TWENTY-THIRD ANNUAL REPORT

OF THE

Kentucky Agricultural Experiment Station

OF THE

STATE UNIVERSITY

LEXINGTON, KY.

FOR THE YEAR 1910.

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Letter of Transmittal

To His Excellency,

HON. AUGUSTUS E. WILLSON,

Governor of Kentucky.

Sir:—

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

Very respectfully,

M. A. SCOVELL, *Director.*

STATE UNIVERSITY

LEXINGTON, KY.

BOARD OF TRUSTEES.

His Excellency, Gov. Augustus E. Willson, ex-Officio Chairman.
President Henry S. Barker, Member ex-Officio.
Hon. Ellsworth Regenstein, Superintendent of Public Instruction, Member ex-Officio.
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Charles B. Nichols, Esq., Lexington, Fayette County.
Hon. James K. Patterson, Lexington, Fayette County.
James W. Turner, Esq., Paintsville, Johnson County.

Agricultural Experiment Station

BOARD OF CONTROL.

RICHARD C. STOLL, Chairman, Lexington, Ky.
CHARLES B. NICHOLS, Lexington, Ky.
LOUIS L. WALKER, Lancaster, Ky.
JAMES G. WHITE, Acting President of University.
MELVILLE A. SCOVELL, Director, Secretary.

STATION OFFICERS.

M. A. SCOVELL, Director and Chemist.
A. M. Peter, Chief Chemist, Head of Chemical Division.
H. E. CURTIS, Chief Chemist, Head of Fertilizer Division.
H. GARMAN, Entomologist and Botanist, Head of Division.
R. M. ALLEN, Head of Food and Drug Division.
J. D. TURNER, Head of Feed Division.
J. O. LaBACH, Chief Chemist, Food and Drug Division.
MISS M. L. DIDLAKE, Assistant Entomologist and Botanist.
S. D. AVERITT, Chemist, Chemical Division.
O. M. SHEDD, Chemist, Chemical Division.
MISS LILLIE LISTON, Chief Clerk, Food and Drug Division.
E. C. VAUGHN, Assistant Entomologist and Botanist.
GEORGE ROBERTS, Agronomist, Head of Division of Agronomy.
E. S. GOOD, Head of Animal Husbandry Division.
J. W. NUTTER, Assistant in Dairying, Animal Husbandry Division.
MISS O. L. GINOCHIO, Secretary to the Director.
H. D. SPEARS, Chemist, Feed Division.
MISS ANNA WALLIS, Stenographer.
J. W. McFARLIN, Inspector, Food and Drug Division.
B. F. SCHERFFIUS, Inspector, Food and Drug Division.
E. KINNEY, Assistant Entomologist and Botanist.
WILLIAM C. MATTHEWS, Artist, Division of Entomology and Botany.
T. R. BRYANT, Extension Work.
L. A. BROWN, Drug Chemist, Food and Drug Division.
JOHN I. CLAYBROOKE, Inspector.
W. R. PINNELL, Inspector, Food and Drug Division.
C. S. PORTER, Drug Inspector, Food and Drug Division.
B. D. WILSON, Assistant Chemist, Fertilizer Division.
D. J. HEALY, Bacteriologist and Microscopist, Food and Drug Division.
MISS RILLA B. NUTTER, Clerk, Food and Drug Division.
A. E. EWAN, Assistant to Agronomist.
WILLIAM RODES, Assistant Chemist, Fertilizer Division.
MISS MAY G. GINOCHIO, Clerk, Food and Drug Division.
MISS LILLA J. PHELPS, Stenographer.
H. C. WOOSLEY, Special Agent, U. S. Department of Agriculture.

Address of the Station,
LEXINGTON, KENTUCKY.

THE KENTUCKY AGRICULTURAL EXPERIMENT STATION

In Account with the United States Appropriations.

	Hatch Fund.	Adams Fund.
Receipts from the Treasurer of the United States, as per appropriations for fiscal year ended June 30, 1910, under acts of Congress approved March 2, 1887 (Hatch Fund), and March 16, 1906 (Adams Fund)	$15,000.00	$13,000.00
Expenditures:		
By Salaries	$ 9,045.00	$11,266.00
Labor	2,657.32	
Publications	792.62	
Postage and stationery	352.85	
Freight and express	136.14	
Heat, light, water, and power	234.06	
Chemical Supplies	14.58	347.15
Seeds, plants, and sundry supplies	380.46	71.37
Library	583.78	
Tools, implements, and machinery	38.00	
Furniture and fixtures	201.55	
Scientific apparatus	100.00	1,315.48
Traveling expenses	150.76	
Contingent expenses	15.00	
Buildings and land	297.88	
Total	$15,000.00	$13,000.00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Kentucky Agricultural Experi-

ment Station for the fiscal year ended June 30, 1910; that we found the same well kept and classified as above; that the receipts for the year from the Treasurer of the United States are shown to have been $15,000.00 under the act of Congress of March 2, 1887, and $13,000.00 under the act of Congress of March 16, 1906, and the corresponding disbursements $15,000.00 and $13,000.00; for all of which proper vouchers are on file and have been examined by us and found correct.

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

(Signed) C. B. NICHOLS,
R. C. STOLL,
Auditors.

(Seal)

Attest: W. T. Lafferty, *Business Agent, Custodian.*

ANNUAL REPORT OF THE Kentucky Agricultural Experiment Station FOR THE YEAR 1910.

REPORT OF THE DIRECTOR.

The work of the Station is comprised in the following Divisions:

Division of Chemistry, A. M. Peter, Head.
Division of Fertilizer Control Work, H. E. Curtis, Head.
Division of Entomology and Botany, H. Garman, Head.
Division of Food Control Work, R. M. Allen, Head.
Division of Feed Control Work, J. D. Turner, Head.
Division of Animal Husbandry, E. S. Good, Head.
Division of Agronomy, George Roberts, Head.
Divison of Extension Work, T. R. Bryant, in Charge.

Chemical Division. In the work of the Chemical Division, 311 samples have been analyzed. Of these, 94 were soils, the others being mineral and potable waters, phosphate rock, limestone, various fertilizing chemicals, tobacco and many miscellaneous substances. A large number of minerals, rocks and ores have been examined and reported upon that are not included in the above enumeration. The chemical analyses of soils included 72 samples from farmers in different parts of the State, 18 for the Soil Survey in Webster County collected by Mr. Jones, and 4 of soils that are being tested in the greenhouse by means of pot experiments.

In the Soil Survey work this year, Mr. Jones, working with the Geologist of the State Survey, has gone over Rockcastle County, Webster County and the Hartford quadrangle in Ohio County. Mr. Jones has continued the work upon Taylor and Adair Counties. He also made a collection of samples in Madison County from the several

types recognized by the United States Bureau of Soils and has in progress pot culture experiments upon two of the different types from that County. It may be interesting to mention here that one of these is the Devonian black shale soil from Berea, which was found to be so strongly acid that clover would not grow upon it, but where lime and phosphate were used in the pot experiments, an excellent growth was obtained. The pot experiments mentioned in the last report are being continued.

We have given more time than usual this year to the study of methods of analysis and think we have decided upon a method of determining small quantities of potassium in soil solutions which will give satisfactory results. We have also done a large amount of work upon the determination of carbonate of lime in soils. This is a very important determination in connection with the question of soil acidity and we have found it difficult to get concordant results where only a small quantity of carbonate of lime is present, hence an accurate method.

Work has been done upon methods of analysis of insecticides and of mineral waters, and on account of the fact that Mr. Shedd is Referee upon Inorganic Plant Constituents for the Association of Official Agricultural Chemists, it was necessary for him to give much time to this subject and more particularly the determination of iron, alumina and phosphoric acid in plant ash. It was also necessary for Dr. Peter, as a member of the Committee of the American Chemical Society upon the analysis of phosphate rock, to give much time to that subject.

On account of the important developments of phosphate in Woodford County, we have been called upon to analyze quite a number of samples of phosphate rock from both Woodford and Fayette Counties.

Division of Entomology and Botany. The report of Professor Garman, concerning his work during the year, is hereby briefly summarized.

Experiments with forage plants to determine their

value for Kentucky and to secure, by selection and otherwise, varieties of special value for the State, have been continued. Including thirty plots at Hindman, Knott County, two hundred and eighty-three forage plots have been occupied with growths of different sorts. About ninety different lots of soy beans have been grown, representing about eighty varieties. These will be reduced next year to fifty varieties by throwing out those not well adapted to this part of the State, the valuable ones rejected being distributed to other parts of Kentucky to determine their adaptability there.

In addition to these plots of forage, we have had in hand several select strains of red clover and one of timothy under observation for improvement with reference to their vigor, productiveness and durability. Several selected strains of wheat have also been grown and some crosses made with reference to their improvement. Two varieties of corn, represented by several strains, have been kept for selection and crossing and some material secured for future work in breeding this plant.

