65*	*2.00*		*2.00*	*17.35*	
				11.32	0.65	11.97			1.95		15.79	15430
		6.00	*4.00*	*10.00*		*11.00*			*2.00*		*14.40*	
				6.65	3.28	9.93	1.00	1.21		0.95	13.43	15431
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*		*1.00*	*12.46*	
16.30	3.58					19.88	1.27	1.54			19.00	15432
						20.00	*0.82*	*1.00*			*14.46*	
				6.90	1.94	8.84	1.52	1.85		4.19	18.65	15433
		4.00	*3.00*	*7.00*		*8.00*	*1.65*	*2.00*		*4.00*	*18.55*	
				8.50	0.97	9.47	2.00	2.43	1.78		18.37	15435
				8.00		*9.00*	*2.06*	*2.50*	*1.50*		*17.68*	
				8.92	1.70	10.62	1.90	2.31	2.36		19.44	15436
				8.00		*9.00*	*1.65*	*2.00*	*2.00*		*16.95*	
				8.27	2.03	10.30	1.00	1.21	1.19		14.92	15437
				7.00		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
20.19	7.85					28.04	2.77	3.36			29.17	15438
						20.00	*2.47*	*3.00*			*19.41*	
22.18	9.96					32.14	1.20	1.46			27.32	15439
						25.00	*1.23*	*1.50*			*18.69*	
				10.04	5.76	15.80					10.04	15441
		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
	National Fertilizer Co.	
15442	O. H. B. Acid Phosphate and Potash	Durham, Blakeman & Cantrell..
15443	O. H. B. National Blood and Bone	Durnam, Blakeman & Cantrell..
15367	Omaha Bone and Meat Meal..	Manuracturer
	North-Western Fertilizing Co., Chicago, Ill.	
15445	Horse Shoe Brand Quick Acting Phosphate	Watkins & Co., Elizabethtown..
15446	H. S. B. Bone and Potash	Dickey & Co., Glasgow
15447	H. S. B. Cap Sheaf Wheat Grower	Henderson & Nelson, Eubanks..
15448	H. S. B. Acidulated Bone and Potash	J. M. Harned, Big Clifty
15449	H. S. B. Corn & Wheat Grower	Watkins & Co.
15450	H. S. B. Challenge Corn Grower	T. J. Turley & Co., Leitchfield..
15451	H. S. B. Raw Bone and Superphosphate Mixture	A. W. Pickerill, Hodgenville
15357	H. S. B. Fine Raw Bone	S. H. Perkins, Elkton
15364		S. M. Vinson, Sonora

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.		
				8.11	4.70	12.81			1.62		$13.23	15442
		7.00	*3.00*	*10.00*		*11.00*			*2.00*		*14.40*	
				9.16	5.05	14.21	0.87	1.06	1.65		17.27	15443
		6.00	*4.00*	*10.00*		*11.00*	*0.82*	*1.00*	*1.00*		*15.86*	
12.34	1.37					13.71	5.34	6.48			26.71	15367
						14.00	*5.35*	*6.50*			*24.45*	
				10.65	2.46	13.11					10.65	15445
		8.00	*2.00*	*10.00*		*12.00*					*10.00*	
				10.29	3.94	14.23			1.93		15.86	15446
		7.00	*3.00*	*10.00*		*12.00*			*2.00*		*14.80*	
				7.76	2.37	10.13	1.15	1.40	1.06		14.77	15447
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*	*1.00*		*12.26*	
				10.55	4.14	14.69	1.02	1.24	1.11		18.49	15448
		7.00	*3.00*	*10.00*		*12.00*	*0.82*	*1.00*	*1.00*		*16.26*	
				9.66	3.63	13.29	1.48	1.80	1.87		19.35	15449
		5.00	*3.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				8.18	4.61	12.79	2.17	2.63	1.52		19.69	15450
		5.00	*3.00*	*8.00*		*10.00*	*2.06*	*2.50*	*1.50*		*18.08*	
				8.33	2.06	10.39	2.38	2.89	0.70		18.66	15451
		4.00	*3.00*	*7.00*		*13.00*	*2.47*	*3.00*	*0.50*		*18.71*	
19.52						19.52	4.03	4.89			27.71	15357
18.50	0.77					19.27	3.90	4.73			26.96	15364
						22.00	*3.29*	*4.00*			*23.07*	

TABLE OF ANALYSES.

Station Number	Name and Address of Manufacturer and Name of Brand	From Whom Obtained
	The Ohio Farmers Fertilizer Co., Columbus, O.	
15499	Soluble Bone and Potash	W. H. Elgin, Hopkinsville .....
15500	Corn, Oats and Wheat Fish Guano	W. H. Elgin ....
	Packers Fertilizer Association, Chicago, Ill.	
15452	Boar's Head Brand Chicago Bone Meal	I. K. Miller & Son, Campbellsville ....
	Pero & Stoecker, Louisville, Ky.	
15350	Pure Bone Meal	Manufacturer ....
15453		T. J. Turley & Co.. Leitchfield..
15351	Pure Animal Matter Corn and Wheat Grower	Manufacturer ....
	Price Ray, Owensboro, Ky.	
15349	Raw Bone Meal	Manufacturer ....
15454		T. J. Turley & Co., Leitchfield..
	Read Phosphate Co., Nashville, Tenn.	
15459	Read's Blood and Bone No. 1.	Lebanon Carriage & Imp. Co., Lebanon ....
15460	Read's Farmers Sp'l Manure.	Wells & Powell, Glasgow .....
15461	Read's Soluble Bone	I. K. Miller & Sons, Campbellsville ....
15358	Read's Special Potash Mixture	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.		
				10.43	3.13	13.56			1.75		$15.52	15499
		8.00	*2.00*	*10.00*		*11.00*			*2.00*		*14.40*	
				8.27	2.72	10.99	0.74	0.90	3.54		16.77	15500
		5.00	*3.00*	*8.00*		*9.00*	*1.23*	*1.50*	*2.00*		*15.69*	
14.35	6.76					21.11	3.04	3.69			24.66	15452
						20.00	*2.47*	*3.00*			*19.41*	
11.86	8.94					20.80	3.64	4.42			25.77	15350
9.16	12.66					21.82	4.28	5.20			27.77	15453
						22.00	*3.50*	*4.25*			*23.70*	
12.74	4.71					17.45	4.22	5.12			25.68	15351
						10.00	*4.00*	*4.86*			*18.00*	
9.83	7.72					17.55	3.45	4.19			22.84	15349
10.05	10.47					20.52	3.76	4.56			25.60	15454
						20.00	*4.50*	*5.46*			*25.50*	
				8.01	4.96	12.97	1.61	1.95	2.30		18.72	15459
				8.00			*1.65*	*2.00*	*2.00*		*16.55*	
				10.01	3.65	13.66	1.00	1.21	2.65		19.12	15460
				10.00			*0.82*	*1.00*	*3.00*		*17.46*	
				9.22	0.81	10.03	0.97	1.18	2.27		16.56	15461
				8.00			*0.82*	*1.00*	*2.00*		*14.06*	
				11.15	2.97	14.12			4.43		19.00	15358
				10.00					*4.00*		*16.00*	

TABLE OF ANALYSES.

Station Number	Name and Address of Manufacturer and Name of Brand	From Whom Obtained
	Read Phosphate Co.	
15372	Read's Red Diamond Special.	Manufacturer ....
15462		W. Lewis, Greensburg .....
15373	Read's Wheat and Clover Grower	manufacturer ....
15385	Read's Fine Ground Bone ..	manufacturer ....
15501		Farmers Supply Co., Madisonville ....
	Singer & Johnson Fertilizer Co., Nashville, Tenn.	
15813	Singer's Raw Bone Meal	Manufacturer ....
15375		W. M. Sloss, Woodburn .....
15376		C. B. Amos, Woodburn .....
15814	Singer's Wheat Grower	Manufacturer ....
15815	Singer's Wheat Grower	Manufacturer ....
	Smith Brothers, Louisville, Ky.	
15465	Corn and Wheat Grower	Earl Head, Clarkson ....
15466	Success Crop Grower	Earl Head ....
	Swift & Co., Chicago, Ill.	
15467	Swift's Pure Superphosphate.	Jas. M. Wright, Franklin .....
15468	Swift's Pure Complete Fertilizer	Wells & Powell, Glasgow .....
15469	Swift's Pure Raw Bone Meal.	Wells & Powell ....

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.		
				10.25	1.93	12.18	2.63	3.19	4.19		$25.15	15372
				9 08	2.60	11.68	2.52	3.06	2.57		22.07	15462
				10.00			*2.47*	*3.00*	*3.00*		*22.41*	
				9.35	2.87	12.22	1.17	1.42	2.70		18.58	15373
				10.00			*0.82*	*1.00*	*2.00*		*16.46*	
16.45						*16.45	3.08	3.74			22.40	15385
22.34	4.91					27.25	2.43	2.95			28.11	15501
						20.61	*2.47*	*3.00*			*19.78*	
16.88	6.56					23.44	4.21	5.11			30.07	15813
12.65	6.51					19.16	3.16	3.84			23.51	15375
11.99	7.35					19.34	3.82	4.64			25.46	15376
						20.00	*3.29*	*4.00*			*21.87*	
				10.59	5.76	16.35	1.55	1.88		1.97	22.02	15814
				10.00			*1.65*	*2.00*		*2.00*	*19.35*	
				10.09	4.67	14.76				2.31	16.75	15815
				10.00						*2.00*	*14.40*	
				8.36	2.44	10.80	1.78	2.16	2.34		18.69	15465
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				8.24	1.70	9.94	0.79	0.96	1.06		14.00	15466
		5.00	*2.00*	*7.00*		*9.00*	*0.82*	*1.00*	*1.00*		*12.66*	
				9.15	0.79	9.94	1.92	2.33	1.60		18.66	15467
				8.00		*12.00*	*1.65*	*2.00*	*2.00*		*18.15*	
				7.84	2.94	10.78	1.19	1.44	1.08		15.24	15468
				8.00		*11.00*	*1.03*	*1.25*	*1.00*		*14.89*	
12.18	13.18					25.36	4.02	4.88			29.71	15469
						23.00	*3.71*	*4.50*			*24.93*	

*Contains Soluble Phosphoric Acid.

TABLE OF ANALYSES.

Station Number	Name and Address of Manufacturer and Name of Brand	From Whom Obtained
	Swift & Co.	
15470	Swift's Pure Bone Meal	Hill & McElroy, Bowling Green.
15463	Swift's Pure Bone and Potash.	R. L. Buchanan, Vine Grove ..
15464		R. L. Buchanan, Vine Grove ..
15471		Jas. M. Wright ....
15472	Swift's Pure Special Phosphate and Potash	Wells & Powell ....
15473	Swift's Special BoneMeal....	Durham & Coakley, Greensburg.
	Tennessee Chemical Co., Nashville, Tenn.	
15474	Ox Slaughter House Bone ...	W. F. Grainger, Franklin .....
15475	Ox Potash Mixture	W. F. Grainger ....
15476	Ox Special Wheat Grower ...	Bourland & Moore, Madisonville
15477	Ox Bone Meal	T. J. Turley & Co., Hartford....
15478	Ox High Grade Dissolved Bone	W. F. Grainger ....
15371	Ox Ammoniated Bone	Manufacturer ....
	Tennessee Valley Fertilizer Co., Florence, Ala.	
15356	Ward's Mixture	Manufacturer ....
15368	Webb's Formula	Manufacturer ....
15389		M. E. Webb, Guthrie .....