The inspection of nurseries and the fumigation of stock, when found infected with San Jose scale, have occupied about the usual time.

The seed work has occupied the time of one assistant very closely during the fall and early spring months. Seedsmen and farmers about the State, and some residing outside our limits, have sent in numerous samples for analysis, besides which many samples have been examined, under the seed inspection law, for adulteration. The value of this work is attested by the growing demand for it, and also by the readiness with which both houses of our General Assembly, at its last session, passed a bill providing for the better equipment of the work. Though the bill failed to become a law, it is believed that there is no inspection work of more direct importance to the agriculture of the State than this, and we are still of the opinion that the very inadequate law now in force should be amended by another and better one regulating especially the sale of

seeds mixed with those of destructive and troublesome pests.

Our Nursery Inspection Law, also, needs revision in the light of our experience of about fourteen years in holding in check the dissemination of fruit pests by means of it. It is not an up-to-date law and will never permit us to do the work we should in controlling the spread of San Jose scale and other pests.

In the office, laboratory and insectary, the usual correspondence with reference to plant pests and forage plants, etc., has been done, together with the study of the life-histories of insects brought to our attention by farmers and others. Among other things, a large number of samples of waters have been tested for bacteria and studied with reference to other organisms. Many of these were sent us by physicians and boards of health in different parts of the State. We believe we have accomplished good in showing our people something of what constitutes a good drinking water. This work is now provided for by appropriation from the State and should go largely to the State Board of Health. However, there are some phases of the subject properly the work of the Station, under the law establishing it, and it is proposed to continue some of the work as opportunity permits.

The study of nodule bacteria with a view to learning the relations and characters of the different species and forms, has been prosecuted continuously.

The work on the corn worm has been continued, as noted in other reports.

Division of Fertilizer Control Work. During the year, 555 brands of fertilizer were registered by 49 different firms. Samples representing all these different brands of fertilizer have been analyzed in the laboratory and, in addition, 458 samples, representing nearly all of these brands, collected by our inspectors during the spring and fall seasons and sent in by farmers, making a total of 1,013 samples analyzed.

There were issued uring the year, 2,223,464 tags and 1,007,552 stamps of the different denominations, representing a value of $30,449.57.

Division of Food Control Work. Professor Allen reports: The lines of work in which this Division has been engaged are:

(a) A summary of the meat survey of the State for publication and the co-operative work with the State Board of Health to establish a practical remedy, in the way of municipal abattoirs and ordinances, for the very unsatisfactory conditions of disease and filth that were found in a majority of the slaughtering houses of the State. The study of such problems is specifically contemplated and provided for in section 11 of the Kentucky Food and Drugs Act. There are, however, a number of flagrant abuses found in the slaughtering houses, which we are preparing to prosecute. The Act provides for the establishment of regulations to carry out its provisions with respect to the unsanitary practices which will be deemed violations thereof, and it provides that such regulations shall be collaborated in connection with the State Board of Health.

(b) A very general clean-up can be announced as the result of the work in the bakeries throughout the State, and there has been an elimination of the ingredients known to the bakery supply trade as "dope" and consisting of such materials as artificial jellies and jams; artificial colors to make products look like they contained the yellow of eggs; artificial egg substitutes, containing such materials as soap bark. The appeal from the verdict given by Magistrate Berry, in Louisville, against a baker who had been warned several times and whose place was finally prosecuted, because of very unsatisfactory conditions, has been passed by Judge Gregory of the Criminal Division of the Jefferson Circuit Court and the warrant and the law were sustained on every point raised by the counsel for the defendant. This decision was of particular importance in that the Court holds that the Legislature intended the Act

not only to prohibit the sale of a product which has become diseased or contaminated, but also intended to prohibit the sale of a product which has been exposed to the danger of disease or contamination.

(c) The inspection of the drugs throughout the State has demonstrated, among other things, the fact that the druggists are confronted by many problems in the preparation of tinctures, and arrangements are being made for the holding of a drug school, to assist them in connection with their problems, beginning the week of July 10, 1911. Announcement of the proposed school has been received with enthusiastic approval by the druggists of the State, and a large attendance is anticipated. Some of the leading drug manufacturers of the country will send experts to lecture at this school.

In relation with the drug work, the Division has entered upon a campaign against misrepresentation with respect to the curative value in connection with the sale of patent medicines.

(d) A bacteriological laboratory, in charge of Dr. D. J. Healy, has been equipped in connection with this Division. Dr. Healy's investigations have begun work in a heretofore neglected and most important part of food control work. His work is being directed to a study of the contamination of food products and especially to milk. For the past two summers, the Division has given special attention to the milk supply of the State and has been especially successful in some of its recent prosecutions, not only for the selling of watered milk, but milk produced in unclean stables and in unclean cans.

Division of Feed Control Work. During the year, practically every town in the State where commercial feeding stuffs are likely to be sold, has been visited from time to time by our inspectors. The results of our analyses and examinations have been reported to the manufacturers and dealers putting out the feed and to the consumers from whom the samples were obtained.

During the year, 1,080 different brands of feeding stuffs were registered, representing 450 firms.

Twenty-nine violations have been reported for prosecution during the year. Fifteen convictions have been secured; nine are still pending, and five have been dismissed at the request of the prosecuting attorney, the violations, after full investigation, being found to be of a minor nature and the first offense.

For the year, 549 inspectors' samples have been analyzed, both chemically and microscopically, and 191 manufacturers' and dealers' samples for registration purposes.

Close inspection has been made and the same policy has been carried out as heretofore in aiding both the manufacturer and consumer in the conservation of feeding materials and their economical use, and in educating the purchaser, as far as possible, as to the economy and desirability of purchasing only high grade materials.

The manufacturers of most every class of goods have united themselves into an organization for the purpose of influencing rules and regulations to govern their products, and this is particularly true and more conspicuous among the manufacturers of low grade goods.

A dealers' organization, headed by the Cincinnati Grain Company of Covington and Cincinnati, is being organized for the purpose of having the Feed Law of this State changed so as to conform with their trade methods. If this organization is successful in securing such changes in the law, through the Legislature, the law would be of little practical benefit to the consumer.

This Division has given considerable atttention to the question of a National Uniform Feed Law and Regulations and Definitions. A Uniform Law was adopted by the Association of Feed Control Officials at its last meeting and the Definitions are now being considered by both the control officials and the trade for the purpose of adopting a uniform list at the next meeting of the Association. Such uniformity throughout the States will greatly facilitate our work.

Division of Animal Husbandry. Experiments relative to the economy of the feeding of hogs, grain in different combinations in dry lots and on different pastures, have been continued.

Bacteriological studies relative to the etiology of infectious abortion in live stock have been continued during the year. During the past spring months, we have been able to isolate the abortus bacillus (Bang) in two different herds of cows, thus confirming the announcement made in 1885 by Dr. E. Bang, Head of the Royal Veterinary College, Copenhagen, Denmark, as to the cause of this disease in cattle.

A serum laboratory, a bleeding house and a number of hog cots have been erected and equipped for the purpose of preparing anti-hog cholera serum. This serum is now being produced. Up to date, this product has been administered to hogs on farms in various parts of the State by members of this Division. Our results have been excellent. The appropriation given us by the last legislature is entirely too small to meet the demands for the serum. It is estimated that the State loses annually from three to five hundred thousand dollars as a result of this disease.

Division of Agronomy. The work of this Division, under Professor Roberts, may be summarized as follows:

Corn breeding for increased yield by the ear-to-row and breeding plot method. Ears were found to vary from the rate of 48 bushels to 107 bushels per acre by weight at harvest time. The highest yielders are crossed in breeding block the second year.

Rates and methods of seeding corn. Variations from 72 to 103 bushels per acre were observed.

Effect of grading seed on the yield of corn.

Effect on yield of planting seed from long and short ears of corn.

Tests of varieties of wheat for yield and milling qualities. Some high yielding varieties of good milling quality

have been found. Seed of these varieties is being multiplied for the purpose of distribution in the State.

Rates of seeding wheat. Results indicate six pecks per acre to be the best amount.

Tests on time and methods of seeding clover. Also experiments on the effect of clipping clover the first season. Results showed a good stand where clipped twice.

Experiments on liming and inoculating alfalfa. Results show that liming and inoculating give good results, while either alone does not give such good results.

Experiments on rate and methods of seeding soy beans. Results show drills 28 inches apart and seeded at rate of one bushel per acre to give best results. Methods of harvesting and threshing with ordinary farm machinery have been developed.

Division of Extension Work. The work of the Extention Division, organized July 1, 1910, has not as yet assumed as definite outline as would have been possible with a regular corps of workers and a definite amount of money at its disposal. However, work along several lines has been undertaken with considerable success.