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.		
22.16	4.86					27.02	2.56	3.11			$28.33	15470
						25.00	*2.47*	*3.00*			*22.41*	
20.11	4.12					24.23	2.76	3.35	3.18		30.02	15463
21.70	4.45					26.15	2.11	2.56	3.34		29.70	15464
21.14	4.32					25.46	2.55	3.10	3.23		30.38	15471
						23.50	*2.47*	*3.00*	*3.00*		*24.51*	
				11.54	0.29	11.83			1.78		15.75	15472
				10.00		*11.00*			*2.00*		*14.40*	
25.04	7.48					32.52	1.17	1.42			28.03	15473
						27.50	*0.82*	*1.00*			*18.96*	
				12.60	1.18	13.78	0.94	1.14		1.67	20.41	15474
		5.00	*3.00*	*8.00*		*9.00*	*1.65*	*2.00*		*2.00*	*17.35*	
				10.31	1.33	11.64				1.64	14.87	15475
		6.00	*4.00*	*10.00*		*11.00*			*2.00*		*14.40*	
				9.81	1.60	11.41	0.96	1.17		1.03	16.53	15476
		4.00	*3.00*	*7.00*		*8.00*	*0.82*	*1.00*		*1.00*	*12.46*	
18.75	2.56					21.31	1.23	1.49			20.23	15477
						20.00	*0.82*	*1.00*			*14.46*	
				13.62	1.45	15.07					13.62	15478
		8.00	*6.00*	*14.00*		*15.00*					*14.00*	
				12.16	1.22	13.38	1.69	2.05		1.96	22.50	15371
		6.00	*4.00*	*10.00*		*11.00*	*1.65*	*2.00*		*2.00*	*19.75*	
				11.01	3.31	14.32	1.55	1.88		6.66	27.17	15356
		6.00	*2.00*	*8.00*		*10.00*	*2.06*	*2.50*		*5.00*	*22.58*	
				10.42	1.94	12.36	1.10	1.34	1.16	5.94	24.87	15368
				13.42	0.50	13.92	1.29	1.57	0.84	4.54	26.46	15389
		9.00	*3.00*	*12.00*		*14.00*	*1.65*	*2.00*		*6.00*	*27.35*	

TABLE OF ANALYSES.

Station Number	Name and Address of Manufacturer and Name of Brand	From Whom Obtained
	Tennessee Valley Fertilizer Co.	
15369	Pride of Kentucky	Manufacturer ....
	Tuscarora Fertilizer Co., Chicago, Ill.	
15480	Tuscarora Standard	Bricken & Merkley, Lebanon ..
15481	Bone and Potash	Bricken & Merkley ... .
15455	Tuscarora Raw Bone Meal...	Thos. M. Barker, Kennedy ....
15456		Chas. E. Barker, Pembroke ....
15457		Chas. E. Barker ... .
15365	Animal Bone	Robt. Shearer, Frazer .....
	Virginia-Carolina Chemical Co., Memphis Division, Memphis, Tenn.	
15482	Beef, Blood and Bone Fertilizer	Earl Head, Clarkson .....
15370	Frisco Special Wheat Fertilizer	Manufacturer ....
	Wake Fertilizer Co., Adairville, Ky.	
15426	Old Kentucky Tobacco Grower	C. S. Coleman, Gracey .....
15434		J. F. Giles, Gracey ....

December 31, 1905.

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.		
				10.78	2.88	13.66	1.15	1.40	3.28		$20.82	15369
				10.00		*12.00*	*0.82*	*1.00*		*4.00*	*20.06*	
				9.71	1.62	11.33	1.46	1.77	2.12		18.80	15480
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				9.93	0.92	10.85			2.37		14.66	15481
		6.00	*4.00*	*10.00*		*12.00*			*2.00*		*14.80*	
13.50	9.78					23.28	4.17	5.06			29.18	15455
14.10	10.21					24.31	4.01	4.87			29.44	15456
13.17	8.78					21.95	4.85	5.89			30.36	15457
						22.00	*3.71*	*4.50*			*24.33*	
20.95	4.29					25.24	2.76	3.35			27.61	15365
						24.00	*2.47*	*3.00*			*21.81*	
				9.89	0.88	10.77	1.96	2.38	2.07		20.17	15482
		6.00	*2.00*	*8.00*		*10.00*	*1.65*	*2.00*	*2.00*		*17.35*	
				10.12	0.59	10.71	2.18	2.65	5.95		24.87	15370
		6.00	*2.00*	*8.00*		*10.00*	*1.98*	*2.40*	*6.00*		*22.34*	
				7.37	1.02	8.39	2.93	3.56		9.27	29.16	15426
				7.25	0.60	7.85	3.00	3.64		10.35	30.36	15434
				6.25			*3.09*	*3.75*		*8.00*	*26.37*	

M. A. SCOVELL, Director and Chemist.
H. E. CURTIS, Chemist, Fertilizers.
W. H. SCHERFFIUS Chemist.
O. M. SHEDD, Ass't Chemist.

DIVISION OF CHEMISTRY

MISCELLANEOUS CHEMICAL ANALYSES MADE IN 1905.

BY A. M. PETER, S. D. AVERITT AND H. L. AMOSS.

Forage Plants.

The following were plants grown on Prof. Garman's grass plots at the Station farm. They were tops only, having been cut off a few inches from the ground, as for hay:

14764—Hungarian clover, trifolium pannonicum, from plot 30, cut June 7th, 1904.

14802—Western wheat-grass, agropyrum occidentalis, cut June 5th, 1905.

14803—Southern fescue, festuca australis, cut June 5th, 1905.

Analyses of the Air-dried Plants—Per Cent..

Number	14764	14802	14803
Water	11.13	8.92	10.01
Ash	11.39	6.51	7.17
Protein	15.38	9.19	8.00
Fiber	27.23	33.22	29.48
Nitrogen-free extract	33.42	40.69	43.49
Fat	1.45	1.47	1.85
Total	100.00	100.00	100.00

Analyses Calculated Water-free—Per Cent.

Number	14764	14802	14803
Ash	12.82	7.15	7.97
Protein	17.31	10.09	8.89
Fiber	30.64	36.47	32.76
Nitrogen-free extract	37.60	44.68	48.33
Fat	1.63	1.61	2.05
Total	100.00	100.00	100.00

The analyses show very good percentages of protein in all, the Hungarian clover comparing favorably with alfalfa in this respect.

Butter.

The following analyses are of butter made in churn tests of Jersey cows in 1905:

Name of Cow.	No. of Sample	From Milkings of	Fat pr.ct.	Water pr.ct.	Salt pr.ct.	Curd pr.ct.
Fair Fortune Teller.	14765	May 19-22	85.44	10.65	3.11	0.80
	14766	May 23-25	84.40	12.33	2.77	0.50
Oona B.	14854	Sept. 15-18	83.37	12.27	3.42	0.94
	14855	Sept. 19-21	79.53	13.58	5.80	1.09
Valentine's Alice ...	14871	Oct. 13-16	82.98	13.24	3.42	0.36
	14872	Oct. 17-19	80.91	13.29	5.09	0.71

Tobacco Stems.

14699—Leached tobacco stems, sent by F. F. Gilmore, Louisville, Ky., January 20, 1905, to determine their value as a fertilizer. The stems were very wet when received and lost 76 per cent. of moisture by air-drying.

ANALYSIS—Per Cent.	As received.	Water-free.
Water	77.84	
Ash	3.12	13.86
Nitrogen	.39	1.74
Phosphoric acid	.21	.93
Potash	.12	.51
Estimated value per ton.....	$1.50	$6.66

The wet stems contain more nitrogen, phosphoric acid, and potash than average barnyard manure. In calculating the "Estimated value per ton," nitrogen has been counted 6 cents a pound and phosphoric acid and potash 5 cents each.

Mineral Waters.

ALLEN COUNTY.

14713—Sulphur water sent by Mrs. M. E. Holland, Scottsville, Ky., March 3, 1905, from a well 65 feet deep in her yard, in Allen County, 1½ mile west of Scottsville. The well is 27 feet in soil and the rest in limestone rock.

ANALYSIS.

One gallon contains 300.3 grains of solid matter (5.151 grams per liter) composed of sodium chloride, calcium sulphate, magnesium sulphate and calcium carbonate, with some sodium sulphide, potassium sulphate and marked traces of iron sulphide, lithium chloride and strontium carbonate. The water also contains some free hydrogen sulphide gas. The total amount of hydrogen sulphide, both free and combined, was found to be 4.9 grains to the gallon (.084 gram per liter).

This is a good alkaline-saline sulphur water.

14790—Sulphur water, labeled "Green Mineral Water," sent by H. C. Chapman, Scottsville, Ky. Received June 17, 1905.

ANALYSIS.

One gallon contains 2145 grains of solid matter (36.792 grams per liter) composed of sodium chloride, calcium sulphate, magnesium chloride, sodium sulphide, calcium carbonate, marked traces of iodides and bromides and traces of zinc, iron, lithium and strontium. The water also contains some free hydrogen sulphide gas. The total amount of hydrogen sulphide, both free and combined, was found to be 31 grains to the gallon (.535 gram per liter).

This is a very strong alkaline-saline sulphur water, containing about four times as much saline matter as Blue Lick water and about fifteen times as much sulphides.

BARREN COUNTY.

14878—Sulphur water sent by G. P. Turner, Coral Hill, Ky., October, 1905. The well is 94 feet deep and the supply abundant, it having been pumped at the rate of 3½ gallons per minute continuously for four hours without diminution. The sample was taken after pumping 1¾ hour.

ANALYSIS.

One gallon contains 35.1 grains of solid matter (0.602 gram per liter) composed of calcium carbonate, sodium chloride, magnesium sulphate and traces of iron, potassium, lithium and stron-

tium. The water also contains 0.12 grain of hydrogen sulphide to the gallon (.002 gram per liter).

This is a weak sulphur water.

CALDWELL COUNTY.

14889—Mineral water sent by C. K. Hanna, Princeton, Ky., November, 1905. The well is 172 feet deep. The water is said to benefit many people who are using it.

ANALYSIS.

One gallon contains 203.5 grains of solid matter (3.49 grams per liter) composed of calcium carbonate, magnesium carbonate, sodium carbonate, sodium sulphate, potassium sulphate, sodium chloride and traces of iron carbonate, strontium carbonate, lithium carbonate and sodium bromide.

This is an alkaline-saline water and should have medicinal value. It contains enough sodium sulphate to act as a laxative.

CHRISTIAN COUNTY.

14874—Mineral water sent by R. F. Smith, Kelly, Ky., October, 1905, from a well 265 feet deep, near that place.

ANALYSIS.

One gallon contains 228.3 grains of solid matter (3.916 grams per liter) composed of calcium carbonate, magnesium carbonate, sodium carbonate, sodium chloride, sodium sulphate and small quantities of ferrous carbonate, lithium carbonate, potassium chloride, sodium iodide and sodium bromide.

This is an alkaline-saline water containing quite a notable quantity of iodides and bromides and should have medicinal value.

CRITTENDEN COUNTY.

14840—Chalybeate water sent by S. M. Jenkins, Marion, Ky., about September 1, 1905. The water is acid and tastes strong of iron.

ANALYSIS.

One gallon contains 165.3 grains of solid matter composed of

sodium chloride, calcium sulphate, magnesium sulphate, ferrous sulphate and small quantities of manganese sulphate, potassium sulphate, lithium sulphate and silica.

This is a saline chalybeate water of the kind known as "alum" waters. It should have medicinal value.

14863—Water from a zinc mine about 4 miles west of Marion, and 100 yards from the "White Sulphur Springs." Sent by F. M. Clement, View, Ky., August 2, 1905: The water was struck in running a cross cut on the zinc vein in a shaft 49 feet deep. There was much gas with it, which made the eyes of the workmen sore and their faces swell. Later the water rose in the shaft above the cross cut. The sample sent was only about one-half pint. A gray sediment had formed in the bottle.

ANALYSIS.

Qualitative tests showed the presence of much sodium chloride with some calcium carbonate, calcium sulphate, calcium chloride, a little magnesium chloride, potassium chloride and lithium chloride. The sediment contained free sulphur, ferrous sulphide and organic matter.

The presence of free sulphur in the sediment would suggest that the gas which appeared with this water was hydrogen sulphide.

FAYETTE COUNTY.

14812—Chalybeate water from a spring on the farm of Mrs. M. D. Burrier, on the Parker's Mill road. The spring has quite a strong flow and the water tastes of iron.

ANALYSIS.

One gallon contains 26.2 grains of solid matter (0.449 gram per liter) composed of calcium carbonate, ferrous carbonate, magnesium carbonate, a little calcium sulphate, sodium chloride and potassium chloride and a trace of strontium carbonate and some organic matter.

A weak chalybeate water.

14876—Saline sulphur water sent from a new well 204 feet deep, on the farm of T. Bailey, in Fayette County, near Lexington, on the Newtown road. Sample received October 23d, 1905.

ANALYSIS.