During the year, fifty-five trips have been made to various places in the State, either by the Head of the Extension Division or those sent at his direction. The principal definite line of work undertaken has been the establishment of agriculture in some of the schools of the State and the formation of agricultural clubs, usually associated either with high schools or common schools. In several of these schools, the teaching of agriculture has been definitely undertaken through the influence and assistance of this Division. Ten boys' and girls' agricultural clubs have been organized and are being successfully put into operation by this Division, while considerable work has been done in cooperation with the Commissioner of Agriculture in the formation and instruction of similar organizations.

In the Sue Bennett Memorial School at London, Ky., a definite agricultural department has been organized and

placed under the superintendency of Mr. L. S. Corbett, whose salary is paid by that school. General supervision of the farm belonging to the school has been assumed by this Division.

In other schools where agriculture has been introduced, the work has been assigned to some teacher already located in the school.

Research Work. Dr. Peter, Professors Garman and Good have continued the research work under the Adams Fund along the same lines as last year. Dr. Healy has undertaken a study of milk fever in cows, under the Adams Fund, and the Director has undertaken the study of scours in calves, under the same fund, in connection with the study of milk fever.

Co-operative Work. The rotation experiment, under Professor Garman, in co-operation with the United States Department of Agriculture, is being conducted, as is also the co-operative tobacco work under Mr. Woosley, Tobacco Expert for the Department. The latter work included, as last year, the experiments in breeding, culture and the use of fertilizers for tobacco, at the Station farm, at Hopkinsville, and also at Bowling Green and Hardinsburg.

In Hardin County, we conducted a demonstration spraying experiment with a view to showing the benefit of such treatment. It proved entirely successful, though the season was too damp for the best work.

The tests of crosses and selections of oats furnished by the United States Department of Agriculture have been continued. This work was begun five years ago with 107 crosses and selections. The poor yielders have been eliminated until now, we have thirty-one left. We will multiply the best selections and hope to develop some good strains of oats for this region.

We have also continued the tests of varieties of barley in co-operation with the United States Department of Agriculture.

Experiments in dipping scabby sheep in tobacco dips,

with and without the addition of sulphur, were carried on in conjunction with the Bureau of Animal Industry, Washington, D. C., and will be concluded in the spring of the coming year.

Farmers' Institutes. Much of the institute work done by the Station has devolved upon Mr. Bryant of the Extension Division, although Professors Roberts, Garman and Good also delivered addresses at a number of the institutes.

State Fair. At the State Fair and at the Blue Grass Fair, exhibits of an educational nature were made. These represented the Division of Agronomy, covering exhibits of seed testing, plant breeding, fertilizer tests, etc.; the Division of Entomology and Botany exhibiting a large variety of injurious insects and samples of the damage done by them to plants; the Division of Food Control, this being in the nature of giving information regarding the branding of food products and the regulations concerning labeling; the Division of Bacteriology, dealing principally with contamination in water and milk. Representatives were constantly on hand to explain to visitors the meaning of the various exhibits.

At the State Fair, there was conducted during the entire week, a Model Dairy, showing the dairymen the simplest, cleanest and least expensive methods of handling pure milk. The buildings for this exhibit were provided by the Fiscal Court of Jefferson County and the equipment largely obtained through donations from various supply houses.

Co-operation with the University. By the action of the joint committee, at its meeting last June, reorganizing the Agricultural College, so that it embraces the Experiment Station as its Research and Post-graduate Department, a closer co-operation has been established than has heretofore been possible. By this arrangement, Professor Garman has supervision of the instruction work in entomology. He has also given some lectures and done other work with

the classes, as his duties at the Station permitted. Professor Roberts devotes half of his time to teaching in the Agricultural College, and it is planned that other members of the Station Staff will give lectures from time to time on the subjects of their respective lines of work.

The Experiment Station, as the Research Department of the Agricultural College, presents to the special student in post-graduate work, fine opportunities. Students who have finished courses at the University have opportunity to work in connection with research work of the Station, and in this way come in contact with research workers, men of the highest standing in the sciences pertaining to agriculture.

Station Staff. Professor George Roberts was elected to take the position of Agronomist vacated by Mr. W. H. Scherffius. He gives half of his time to Experiment Station work.

Mr. T. R. Bryant resigned his position in the Division of Animal Husbandry to become Assistant Professor of Extension Work, and is now in charge of that Division.

Dr. D. J. Healy has accepted the position of Bacteriologist and Microscopist of the Food Division, and entered upon his duties May 1st of this year.

Two new members have been secured for the staff of the Division of Animal Husbandry: Dr. F. M. Surface of the Maine Station and Dr. Robert Graham of the Iowa State Department of Agriculture. Dr. Surface is to act as Biologist of the Station, giving his attention to the etiology of infectious abortion among mares under the Adams Fund work; Dr. Graham will give his attention largely to the preparation of hog cholera serum and act as Veterinarian of the Station. Both will assume their duties here shortly after the beginning of the new year.

Mr. E. Kinney resigned his position as Assistant Entomologist and Botanist to take the position of Assistant Agronomist.

Publications. The following bulletins and reports have been issued during the year:

Bulletin No. 147:

Common Insecticides and Fungicides with Directions for the Treatment of Farm Pests.

Bulletin No. 148:

Seed Testing Apparatus: A Study of the Conditions under which our Germination Tests are Made.

Bulletin No. 149:

Bleached Flour.

Bulletin No. 150:

Preservation of Drugs.

Bulletin No. 151:

An Outbreak of the Gad-fly in Kentucky.

Bulletin No. 152:

Commercial Fertilizers.

Twenty-first Annual Report.

Report to the Governor on the Enforcement of the Food and Drugs Act, 1908 and 1909.

The Director's Report to the Governor on the enforcement of the Pure Food and Drug Law follows. After this, are appended the bulletins published during the year and the analyses of mineral waters made in the general work of the Station that are deemed of most interest. Following this, the meteorological data will be found.

M. A. SCOVELL, *Director.*

REPORT

OF THE DIRECTOR
OF THE

Kentucky Agricultural Experiment Station

TO THE

GOVERNOR OF KENTUCKY

ON THE

Enforcement of the Food and Drugs Act

FOR THE YEARS 1908 AND 1909

LEXINGTON, KENTUCKY,
Februarv 23, 1910.

Kentucky Agricultural Experiment Station

BOARD OF CONTROL.

CHARLES B. NICHOLS, Chairman, Lexington, Ky.
RICHARD C. STOLL, Lexington, Ky
LEWIS L. WALKER, Lancaster, Ky.
T. L. EDELEN, Frankfort, Ky.
JAMES K. PATTERSON, President of the University.
MELVILLE A. SCOVELL, Director, Secretary.

FOOD AND DRUG DIVISION.

M. A. SCOVELL, Director of the Station.

R. M. ALLEN, Head of Division.

J. O. LaBACH, Chief Chemist.

L. A. BROWN, Chemist, Drugs.

MISS LILLIE LISTON, Chief Clerk.

B. F. SCHERFFIUS, Inspector.

J. W. McFARLIN, Inspector.

J. H. MARTIN, Inspector, Drugs.

H. D. SPEARS, Chemist.

W. R. PINNELL, M. D., Inspector.

REPRESENTATIVES FOR DRUG REGULATIONS UNDER SECTION EIGHT OF FOOD AND DRUGS ACT.

A. T. McCORMACK, Representing Kentucky State Medical Association.

J. W. GAYLE, Representing Kentucky Pharmaceutical Association.

Lexington, Kentucky.

Honorable Augustus E. Willson,

Governor of the Commonwealth of Kentucky,

Frankfort, Kentucky.

Sir:

Under Section 10, of the Food and Drugs Act of the Commonwealth of Kentucky, approved March 13, 1908, I submit herewith a report of the food and drug inspections and analyses made under that Act for the years 1908 and 1909.

SAMPLES INSPECTED AND ANALYZED.

During this period 3410 samples of foods and drugs have been taken from various markets throughout the State and submitted to analysis. Of this number 1004 were found to be adulterated or misbranded. In addition to this, 740 miscellaneous and unofficial samples, taken for study or submitted, by consumers, have been examined, making a total of 4150 samples inspected.

The inspections have covered not only the food products themselves, but also the sanitary conditions of factories, grocery stores, bakeries, slaughter houses, dairies, milk depots, creameries and places where foods are produced, prepared, stored, kept or offered for sale. The analyses have covered various classes of food products taken from the market, including milks, creams, butters, oleomargarines, flours, oysters, meats, including sausage, canned goods, preserves, jellies, pops and liquors. Of the 2943 official samples of foods analyzed, 557 were found to be adulterated.

Of the 467 official samples of drug products taken from the market and analyzed, 183 were found to be adulterated or misbranded under the Act.