One gallon contains 1019.7 grains of mineral matter (17.49 grams per liter) composed of sodium chloride, calcium chloride, magnesium chloride, potassium chloride, calcium carbonate, a little calcium sulphate and marked traces of strontium sulphate, lithium chloride, sodium sulphide, iodide, bromide and borate, zinc sulphide and iron carbonate.

The water also contains some free hydrogen sulphide. The total amount of hydrogen sulphide, both free and combined, was found to be 0.56 grain per gallon (.0096 gram per liter).

This kind of saline sulphur water is often obtained by boring in our limestone rocks. It has some value medicinally.

FLOYD COUNTY.

14873—Mineral water sent by J. L. Spurlock, in October, 1905, from a well just bored at the mouth of Middle Creek, on the Big Sandy River.

ANALYSIS.

One gallon contains 222.8 grains of solid matter (3.822 grams per liter) composed of sodium chloride, calcium carbonate, calcium chloride, magnesium chloride, a little calcium sulphate, potassium chloride, sodium bromide, lithium carbonate and traces of sodium iodide, ferrous carbonate, strontium carbonate, silica and organic matter.

This is a saline water of moderate strength and should be pleasant and wholesome for drinking. It should have some medicinal value.

GREEN COUNTY.

14890—Mineral water sent by Sam. J. Heitzer, Greensburg, Ky., in November, 1905, from a well on his farm, about 4 miles from that place.

ANALYSIS.

One gallon contains 204.9 grains of solid matter (3.515 grams per liter) composed of calcium carbonate, sodium chloride, calcium sulphate, magnesium sulphate and small quantities of potassium chloride, ferrous carbonate, lithium carbonate, sodium bromide and silica.

This is a saline water of moderate strength containing a notable quantity of bromide.

HOPKINS COUNTY.

14875—Mineral water sent by G. O. Prowse, White Plains, Ky., in October, 1905, from a well 60 feet deep, bored about two years ago in that town.

ANALYSIS.

One gallon contains 142.6 grains of solid matter (2.446 grams per liter) composed of calcium sulphate, magnesium sulphate, sodium sulphate, sodium chloride, a little ferrous sulphate, potassium sulphate and silica and a trace of lithium sulphate.

This is a weak saline chalybeate and may be classed as an "alum" water.

JEFFERSON COUNTY.

14804—Water from a well 65 feet deep on the property of Mrs. W. P. Way, at Forrest, near Anchorage. It is thought to resemble the water of Anita Springs.

ANALYSIS.

Total solid matter.....	20.5 grains per gallon—	0.352 gram per liter
Ignited solids	15.4 grains per gallon—	.264 gram per liter
Organic and volatile....	5.1 grains per gallon—	.088 gram per liter

The mineral matter consists of calcium carbonate, magnesium carbonate, sodium chloride, a little calcium sulphate and traces of iron, potassium and lithium. The slight sediment in the demijohn contained a trace of iron and some organic matter.

This water does not differ materially from our ordinary well and spring waters, though containing slightly more total solids and

sodium chloride than the average of such waters. It does not contain sodium carbonate and appears to contain somewhat less magnesia than the Anita water, but is quite like it in other respects.

LINCOLN COUNTY.

14684—Salt water from the well of Jeff. Austin, in the town of Mount Salem, sent in January, 1905. The well was recently drilled and is 50 feet deep.

ANALYSIS.

One gallon contains 3114.2 grains of solid matter (53.418 grams per liter) composed of sodium chloride, calcium sulphate, calcium chloride, magnesium chloride, small quantities of potassium chloride, sodium iodide, sodium bromide, sodium metaborate, lithium chloride and strontium sulphate and traces of iron and zinc.

Quite a strong brine containing notable quantities of iodine, bromine and lithium. Such waters have been used for brine baths.

PULASKI COUNTY.

14728—Water sent by D. E. McQuary, March, 1905, from Siloam Well, at "Walnut Lawn," farm of J. F. McQuary, in the eastern part of the county, near Plato. The well was bored in the winter of 1904-5, and is 60 feet deep, 50 feet in rock. It is on high ground. A number of persons in the neighborhood claim to have been benefited by drinking the water.

ANALYSIS.

One gallon contains 25.4 grains of solid matter (0.435 gram per liter) composed of calcium carbonate, magnesium carbonate, sodium carbonate, a little sodium chloride and potassium sulphate and traces of iron carbonate and lithium carbonate.

This is a pure alkaline water and should have some medicinal value. It would be good water for table use, especially if carbonated.

TODD COUNTY.

14682—Water sent by Geo. P. Street, Elkton, Ky., in December, 1904, from a well near that place. The well was bored in

1903. It is 42 feet deep, 16 feet through soil, 24 feet through limestone and 2 feet in soft shale.

ANALYSIS.

One gallon contains 26.9 grains of solid matter (0.462 gram per liter) composed of sodium carbonate, calcium carbonate, a little magnesium carbonate and traces of the carbonates of iron, zinc, lithium and strontium, potassium sulphate, sodium chloride and sodium nitrate.

The nitrogen of nitrates is 1.6 parts per million and the water also contains a decided trace of free ammonia.

This is an alkaline water and should have some medicinal value, though the presence of some free ammonia makes it important to know more about the situation of the well before using it for drinking.

14841—Sulphur water sent in September, 1905, by Jas. M. Weathers, Elkton, Ky., from the property of C. M. Redford, situated on the main street of that place. The well is 53 feet deep. Many persons claim to have been benefited by drinking the water.

ANALYSIS.

One gallon contains 187.2 grains of solid matter (3.212 grams per liter) composed of sodium chloride, sodium sulphate, sodium sulphide, calcium carbonate, magnesium carbonate and small quantities of potassium sulphate, lithium carbonate, iron sulphide and zinc sulphide.

The water also contains some free hydrogen sulphide gas. The total amount of hydrogen sulphide, both free and combined, is 4.9 grains to the gallon (.084 gram per liter).

This is a good alkaline saline sulphur water.

14861—Sulphur water sent by S. H. Perkins, Elkton, Ky., September, 1905, from a well 46 feet deep, on his farm, on Elk Fork, near that place.

ANALYSIS.

One gallon contains 54.9 grains of solid matter (0.942 gram

per liter) composed of sodium chloride, calcium carbonate, magnesium carbonate, sodium carbonate, sodium sulphide, a little sodium sulphate, potassium sulphate, silica and marked traces of iron carbonate, lithium carbonate and sodium metaborate.

The total amount of hydrogen sulphide present, both free and combined, is 1.16 grain to the gallon (0.02 gram per liter).

This is a good weak alkaline sulphur water.

14862—Sulphur water sent by Mr. Perkins at the same time as 14861 from another well, 83 feet deep, on the same farm.

ANALYSIS.

One gallon contains 44.5 grains of solid matter (0.764 gram per liter) composed of sodium chloride, sodium carbonate, calcium carbonate and magnesium carbonate, with a little sodium sulphate, potassium sulphate, silica and traces of iron carbonate and lithium carbonate.

The total amount of hydrogen sulphide is 0.23 grain to the gallon (0.004 gram per liter).

This water is quite like 14861, but contains less sulphur and total solids and a notably larger proportion of sodium carbonate.

14864—Sulphur water sent by Mrs. Addah Bradley, September 30, 1905, from a well bored in July last on her lot in Elkton, Ky.

ANALYSIS.

One gallon contains 71.1 grains of solid matter (1.224 gram per liter) composed of calcium carbonate, magnesium carbonate, sodium carbonate, sodium sulphate, potassium sulphate, sodium chloride and sodium sulphide and a little iron carbonate, lithium carbonate and zinc sulphide.

The water also contains some hydrogen sulphide, the total amount of which, both free and combined, is 3.34 grains in the gallon (.0576 gram per liter).

This is an alkaline saline sulphur water, quite strong in sulphur, but with a moderate amount of salts.

WARREN COUNTY.

14829—Salt sulphur water sent by Lewis P. Smith, Bowling Green, Ky.

ANALYSIS.

One gallon contains 1127 grains of solid matter (19.33 grams per liter) composed of sodium chloride, magnesium chloride, calcium carbonate, calcium sulphate and sodium sulphide, with lithium chloride and potassium chloride in notable amount and traces of iodides and bromides.

The water also contains much hydrogen sulphide, the total amount of which, both free and combined, is 11 grains to the gallon (.188 gram per liter).

This is a very strong salt sulphur water containing so much hydrogen sulphide gas and alkaline sulphide that it is hardly drinkable without dilution.

WHITLEY COUNTY.

14848—Chalybeate water brought by John S. Huddleston, Lexington, Ky., September 13, 1905, from a well in Whitley County, Ky., near Jellico, Tenn. The well was bored 10 years ago and is quite deep.

ANALYSIS.

One gallon contains 144.6 grains of solid matter (2.48 grams per liter) composed of magnesium sulphate, calcium sulphate, sodium sulphate, sodium chloride, a little potassium sulphate, ferrous sulphate and silica and a trace of lithium sulphate.

This is a weak saline chalybeate water and should have some medicinal value.

WOODFORD COUNTY.

14715—Mineral water brought by G. A. Hancock, March 13, 1905, from a bored well, 180 feet deep, near Versailles, Ky.

ANALYSIS.

One gallon contains 376.2 grains of solid matter (6.452 grams per liter) composed of sodium chloride, calcium carbonate, mag-

nesium carbonate, a little calcium sulphate, potassium chloride, iron carbonate, zinc carbonate, sodium bromide, silica and traces of potassium iodide, lithium carbonate and strontium carbonate.

The water also contains .05 grain of hydrogen sulphide to the gallon (.0009 gram per liter.

It is a strong saline water, such as is often obtained by boring in our Trenton limestone. Such waters possess some medicinal value.

14734—Salt sulphur water brought by Mrs. Nat. Harris, Versailles, Ky., April 19, 1905, from a well, 120 feet deep, just outside the corporate limits of that place. The well was bored in June, 1904. The water stands in it 80 feet deep.

ANALYSIS.

One gallon contains 852 grains of solid matter (14.616 grams per liter) composed of sodium chloride, calcium chloride, magnesium chloride, a little calcium sulphate, calcium carbonate, sodium sulphide, potassium chloride, lithium chloride and sodium bromide and traces of potassium iodide, sodium metaborate, iron sulphide and zinc sulphide.

The total amount of hydrogen sulphide, including that derivable from the sodium sulphide, is 1.01 grain per gallon (.0175 gram per liter).

This water is much stronger in saline matter and sulphides than the preceding, but the composition of the saline matter is very similar to that.

METEOROLOGICAL SUMMARIES

FOR THE YEAR 1905.

Compiled from the records of the Local Office U. S. Weather Bureau 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	Absol'e range.
	In.	In.		In.		In.
January	29.14	29.57	26	28.71	7	.86
February	29.13	29.51	19	28.68	25	.82
March	29.00	29.32	13	28.71	19	.61
April	28.87	29.35	23	28.63	26	.72
May	28.92	29.19	1	28.69	17	.50
June	28.93	29.12	3	28.80	22	.32
July	29.93	29.15	15	28.77	22	.38
August	28.95	29.14	29	28.75	15	.39
September	29.01	29.16	6	28.83	2	.33
October	29.06	29.41	29	28.92	10	.49
November	29.01	29.46	30	28.55	16	.91
December	29.05	29.61	5	28.48	21	1.13
		Highest		Lowest		
Mean	29.00	29.61	Dec. 5	28.48	Dec. 21	.62

TEMPERATURE.

Months.	Elevation of the Dry Thermometer Bulb Above Ground Dec. 31st, 75 Feet. From Self-Registering Instruments.										No. of Days.		
	Mean.							Range.					
	Max.	Min.	Monthly.	Highest	Date	Lowest	Date	Absolute	Mean Daily	Mean daily change	Max. below 32 degrees	Max. above 90 degrees	Min. below 32 degrees
				°									
January	32.0	16.7	24.4	60	1	—6	25	66	15.3	7.2	18	0	29
February	32 8	17.0	24.9	51	28	—7	14	58	15.8	5.9	11	0	26
March	58.8	39.5	49.2	78	28	26	13	52	19.4	5.9	0	0	6
April	63.4	44.2	53.8	82	28	26	16	56	19.2	6.9	0	0	3
May	74.7	56.8	65.8	86	29	43	1	43	17.9	3.2	0	0	0
June	80.9	63.7	72.3	92	18	54	1	38	17.3	3.3	0	1	0
July	82.8	66.4	74 6	90	17	58	25	32	16.5	2.1	0	2	0
August	82.0	65.1	73.6	91	6	56	26	35	16 9	2.5	0	1	0
September	77 5	59.5	68.5	86	18	46	26	40	18 0	3.7	0	0	0
October	64.4	46.5	55 4	81	8	33	12	48	17.8	5.3	0	0	0
November	52.5	34.9	43.7	69	18	20	30	49	17.6	6.5	1	0	10
December	41 3	24.3	35.3	50	9	18	24	32	12.0	4.6	3	0	20
Mean	61.9	45.0	53 5	Max. 92	Jun. 18	Min. —7	Feb. 14	46	17.0	4.8	.....	.....	.....