The analyses of the food and drug samples included chemical, bacteriological and microscopical examinations. Many of the analyses covered thorough investigation as to complete composition and character of the products, some for the purpose of research work. The bacteriological work was mostly of milks and meats and examinations in the study of sanitary conditions. For this purpose we are fitting up a bacteriological laboratory and will seek the best help in this line.

In the examination of food and drug products, it is often necessary to make not only a chemical analysis, but a microscopical analysis and also a bacteriological analysis, and for this reason we have fitted up laboratories in each.

ADULTERATION.

Among the food products found adulterated may be mentioned the following:

Flours, bleached with nitric oxide fumes.

Oysters, watered to add bulk and to give size to the oysters themselves.

Cider Vinegars, labeled "Pure Apple Cider Vinegar," "Cider Vinegar," "Apple Vinegar," etc., but found to be distilled vinegar, colored in imitation of apple vinegar. Our inspections have shown that in many cases where the consumer called for apple vinegar, the retailer sold distilled vinegar, colored in imitation of apple vinegar, the manufacturers evidently selling it to the retailer as distilled vinegar. Investigations in this line led to the conclusion that the adding of color to distilled vinegars results in the final deception of the consumer.

Sausages, containing starch or cereals and added water, thereby increasing the weight.

Sausage, made out of partly decomposed meats and meat refuse and contained in unclean casings.

Watered and Skimmed Milks. It may be noticed in this

connection that we found no milks containing preservatives or antiseptics. When the food law in this State first went into effect, most of the milks in the cities and some in the smaller towns, were adulterated by the addition of formaldehyde and boric acid. Our inspections last year showed none of these adulterants. Some of the milkmen, however, still think it essential to financial success either to skim milk at times or to add water.

Milks, offered for sale in unclean and unsanitary condition.

Maraschino Cherries, so labeled, not Maraschino cherries, and artificially colored and preserved with benzoate of soda or sulphates.

Creme de Menthe Cherries, containing saccharin, benzoate of soda and artificial coloring.

Mince Meats, containing glucose, benzoate of soda and saccharin.

Fruit Juices, found to be a mixture of granulated sugar, citric acid, artificial flavors, artificial colors and benzoate of soda.

Raspberry and Strawberry Preserves, made largely from apple stock and found to contain glucose, saccharin and benzoate of soda.

Lemon Extracts, found to be largely a mixture of citral from lemon grass, artificially colored and containing no true lemon oil.

Pineapple, Strawberry and Banana Extracts, not made from fruit so named, but from artificial or synthetic flavors.

Vanilla Extracts, not made from vanilla bean, but from synthetic flavors, as vanillin, coumarin, etc.

Canned Sugar Corn, found to be field corn, sweetened with saccharin.

Maple Syrups, adulterated with cane sugar and artificially flavored.

New Orleans Molasses, containing various quantities of glucose and sulphites.

Sorghum Molasses, containing glucose.

Tomato Catsups, containing tomato cores, skins, artificially colored, and preserved with benzoate of soda.

Mustards, largely adulterated with starch and artificially colored.

Strawberry, Lemon, Pineapple, Orange, Sarsaparilla, Chocolate, soda pops, artificial preparations made of citric acid, artificial flavors, artificial colors and saccharin.

Soda Fountain Syrups, containing artificial colors, artificial flavors and added citric acid and antiseptics.

Pickles, containing alum and preserved with benzoate of soda.

Ice Creams, not up to standard and often made from milk instead of cream and containing gelatine or gum tragacanth to give "stand-up" quality.

Baking Powders, containing ground mineral as a filler and otherwise misbranded.

Creams, on tables in hotels found to be below standard.

Misbranding in Stating the Labels on Food Products. We have found innumerable statements misleading as to quality, purity, character and value of the products labeled. To correct such misbranding, we have notified the manufacturers and jobbers that the labels must be true to the product sold and we find, generally, that the manufacturers are willing to relabel their products in accordance with the law.

Among the violations of the drug law were found:

"Witch Hazel," short in alcohol and containing formaldehyde.

"Witch Hazel," containing methyl alcohol.

"Tartaric Acid," containing sulphuric acid, calcium and heavy metals.

"Precipitated Sulphur," grossly adulterated with calcium sulphate.

"Spirit Nitrous Ether," not up to the U. S. P. standard.

"Hydrogen Peroxide," containing an excessive amount of free acid and otherwise below the U. S. P. standard.

"Spirit of Camphor," low in camphor.

"Glycerin," containing butyric acid, acrolein, sugars and heavy metals.

"Citric Acid," containing heavy metals and sulphates.

"Boric Acid," containing sulphates and calcium.

"Tincture of Iodine," not up to the U. S. P. standard.

"Rheumatic Cure," and various other "Positive Cures," labeled "A never failing remedy," etc., and with other misstatements as to the quality and value of the medicines.

"Headache Medicines," not labeled to show the acetanilid and similar drugs which the law requires to be shown, or containing more of the drug than claimed in the label; or labeled, "Contains no Morphine," and not labeled to show that the medicine contains a dangerously large amount of acetanilid or phenacetin.

"Cold Cures," not labeled to show the presence of acetanilid and other powerful drugs.

"Lemon Seltzer," labeled "Entirely free from all injurious and harmful drugs," and found not to contain lemon and to contain acetanilid, a harmful drug.

"Sure Cure for Cholera, Cramps, Diarrhea," found to be a mixture of alcohol, morphine, and chloroform, such drugs being not cures, but at the most, *reliefs.*

"Fowler's Solution," below the Pharmacopœial standard.

"Tincture of Ferric Chloride," deficient in alcohol.

"Cream of Tartar," not up to the Pharmacopœial standard.

"Brain Relief," labeled "Cures Headache, Neuralgia, contains no Morphine, Opium, Antipyrin, perfectly harmless, will not affect the heart," found to contain acetanilid.

"Grip and Cold Tablets," containing acetanilid and labeled "Perfectly Safe."

"Paris Green," not up to the standard necessary for the uses for which this insecticide is needed by the farmers.

The Act of 1908 provided for a hearing for the first offense and in consequence, the work during the past year has largely been given to hearings, and where there is evidence of good intent and a promise by the manufacturer or dealer to take the goods, either misbranded or adulterated, out of the State we have asked for no prosecution in such cases. Inspectors, however, have been sent, in almost every case, to take samples of the same goods subsequently and whenever we have found any such goods adulterated, the prosecuting attorneys have been notified and vigorous prosecutions asked for.

OLEOMARGARINE.

During 1909, 76 convictions were obtained for selling oleomargarine for butter or for coloring it in imitation of butter. The food law does not prohibit the sale of oleomargarine, but it does require that it shall be sold as oleomargarine and not as butter, or colored in imitation of butter. Color is put in oleomargarine to make it look like butter. Such use of coloring having for its purpose the deception, sometimes of the seller, and always of the consumer, is, therefore, properly legislated against both throughout this country and in Europe. There are other food products also, to which a pinch of added color, may add sometimes by way of deception a 100 per cent. to their market value. In all such cases, the use of artificial color in this State is restricted, although the added color may be entirely harmless.

OYSTERS.

Prior to the Food and Drugs Act of 1908, bulk oysters were largely adulterated with water and preservatives when offered for sale on the markets in this State. Since the law went into effect, an order was issued prohibiting the use of water and preservatives. This order has been complied with most generally throughout the State and the effect has been marked in the quality and food value of the bulk oysters

now sold in the State. More oysters are contained in a pint now than heretofore were contained in a quart. Not only this, but the oysters themselves and the flavor are much better preserved. When oysters, and other sea food, are put in fresh water, they absorb a large quantity of it, to the detriment of the flavor and greatly to the detriment of the keeping qualities.

FLOUR.

The subject of bleaching flour has received careful attention. I was present at the hearing given before the Secretary of the United States Department of Agriculture at Washington. As a result of the testimony before this hearing, the Department of Agriculture prohibited the sale of bleached flour. The nitric oxide which bleaches the flour is not only poisonous in itself, but evidence was produced to show that even the small quantity contained in the flour itself acted as a poison, and furthermore that the bread made from either bleached flour or highly bleached flour contains some nitric oxide; that it was not of first quality and that in all probability some changes had been made in its composition by the process of bleaching the flour, which are detrimental to its baking and food qualities. Furthermore, it was shown that second grade flours could be bleached and added to first grade flours; that flours from inferior wheat could be made to look like flours from first grade wheat. For the reasons above stated, I issued, on June 8, 1909, and following the regulation by the Federal Government, a regulation prohibiting the sale of bleached flour. This regulation was complied with by nearly all of the millers throughout Kentucky, and at a recent meeting of the Millers of Central Kentucky in Lexington, our course with respect to bleached flour was unanimously endorsed.

BREAD.