PRECIPITATION.

(Amount in inches and hundredths.)

Elevation of top of gauge above ground December 31, 68 feet.

MONTH.	Total Amount.	Greatest Amount in any 24 consecutive hours.		No. of days on which 1 inch 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	2.04	.41	10—11	0	15	15—20	3.82
February	2.13	.92	8	0	14	21—23	3.70
March	5.87	1.79	20—21	2	19	10—17	4.90
April	2.87	.87	21	0	19	17—20	3.72
May	5.54	2.00	10	1	17	19—24	3.49
June	3.31	1.73	11	1	18	1—10	4.25
July	4.94	1.71	21—22	1	17	24—31	5.10
August	4.11	2.36	23	1	21	1—6	3.52
September ...	3.20	1.91	1	1	24	20—29	2.54
October	3.45	1.79	24—25	1	21	3—9	2.22
November	3.58	2.44	28—29	2	21	10—15	3.72
December	4.13	1.81	14—15	1	21	9—13	3.40
Total.....	45.17	.....	.....	....	227	.....	44.38

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	S. W.	36	N. W.	24	0	0
February	W.	37	N. W.	25	0	0
March	S.	60	S. W.	29	2	0
April	N. W.	56	S. W.	10	2	0
May	S.	42	W.	4	1	0
June	S. W.	30	N. W.	11	0	0
July	S. W.	40	S. E.	10	1	0
August	N. E	30	W.	23	0	0
September	S. W.	24	S.	10	0	0
October	N. E.	44	W.	11	1	0
November	S. W.	46	S.	28	1	0
December	S. W.	46	S. W.	29	2	0
Mean	S. W.	....	.....	.....	.....	...

*Days with 40 miles per hour and over.

CLOUDINESS.

MONTHS.	Mean Cloudn's (0 to 10)		Character of Day.		
	8 A. M.	Monthly.	Clear	Partly Cloudy	Cloudy
January	7.3	6.2	6	12	13
February	6.2	6.1	9	6	13
March	6.5	5.5	8	18	5
April	5.4	4.4	9	17	4
May	6.0	4.4	10	16	5
June	5.2	4.1	11	13	6
July	5.0	4.3	10	18	3
August	4.4	3.3	16	14	1
September	3.9	4.0	14	9	7
October	5.1	4.8	15	4	12
November	5.3	4.8	12	8	10
December	6.4	6.4	8	6	17
Summary	.....	.....	128	141	96
Mean	5.6	4.9	.....	.....	.....

NUMBER OF DAYS WITH—

MONTHS.	Thunder Storms	Snows	Hail	Fog
January	0	14	0	0
February	0	7	0	4
March	0	0	0	3
April	6	2	1	0
May	10	0	2	0
June	7	0	0	1
July	9	0	0	0
August	8	0	0	2
September	2	0	0	1
October	1	0	0	0
November	0	0	0	0
December	0	1	0	0
Total	43	24	3	11

INDEX

Agropyrum occidentalis, analysis of 225
Allen County, analyses of mineral waters from 226, 227
Allen, R. M., v, xvi; Bulletin 119 by 23
Amoss, H. L. ..... xvii, 225
Analyses of butter from churn tests 226
commercial fertilizers 85, 94, 193, 200
corn grains from different parts of the ear..... 183-188
Hungarian clover, trifolium pannonicum 225
Kentucky-grown corn 177-188
leached tobacco stems 226
mineral waters 226-236
Southern fescue, festuca australis 225
Western wheat-grass, agropyrum occidentalis..... 225
Antiseptics and artificial color in food 36
Apple tree measuring worm 65
Austin, Jeff., salt water from 232
Averitt, S. D., ... v, xvii, 225
Bailey, T., sulphur water from 230
Barker, Judge Henry S. iv
Bark louse on oak trees 51
Barren County, analysis of sulphur water from 227
Beckham, Gov. J. C. W. ..... iii, iv, x
Bell, Judge William C. iv
Board of Control of the Experiment Station v
Board of Trustees of the State College iv
Bradley, Mrs. Addah, sulphur water from 234
Brooks, Basil M. iv
Brown June-bugs, injuring forest trees 76
Bulletin 118—Corn, field tests 3
119—Labels on adulterated and imitation foods..... 23
120—Tree and wood-infesting insects; cabbage snakes..... 45
121—Analyses of commercial fertilizers 85
122—Corn, method of selecting seed; composition of varieties 157
123—Analyses of commercial fertilizers 193
Bulletins published in 1905 xvi
Burrier, Mrs. M. D., chalybeate water from 229
Butter from churn tests, analyses of 226
Cabbage snakes 78-81
Caldwell County, analysis of mineral water from 228
Carolina poplars, injury by cottonwood leaf-beetle..... 55
Carpenter, Hon. T., ... iv
Cask-beetles 68-74
Casks, insect injury to 68
Certificate to accompany samples of fertilizer for analysis..... 90
Chapman, H. C., sulphur water from 227
Chemical study of Kentucky-grown corn 157, 160
Christian County, analysis of mineral water from 228
Clay, Hon. Cassius M., ... iv
Clement, F. M., analysis of mineral water from 229
Commercial fertilizers, analyses of 85, 94, 193, 200
directions for sampling 90
form of certificate with samples for analysis, 90
section of the law providing for free analysis 91
values used in calculating relative value.... 92, 108
Corn, analyses of 177-188
analyses of grains from different parts of the ear..... 183-188
depth of planting and method of cultivating..... 9-11