The inspection of bakeries throughout the State demonstrated the fact that bread, consumed more largely probably than any other article of food, and very often without being heated to destroy the germs, was subject to very great danger of being contaminated with disease germs. Tuberculosis and

other diseases may be caused by eating bread, exposed, unwrapped, to the uncleanliness of the market, or to which the sticker tag has been reattached as it comes off during delivery and sale. It may be easily surmised as to how the tag is attached after coming off in market.

Reports come to us that the handling of bread is very unsanitary. That it is often handled in the arms of persons who are unclean, sometimes by children, and that it is thrown into the wagons in a haphazard way and carried through the dusty streets. By such methods of handling bread, it is little wonder that it is difficult to control diseases such as tuberculosis, leaving out of the question the other means of getting the tuberculosis germ.

SANITARY INSPECTION.

The Food and Drugs Act of 1908 conferred upon the Director of the Station in co-operation with the State Board of Health, authority to make rules and regulations covering the sanitary conditions of places where food is prepared, transported, stored or exposed for sale. In compliance with this authority, a systematic inspection has been made of the slaughtering houses, bakeries and dairies in the various parts of the State, the inspectors noting the facts with respect to building, equipment and the cleanliness of utensils, floors, walls, plumbing and the general methods employed by each plant in the production of milk, meat or bread. In some instances we found well conducted places, supervised by those having expert knowledge of their business, while in other instances, we found many places really unfit for the production of human food and those in charge either careless in the matter of cleanliness and hygienic conditions, or ignorant, or both. To remedy such conditions, we have sent out rules and regulations, adopted jointly by this Station and the State Board of Health under Sections 1, 6, 8 and 11 of the Food and Drugs Act, for dairies, bakeries and slaughtering houses. These regulations have been mailed to the parties interested and our inspectors have been instructed to give information pertaining to these regulations and we have also issued bulletins giving information and guidance with reference to these topics. In drafting the regulations for

bakeries, we had the assistance of a committee from the Master Bakers Association of Louisville, and we have appointed as temporary inspectors two men who have practical knowledge to assist in the inspection of bakeries. We have also sent to each dairyman, baker or slaughter house man, a copy of the inspector's report on his plant, with suggestions as to how to improve it.

This has had a marked improvement on the plants generally. Replies tell of new floors, better drainage, more light, new utensils, better methods of sewage and, in many instances, new plants throughout. For example, the proprietor of a slaughtering house which was originally found to be very unsanitary, the offal being scraped to hogs in the rear of the building, and the floors and walls having the appearance of never having been cleaned, writes:

> "There are no more hog pens in rear of building. The walls and floors are now washed every day after the killing. My offal is now tanked and made into fertilizer. The cold storage is thoroughly cleaned each week."

A Newport dairyman, whose dairy was found to be filthy, with a dusty loft, milk strained in the barns and utensils never scalded, writes:

> "We have made some new improvements. We made a new floor in the cow stable, and whitewashed the stable inside and out. We built a new house to strain and cool the milk in, and made place to wash cans in hot water. We put a concrete floor in the milk house."

A baker from Madisonville, writes:

> "Since my bakery was inspected, I have built a new shop, brick building, concrete floor, new machinery, everything up-to-date. Shop is advertised as the cleanest bakery in Kentucky, open to inspection at all times."

Another example is that of a slaughter house plant in Paris.

When this was first inspected, it showed the following conditions: An old, narrow killing room with open floors and walls, neither of which showed evidence of ever having been cleaned. The offal was scraped to the rear door and had accumulated in large piles. This plant was surrounded with garbage and weeds and there was no evidence of its ever having been cleaned up. We sent a copy of the inspector's report to the proprietors and notified them to change the conditions.

On the second inspection, the inspector found the weeds cut, the offal hauled away, the floors and walls washed and whitewashed inside and out, and since this inspection, the proprietors are erecting a modern building to cost in the neighborhood of twenty-eight thousand dollars, with cement floors and walls, cold storage rooms, and a tankage plant to render the offal and waste into soap and make fertilizers. The owners have also made arrangements with all the other butchers in Paris to do the slaughtering for all and at a less cost. This arrangement will make it convenient for the city of Paris to inspect all animals slaughtered with respect to disease.

Another such example may be cited with respect to a plant in Middlesboro, and many other examples could be given as to slaughtering houses, bakeries and dairies throughout the State.

PRESERVATIVES.

The extensive use of chemical preservatives in food products was the policy of many food manufacturers and sellers of food products, prior to the enactment of food laws. When our first State law became effective in 1898, we found the use of chemical preservatives in food products very general. The dairymen were using, very extensively, formaldehyde in the form of freezein, icein, etc., and boracic acid, which contributed more than anything else towards unsanitary dairies and milk depots; for, with preservatives to depend upon, it was not necessary to see that the barns and dairy utensils were scrupulously clean and that the milk was cooled before putting it into cans or bottles.

With salicylic acid and, later, benzoic acid, as preservatives, fruit pulps were stored in barrels or other packages, during the ripening season, to be manufactured into various preparations

any time thereafter. The by-products of canning factories could be shipped in unsterilized packages to catsup or other vegetable and fruit factories. Often these bulk packages were sent to other cities to be manufactured and bottled, and when so bottled, they were often dosed with more preservatives, to be sure that they would keep. The market was full of food products exposed in open buckets and pails, preserved against decay by means of antiseptics. Soda fountains might be careless as to cleanliness, and open jars of fruit were exposed because the syrups were preserved against spoiling.

There is no doubt that the prevalent unsanitary methods in factories, stores, hotels and restaurants, were due, in a large degree, to the use of antiseptics. Antiseptics, such as formaldehyde, boric acid and benzoic acid, are not employed to change the taste of spoiled foods, but, on the other hand, their use protects the food from showing evidence of spoiling, without protecting against contamination, often with the result of deceiving the consumer as to the freshness of the food.

The food laws of 1898 and 1900 permitted the use of antiseptics, provided each food product containing them was labeled to show the presence of such antiseptics. The exposure, however, of the use of antiseptics had a marked effect and at the present time, we find no preservatives in milk or its products, or in meats, in this State, and very little in other food products. We have endeavored to keep all chemical preservatives from food products in this State. The preservative clause in the Act of 1908 is more prohibitive than the former laws.

There has been a persistent effort on the part of some manufacturers to use benzoate of soda in the manufacture of food products, and the National law has, by ruling lately, allowed its use, provided it be so stated on the label. The Secretary of Agriculture has reached this conclusion after the report of the Referee Board who made experiments with young men as to the effects of benzoate of soda in small and large quantities.

Under date of March 4, 1909, the following regulation was issued by the Federal Government:

> "The Referee Board of Consulting Scientific Experts, composed of Dr. Ira Remsen, Dr. Russell H. Chittenden, Dr. John H. Long, Dr. Alonzo E. Taylor and Dr. C. A. Herter, have reported upon the use of

benzoate of soda in foods. *The Board reports, as a result of three extensive and exhaustive investigations, that benzoate of soda mixed with food is not deleterious or poisonous and is not injurious to health.* (Italics added.) The summary of the report of the Referee Board is published herewith.

"It having been determined that benzoate of soda mixed with food is not deleterious or poisonous and is not injurious to health, (italics added) no objection will be raised under the Food and Drugs Act to the use in food of benzoate of soda, provided that each container or package of such food is plainly labeled to show the presence and amount of benzoate of soda.

"Food Inspection Decisions 76 and 89 are amended accordingly."

This regulation, as you will observe, opens the door again to benzoate of soda, *in unrestricted amount in all foods,* and, unless a policy of discrimination is adopted by the Federal Government, it will open the door to the use of the other antiseptics, such as boracic acid and formaldehyde. For, if present inability to detect the little traces of injury which minimum amounts of these antiseptics may make in the digestive tract of a healthy subject, during a period of a few months, is to be made the sole test, then boracic acid, formaldehyde, salicylic acid and other antiseptics will come back into the foods to an even greater extent than before the passage of the food laws. The three Secretaries based their decision upon a report of a Referee Board of scientists, which report is summarized by that Board into general conclusions as follows:

"First—Sodium benzoate in small doses (under 0.5 gram per day) mixed with the food is without deleterious or poisonous action and is not injurious to health.

"Second—Sodium benzoate in large doses (up to 4 grams per day) mixed with the food has not been found to exert any deleterious effect on the general health, nor to act as a poison in the general acceptance of the term. *In some directions, there were slight*

> *modifications in certain physiological processes, the exact significance of which modifications is not known.* (Italics added.)
>
> "Third—The admixture of sodium benzoate with food in small or large doses has not been found to injuriously affect or impair the quality or nutritive value of such food."

To my mind, the second conclusion of the Referee Board still raises a strong element of doubt with respect to the points considered by the Board, and there are many other questions in connection with this subject regarding which the Board made no investigation, and yet which have important bearing upon the final determination. In my opinion, therefore, the conclusions of the Referee Board do not justify the conclusion that the use of benzoate of soda in food products shall be allowed.

There have been other carefully conducted scientific experiments made on individuals under nearly like conditions for a longer time than those reported by the Referee Board, which gave data contrary to those of the Board.

Dr. Wiley carried on exhaustive experiments in this line for a much longer period and from the results of his experiments, he reached the following opinion:

> "From the careful study of the data in the individual cases and the summary of results, it is evident that the administration of benzoic acid, either as such or in the form of benzoate of soda, is highly objectionable and produces a very serious disturbance of the metabolic functions, attended with injury to digestion and health."

When Dr. Wiley first began experiments with preservatives on his squad of young men, the criticism was made that the results might or might not be of value—of value, if the results showed ill effects; of little value, if the results on the young men under observation showed they were not affected by the use of preservatives. For it was justly pointed out that any strong healthy man could eat most anything under any circum-

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stances without apparent injury to health, whereas the results might show decidedly injurious effects if fed to those of enfeebled constitution or digestive power, or to the young, and especially to infants. And this criticism can be justly applied to the conclusions of the Referee Board.

Aside from the question of the injury to health of the preservative, there is absolutely no question whatever that the use of preservatives makes possible the use of materials in foods, in condition that would prevent their use if preservatives were not used, and makes it possible, also, for unsanitary conditions, as pointed out above.

It is further claimed that its use is not injurious, at least in some food products, where only a small quantity of the food is taken, as in tomato catsup, fountain syrups and condiments. But, if allowed in such food products, there is no good excuse why it should not be allowed in other food products. If the preservative is allowed in one food product, the claim is strong that it should be allowed in all food products, and yet I believe it would be almost criminal to allow the use of any preservative in milk, as it is almost universally used as a food for invalids and infants, and the physiological effects from preservatives in milk, when fed under such conditions, are doubtful.

The American Medical Association has adopted strong resolutions against the use of benzoate of soda as a preservative. The sentiment against the use of benzoate of soda in food products is almost unanimous among physicians. A circular was sent from the Food and Drug Division of the Experiment Station to the physicians throughout the State and replies, many of which are based upon long practical experience with the use of benzoate of soda as a medicine, are strong against the use of this substance in food products.

From the exhaustive experiments made on the use of preservatives by Dr. Wiley; by the Referee Board, and from the results abroad; from the opinions of physicians who have used this substance as a medicine, and from those who have had charge of the pure food work a number of years, it is evident that there is a question of doubt as to the effect of the preservatives upon health, especially of benzoate of soda, and there is no question but that preservatives may be used to offset unsanitary conditions. For these reasons, we have endeavored to prevent the use of preservatives. The very spirit of the pure

food act, if it means anything, means that the public shall be guarded against risks.

LIQUORS.

The Kentucky Food and Drugs Act of 1908 provided that the sections with respect to liquors would not be effective until on and after January 1, 1909. This part of the law, therefore, has been effective only a little over a year. We found difficulty at the very start in arranging to enforce this part of the law. It was necessary, first, to promulgate standards and regulations. While the law provides that the Director is empowered to adopt and fix standards of purity, quality or strength when such standards are necessary or not specified or fixed by the Act, it also provides that when such standards differ from those legally adopted by the United States Department of Agriculture, the Director shall arrange for a conference with the United States Department of Agriculture for the purpose of arriving at, if possible, a uniform standard. The law provides further that in the case of final dispute, the question shall be determined by the courts, and also provides that when the standard of any food product has been determined by the Supreme Court of the United States, such standards shall govern in the enforcement of the provisions of the act.

It was hoped that standards would be adopted by the United States Department of Agriculture under the Food and Drugs Act of 1906, before our act pertaining to liquors went into effect, and that the standards might be such that they could be adopted by this State, for the enforcement of the law with respect to these products should follow closely the action of the Federal Government, as the internal revenue laws empower the Commissioner of Internal Revenue to prescribe rules and regulations for the branding of such products.

The question of proper branding of distilled spirits has been actively under consideration by both State and Federal authorities for a number of years. The subject was investigated and reported upon by the Joint Committee on Food Standards from the Association of Official Agricultural Chemists and the Association of State and National Food and Dairy Departments; by the chemists of the Bureau of Internal Revenue, working in connection with the field service of that Bureau and in connection with the trade; and by the chemists of the Bureau of Chemistry of the Department of Agriculture, and the active work done by these two Bureaus was, in many ways, the

most exhaustive and thorough ever before made in this or any other country.

Later, the subject came up under the Federal Food and Drugs Act of June 30, 1906. It was further investigated by the Bureau of Chemistry of the Department of Agriculture, and by direction of the President it was considered and reported upon by Attorney General Bonaparte, in some four or more reported opinions. (See 26 O. P. 216, 26 O. P. 262, 26 O. P. 474, 26 O. P. 541.)

Following the first two of these opinions, President Roosevelt, under date of April 10, 1907, issued the following directions for the branding of whiskies:

> "Straight whisky will be labeled as such.
>
> "A mixture of two or more straight whiskies will be labeled 'Blended whisky,' or 'whiskies.'
>
> "A mixture of straight whisky and ethyl alcohol, provided that there is a sufficient amount of straight whisky to make it genuinely a 'mixture,' will be labeled as 'Compound of,' or 'Compounded with,' pure grain distillate.
>
> "Imitation whisky will be labeled as such."

Following opinions, 26 O. P., 474, and 26 O. P., 541, the Commissioner of Internal Revenue issued regulations for the branding of distilled spirits in harmony with the regulations promulgated under the Food and Drugs Act. These regulations with respect to the question as to whether or not neutral spirits is whisky, and as to coloring with caramel coloring, were passed upon by the United States District Courts at Cincinnati and Peoria, and with respect to what constitutes spirits or neutral spirits by other Federal Courts throughout the country, all of which decisions are reported in the volume of the United States Treasury Decisions for the year 1908.

The decisions by the courts are to the effect that whisky and neutral spirits are not like substances and that the purpose and effect of adding burnt sugar or caramel coloring to new, water-white distilled spirit is for the purpose of imitating the appearance of aged whisky.

Interests, which were opposed to the regulation promulgated in President Roosevelt's administration and to the holdings of the courts, appealed again to the Executive Department early in President Taft's administration, with the result that the President ordered the reopening of the matter before Solicitor General Bowers.

The Solicitor General's decision not being acceptable to all parties concerned, the President took the matter up for personal consideration, and, on December 26, last, ordered the rulings of President Roosevelt changed in some respects; holding that neutral spirits and whisky are like substances, but further holding that those who make rectified, redistilled whisky are "required to use a brand which will show exactly the kind of whisky they are selling," as "Whisky made from redistilled spirits," or "Whisky made from neutral spirits," as the case may be.

The President's statement is in part as follows:

> "With this result, the question arises, What ought the order to be so that the purpose of the pure food law can be carried out? The term 'straight whisky' is well understood in the trade and well understood by consumers. There is no reason, therefore, why those who make straight whisky may not have the brand upon their barrels of straight whisky, with further descriptive terms, as 'bourbon' or 'rye' whisky, as the composition of the grain used may justify, and they may properly add, if they choose, that it is aged in wood.
>
> "Those who make whisky of 'rectified,' 'redistilled' or 'neutral spirits' cannot complain if, in order to prevent further frauds, they are required to use a brand which will show exactly the kind of whisky they are selling. For that reason it seems to me fair to require them to brand their product as 'Whisky made from rectified spirits,' or 'Whisky made from redistilled spirits,' or 'Whisky made from neutral spirits,' as the case may be; and, if aged in the wood, as sometimes is the case with this kind of whiskies, they may add this fact.
>
> "A great deal of liquor sold is a mixture of straight whisky with whisky made from neutral spirits. Now, the question is, whether this ought to be regarded as a compound or a blend. The pure food law provides that 'in the case of articles labeled, branded or tagged so as to plainly indicate that they are compounds, imitations or blends,' the term 'blend' shall be construed to mean a mixture of like substances, but excluding harmless color-

ing or flavoring ingredients used for the purpose of coloring and flavoring only. It seems to me that straight whisky and whisky made from neutral spirits, each with more than 99 1-2 per cent. ethyl alcohol and water, and with less than one-half of 1 per cent. of fusel oil, are clearly a mixture of like substances, and, that while the latter may have, and often does have, burnt sugar or caramel to flavor and color it, such coloring and flavoring ingredients may be regarded as for flavoring and coloring only, because the use of burnt sugar to color and flavor spirits as whisky is much older than the coloring and flavoring by the tannin and the charred barrel. Therefore, where straight whisky and whisky made from neutral spirits are mixed, it is proper to call them a blend of straight whisky and whisky made from neutral spirits. This is also in accord with the decision of the British Royal Commission in the case which I have cited upon a similar issue.