descriptions of the varieties analyzed 160-176
descriptions of varieties tested 14-19
field tests of 3
for seed, method of preserving 12
fodder, method of handling 11
germination of various samples 176
how to test germination 157-160
method of selecting for seed 157-160
score card, for judging 12-14
test of varieties 7, 8
yields obtained on Station farm 5, 7, 8
Cottonwood leaf-beetle on Carolina poplar 55
Crepidodera helixines 61
Crittenden County, analyses of mineral waters from 228, 229
Curtis, H. E., ... v
Curtis, H. E., et al., bulletins on commercial fertilizers by..... 85, 193
Datana integerrima on black walnut 54
Didlake, Miss M. L., ... v
Director's report viii
Division of Agriculture ..... viii, xvi
Animal Husbandry viii
Chemistry ..... viii, ix, xvi
Entomology and Botany ..... viii, ix
Fertilizer Control Work ..... viii, ix
Food Control Work ..... viii, ix
Horticulture viii
Elm leaf-beetle, 45; life-history of 49
Ennomus subsignaria 65
Fair Fortune Teller, analysis of butter from 226
Fayette County, analyses of mineral waters from 229, 230
Festuca australis, analysis of 225
Ferguson, Hon. McD., ... iv
Field tests of corn 3
Floyd County, analysis of mineral water from 230
Food adulteration and prices 35
Food, antiseptics and artificial color in 36
Food Control Work, report of x
Foods, labels on adulterated and imitation 23
Forage plants, analyses of 225
Forest trees, injury by brown June-bugs 76
Frazee, D. C., ... vii
Frazee, David F., ... iv, v, yii
Galerucella luteola 45
Garman, H., ... v, xvi
Garman, H., Bulletin 120, Tree and wood-infecting insects and cabbage snakes, by 45
Germinating box for testing seed corn 158
Green County, analysis of mineral water from 230
Green Mineral Water, Allen County, analysis of..... 227
Hager, Hon. John F., ... iv
Hancock, G. A., mineral water from 235
Hanna, C. K., analysis of mineral water from 228
Harper, J. N., v, viii; Bulletin 118, Corn, by 3
Harris, Mrs. Nat., sulphur water from 236
Heitzer, Sam. J., mineral water from 230
Herald 62
Holland, Mrs. M. E., sulphur water from 226
Hopkins County, analysis of mineral water from 231
Hopkins, Hon. Frank A., ... iv
Huddleston, John S., chalybeate water brought by 235
Hungarian clover, analysis of 225
Insects infesting trees and wood 45
Insect injury to casks 68
Insect injury to oak trees 51
Jefferson County, analysis of water from 231
Jenkins, S. M., analysis of chalybeate water from 228
Keller, G. N., ... v, viii
Kinkead, Judge George B., ... iv, v, vii
Kermes pubescens on oak trees 57
LaBach, J. O., ... v, xvi
Labels on adulterated and imitation foods 23
Lachnosterna hirticula, injuring forest trees 76
Letter of transmittal iii

Lina lapponica 59
Lina scripta, on Carolina poplars 55
Lincoln County, analysis of salt water from 232
Lithocolletis hamadryadella, ... 51
Liston, Miss L., ... v
McChord, Judge John, ... iv
McQuary, D. E., mineral water from 232
Melalopha inclusa 56
Meteorological Summaries for 1905 237-242
Method of selecting seed corn 157-160
Mineral waters, analyses of 226-236
Monarthrum fasciatum and mali, injuring casks 68
Monilia candida 72
Nelson, Hon. Robert W., ... iv
Nichols, Charles B., ... iv, v
Number of brands of fertilizer on sale in 1905..... 85, 193
Number of fertilizer samples collected and analyzed..... 85, 193
Nutter, J. W., ... v
Oak trees, an insect injury to 51
Officers of the Station v
Oona B., analysis of butter from 226
Patterson, President Jas. K., ... iv, v
Pemphigus vagabundus 56
Perkins, S. H., sulphur waters from 233, 234
Peter, A. M., ... v, xvii, 225
Phytoptocecidium of willows 64
Poplar leaf-tyer 56
Prowse, G. O., mineral water from 231
Pteronus ventralis 63
Pulaski County, analysis of mineral water from 232
Rainfall recorded in 1905 239
Ramsey, Hon. William R., ... iv
Redford, C. M., sulphur water from 233
Report of the Auditing Committee vi
Report of work under the food law x
Scherffius, W. H., ... v, viii, xvii
Scherffius, W. H., bulletin on corn by 157
Scherffius, W. H., et al., bulletins on commercial fertilizers by..... 85, 193
Scoliopterix libatrix 62
Scovell, M. A., ... iii, v, xvi
Scovell, M. A., et al., bulletins on commercial fertilizers..... 85, 193
Seventeen year locust 74
Shedd, O. M., ... v
Shedd, O. M., et. al., bulletins on commercial fertilizers by..... 85, 193
Smith, Lewis P., sulphur water from 235
Smith, R. F., analysis of mineral water from 228
Southern fescue, analysis of 225
Spurlock, J. L., mineral water from 230
Station Board of Control v
Station Staff ..... v, viii
Stout, Judge Robert L., ... iv
Street, Geo. P., analysis of mineral water from 232
Taylor, H. W., ... v, viii
Temperature record in 1905 238
Tobacco stems, leached, analysis of 226
Todd County, analyses of mineral waters from 232-235
Tree-infesting insects 45
Trifolium pannonicum, analysis of 225
Trustees of the State College iv
Turner, J. D., ... v
Turner, G. P., analysis of sulphur water from 227
U. S. Appropriation, disbursements under vi
Vagabond gall-louse 56
Valentine's Alice, analysis of butter from 226
Values used in calculating relative value of fertilizers..... 92, 108
Varieties of corn tested 7, 8, 14-19
Walnut worm 54
Warren County, sulphur water from 235
Way, Mrs. W. P., water from 231
Weather records in 1905 237-242
Weathers, Jas. M., sulphur water sent by 233
Western wheat-grass, analysis of 225

Whitley County, analysis of chalybeate water from 235
Willow, an undescribed phytoptocecidium of the 64
Willow flea-beetle 61
Willow leaf-beetle 59
Willow slug 63
Woodford County, analyses of mineral waters from 235, 236
Wood-infesting insects 45