"Canadian Club whisky is a blend of whisky made from neutral spirits and of straight whisky aged in the wood, and its owners and venders are entitled to brand it as such.

"Neutral spirits made from molasses and reduced to potable strength has sometimes been called whisky, but not for a sufficient length of time or under circumstances justifying the conclusion that it is a proper trade name. The distillate from molasses used for drinking has commonly been known as rum. The use of whisky for it is a misbranding.

"There are other kinds of liquor in respect to which a decision is invoked, but it is thought that the principles above stated, and the directions above given in special cases, will furnish a clear precedent for all other cases.

"By such an order as this decision indicates, the public will be made to know exactly the kind of whisky they buy and drink. If they desire straight whisky, then they can secure it by purchasing what is branded as 'straight whisky.'"

Following the decision of President Taft, the Secretaries of the Treasury, of Agriculture and of Commerce and Labor have just promulgated regulations as follows:

"Under the Food and Drugs Act of June 30, 1906, all unmixed distilled spirits from grain, colored and flavored with harmless color and flavor, in the customary ways, either by the charred barrel process, or by the addition of caramel and harmless flavor, if of potable strength and not less than 80 degrees proof, are entitled to the name whisky without qualification. If the proof be less than 80 degrees, i. e., if more water be added, the actual proof must be stated upon the label and this requirement applies as well to the blends and compounds of whisky.

"Whiskies of the same or different kinds, i. e., straight whisky, rectified whisky, redistilled whisky and neutral spirits whisky are like substances and mixtures of such whiskies, with or without harmless color or flavor used for purposes of coloring and flavoring only, are blends under the law and must be so labeled. In labeling blends the Act requires two things to be stated upon the label to bring the blended product within the exception provided by the statute: First, the blend must be labeled, branded or tagged so as to plainly indicate that it is a blend, in other words that it is composed of two or more like substances, which in the case of whisky must each be of itself a whisky, and, Second, the word 'blend' must be plainly stated upon the package in which the mixture is offered for sale. A mixture of whiskies, therefore, with or without harmless coloring or flavoring, used for coloring and flavoring only, is correctly labeled 'Kerwan Whisky. A Blend of Whiskies.'

"Since the term whisky is restricted to distillates from grain, and distillates from other sources are unlike substances to distillates from grain, such distillates from other sources without admixture with grain distillates are misbranded if labeled whisky without qualification, or as a blend of whiskies. However, mixtures of whisky, with a potable alcoholic distillate from sources other than grain, such as cane, fruit or vegetables, are not misbranded if labeled compound whisky, provided the following requirements of the law are complied with: First, that the product shall be labeled, branded or tagged so as to plainly indicate that it is a compound, i. e., not a mixture of like substances, in this case whiskies; and, Second, that the word 'Compound' is plainly stated upon the package in which the

mixture is offered for sale. For example, a mixture of whisky, in quantity sufficient to dominate the character of the mixture, with a potable alcoholic distillate from sources other than grain and including harmless color and flavor is correctly labeled 'Kerwan Whisky. A compound of whisky and cane distillate.' Unmixed potable alcoholic distillates from sources other than grain, with or without harmless color or flavor, are not misbranded if labeled 'Imitation Whisky.'

"When an essence or oil is added to a distillate of grain, which without such addition is entitled to the name whisky, and the effect of such addition is to produce a product which simulates a whisky of another kind different from the kind of whisky to which the essence is added, the mixture is an imitation of the particular kind of whisky which is simulated, e. g., if rye essence be added to a highly rectified distillate of corn, the mixture is misbranded if labeled rye whisky. Such a mixture is not misbranded if labeled 'Whisky—Imitation Rye.'

"Nothing in the Food and Drugs Act inhibits any truthful statement upon the label of any product subject to its terms, such as the particular kind or kinds of whisky, vended as whisky or as blends or compounds thereof, but when descriptive matter, qualifying the name whisky, is placed upon the label, it must be strictly true, and not misleading in any particular. The law makes no allowance for seller's praise upon the label, if false or misleading, and the product is misbranded if a false or misleading statement be made upon one part of the label and the truth about the product be stated upon another part. Similarly a product is misbranded if the label is false or misleading through the use of a trade-marked statement, design or device. The fact that a phrase, design or device is registered in the U. S. Patent Office gives no license for its deceptive use. All descriptive matter qualifying or particularizing the kind of whisky, whether volunteered or required by the law to be stated, as in the case of blends and compounds, must be given due prominence as compared with the size of type and the background in which the name whisky appears, so that the label as a whole shall not be misleading in any particular.

"Food Inspection Decisions 45, 65, 95 and 98, and

all rulings in conflict herewith, are hereby revoked.

FRANKLIN MACVEAGH,
Secretary of the Treasury.
JAMES WILSON,
Secretary of Agriculture.
CHARLES NAGEL,
Secretary of Commerce and Labor.

"WASHINGTON, D. C., February 16, 1910."

These regulations are not in accord with those promulgated and enforced by President Roosevelt; nor are they, in my judgment, in accord with President Taft's decision, for he explicitly states:

> "Those who make whisky of 'rectified,' 'redistilled' or 'neutral spirits' cannot complain if, in order to prevent further frauds, they are required to use a brand which will show exactly the kind of whisky they are selling. For that reason it seems to me fair to require them to brand their product as 'Whisky made from redistilled spirits,' or 'Whisky made from neutral spirits,' as the case may be."

The regulations as now adopted do not require such labeling, and it would appear, under Paragraph 1, of the regulations as now adopted, that new neutral spirits, or, in fact, new commercial alcohol, may be colored to imitate the characteristics of genuine aged whisky and sold as "whisky."

The regulations lay stress upon the difference between neutral spirits made from grain and neutral spirits made from other sources, an immaterial difference, but the real question of the pronounced difference between neutral spirits on the one hand, and aged whisky, possessing the congeneric qualities from the sound grain and proper aging on the other, seems to be ignored.

From the above and other reasons, the regulations as now adopted by the Federal Government are not, in my opinion, in harmony with the true intent of the Kentucky law.

I believe that the fundamental principles enunciated by the Committee from the Association of Official Agricultural Chemists and the Association of State and National Food and Dairy Departments, by Attorney General Bonaparte, President Roosevelt and the United States District Courts represent the closest approach to the material facts that has yet been made.

The hearings before the joint committee of which I am a

member and its other investigations brought out the following important facts:

1. That whisky is made from the very best grain. If the grain is musty or of an inferior grade, the flavor will be inferior.
2. That during the process of manufacture, the mash must be kept at certain temperatures.
3. That great care must be given to the yeast used and to the water employed.
4. That in making neutral spirits or alcohol, inferior grades of grain or other products containing starch or sugar may be used, and less care may be exercised in mashing and the mashing may be, and is usually, made at a higher temperature, in all probability converting some of the cellulose of the grain into alcohol; and no attention is paid to the flavor, as the object is to make the ethyl alcohol as free from flavoring substances as possible.
5. That when whisky is distilled, it has been the custom for more than 100 years to ripen it in charred barrels, and prior to that time in wooden casks; and that it is necessary to thus mature it in order to render new whisky potable.
6. That the proper aging of whisky is expensive and that various artifices have been resorted to to make the raw product resemble aged whisky, such as coloring with caramel and heating new whisky in barrels.
7. That the process of distillation for making whisky and neutral spirits is different.
8. That the chemical composition of matured whisky and alcohol or neutral spirits is different.
9. That for these reasons, whisky and alcohol are not like substances.
10. That the liquor trade itself recognizes and maintains a strict difference between whisky and neutral spirits up to the time that the product is ready for sale to the consumer.

It follows, therefore:

1. That when alcohol or neutral spirits is reduced by water to the proof of whisky and artificial coloring and flavoring essence are added, the product is not a genuine whisky, but is an imitation of the genuine.
2. That where aged whisky is mixed with alcohol or neu-

tral spirits, the flavor and other characteristics of whisky are reduced in proportion to the amount added and that the product should not be called whisky without qualification.

3. The distillate of sound grains, even under the same care used and under the methods used for distillation in making the best whiskies, should not be designated as whisky without qualification until it is properly matured.

In view, therefore, of all the above, and under Sections 2, 3, 4, 5, 6, 7 and 8, of the Kentucky Food and Drugs Act, approved March 13, 1908, I have adopted the following regulations to govern the enforcement of the Kentucky Act with respect to the branding of whisky and blends, compounds and imitations thereof.

Whisky is the properly distilled spirit from the properly prepared and properly fermented mash of sound malted grain or sound grain, the starch of which has been hydrolized by malt; and contains the volatile flavors, essential oils and other substances derived directly from the materials used, and the higher alcohols, ethers, acids, and other volatile bodies congeneric with ethyl alcohol, produced during fermentation and which are carried over in the distillation, as give, when the distillate is properly ripened, aged or matured, together with the changes and secondary products produced during aging, the characteristic appearance, odor, taste and other qualities as distinguished from commercial alcohol, refined alcohol or neutral spirits or other forms of new spirit, and as distinguished from rum, brandy, gin, cordials and other potable spirituous liquors.

Age of Whisky. If the whisky possesses any shade of amber color, or, if it is represented to be "old," "aged," and so on, it will be presumed to have been stored at least four years in proper wooden casks, unless the exact age is made known to the purchaser or consumer.

Whiskies which have been subjected to quick aging, such as the excessive heating of warehouses, or the introduction of steam coils into barrels, must have the fact plainly represented to the purchaser or consumer.

Coloring. The test as laid down in the Pharmacopoeia limits the conventional amber color of whisky to such as is acquired from the casks during aging and excludes added caramel coloring. The addition of such caramel or other coloring must, therefore, be fully represented to the purchaser.

Mixtures of whisky and neutral spirits, provided that there is sufficient whisky to make the product a genuine mixture, is a compound, but the word whisky may be used in the labeling,

provided the other material ingredients are also stated in connection therewith. For example, the mixture may be labeled "Whisky and neutral spirits," or "Whisky and silent spirits," or "Whisky and velvet spirits," or "Whisky and alcohol," etc.

Imitation whisky. Neutral spirits and other forms of ethyl alcohol, including new whisky, which have been treated with essences, oils and other artificial flavors, and colored so as to resemble in appearances a particular type of whisky, or so as to resemble the true characteristic of aged whisky, must be either labeled "Imitation," or labeled so as to show the exact character thereof.

Blended whisky. The law limits the term "blend" to "a mixture of like substances," and, unless, therefore, the character and composition of the blend is indicated, the legend "blended whiskies," or "whisky, a blend," or "a blend of whiskies," or "blended whisky," will be construed to mean a mixture of two or more properly aged whiskies, not excluding such additional coloring and flavoring as are not added for the purpose or effect of imitating a particular type of whisky or imitating aged whisky.

Labeling. The Act intends that all such labeling shall apply not only to sales among the trade, but to all sales, whatever the size, quantity or circumstance, between the trade and the consumer. In respect to labeling, the Kentucky Act provides, Section 4, that "all such labels and all labeling of packages provided for in any provisions of this act shall be on the main label of each package and in such position and character of type and terms as will be plainly seen, read and understood by the purchaser or consumer." The act also prohibits all misbranding with respect to kind, origin or other qualities.

Nothing in the Food and Drugs Act inhibits any truthful statement upon the label of any product subject to its terms, such as the particular kind or kinds of whisky, vended as whisky or as blends or compounds or imitations thereof, but when such descriptive matter is placed upon the label, it must be strictly true, and not misleading in any particular. The law makes no allowance for seller's praise upon the label, if false or misleading, and the product is misbranded if a false or misleading statement be made upon one part of the label and the truth about the product be stated upon another part. Similarly a product is misbranded if the label is false or misleading through the use of a trade-marked statement, design or device. The fact that a phrase, design or device is registered in the U. S. Patent Office gives no license for its deceptive use. All descriptive matter qualifying or particularizing the kind of

whisky, whether volunteered or required by the law to be stated, as in the case of blends, compounds and imitations, must be given due prominence as compared with the size of type and the background in which the name whisky appears, so that the label as a whole shall not be misleading in any particular.

ORGANIZATION OF THE WORK.

With the approval of the Board of Control of the Station, Dr. Linwood A. Brown has been appointed drug chemist, and Mr. James H. Martin, field drug inspector. Dr. Brown is a Kentuckian, a graduate of the University of Michigan and of the Louisville College of Pharmacy. He came to us from the Drug Department of North Dakota, and, before that time, had had experience as chemist in one of the large and high-class drug manufacturing concerns in New York City. Mr. Martin is a graduate of the Philadelphia College of Pharmacy and a practical druggist.

The organization of the work by the Federal Government took two of our men, Mr. W. G. Campbell, for the position of Chief Inspector, and Mr. B. R. Hart, for the position of Chief of the Cincinnati laboratory. Dr. W. E. Gary, one of our inspectors, resigned to accept a position under the local Health Department of Louisville. In February of 1908, Mr. R. M. Allen, Head of the Division, was given leave of absence to accept employment from the United States Department of Justice as Special Counsel to assist in the whisky branding cases, and was later appointed Special Assistant to the Attorney General in all work under the Food and Drugs Act. During my recent illness, he arranged with the Attorney General for a return to State work.

The present organization of the Food and Drug Division is as follows:

R. M. Allen, Head of Division.
J. O. LaBach, Chief Chemist.
L. A. Brown, Chemist, Drugs.
Miss Lillie Liston, Chief Clerk,
B. F. Scherffius, Inspector.
J. W. McFarlin, Ispector.
H. D. Spears, Chemist.
J. H. Martin, Inspector, Drugs,
W. R. Pinnell, Inspector.

Under Section 10 of the Kentucky Act, Dr. A. T. McCormack has been elected by the Kentucky State Medical Association, and Mr. J. W. Gayle by the Kentucky Pharmaceutical As-

sociation, as representatives to co-operate with the Director of the Station in the promulgation of drug regulations.

Our work has had an active support from all lines of the food and drug trade, and the efforts of the manufacturers and dealers towards the highest standards should give their trade a more and more commanding influence throughout the markets of the country. We have had also the hearty co-operation of the State Board of Health, the State Board of Pharmacy, medical associations, the State Federation of Women's Clubs and other organizations.

A detailed report by the Food and Drug Division gives the results of cities and towns inspected, samples taken, analyses of all samples, rulings, hearings, court data and other details.

Respectfully submitted,

M. A. SCOVELL, Director.

Lexington, Ky., February 23, 1910.

DETAILED REPORT TO BE PUBLISHED IN SEPARATE BULLETINS

DR. M. A. SCOVELL, Director,

Kentucky Agricultural Experiment Station.

Dear Sir:—Complying with your instructions, I have given very careful consideration to each case of adulteration or misbranding, and other samples, among the large amount of inspection and analytical data accumulated for this report, with respect to the requirements of the Act of 1908 in the matter of publication.

These data include inspection and analyses both under the Food Act of 1900 and the Food and Drugs Act of 1908. The Food and Drugs Act of 1908 changes the method of administrative procedure, in providing for a hearing before publication, and, in my opinion, the publication, since the going into effect of the Act of 1908, of any inspections and analyses done under the Act of 1900, must be governed by the administrative procedure provided in Section 9 of the later Act.

In going over the items of adulteration and misbranding, included in the two years to which this report applies, I find that corrections have been made by the manufacturers, dealers, dairymen, bakers and others, in a large number of instances; and, it is evident that further action under the law in many of these instances, should be governed by further inspections and analyses.

The list of samples analyzed includes a number which, if published now, must be published as "not found adulterated or

misbranded,'' and which samples the members of the Division and myself desire to be further investigated before so reporting. Especially is this true with respect to certain products to be submitted to further sanitary and bacteriological investigation.

For the above reasons I recommend, therefore, that the data intended for this report be worked up into special bulletins instead of being published now in a necessarily incomplete condition. With some further investigations these data will afford material for excellent bulletins, by the different members of the laboratory and field staff, on such subjects as the composition and food value of infant foods, the analysis and commercial purity of such drug products as glycerine, tartaric acid, hydrogen peroxide and the composition of various headache remedies and other patent and proprietary drug products. With some additional investigation, the Division can publish special bulletins or reports on the sanitary condition and the chemical and bacteriological composition of the milk, bread and meat supplies of the State and so on. Such a plan will enable the different members of the staff to work up a large amount of material into such concise form as would be of most value to the trade and general public.

I desire to further recommend the publication of the results of prosecutions in the form of ''Notices of Judgment under the Kentucky Food and Drugs Act,'' and that the same be published as soon as a case or class of cases is terminated.

Respectfully,

R. M. Allen,
Head of Division.

March 31, 1910.

KENTUCKY
AGRICULTURAL EXPERIMENT STATION

OF THE

STATE UNIVERSITY.

BULLETIN NO. 147

Common Insecticides and Fungicides, with Directions for the Treatment of Farm Pests.

LEXINGTON, KENTUCKY,
MARCH 15, 1910.

Kentucky Agricultural Experiment Station.

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W. R. PINNELL, Inspector, Food and Drug Division.
C. S. PORTER, Drug Inspector, Food and Drug Division.
H. C. WOOSLEY, Special Agent, U. S. Department Agriculture.
*On leave of absence.

NOTICE.

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

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

Address:

KENTUCKY AGRICULTURAL EXPERIMENT STATION,

LEXINGTON, KY.

BULLETIN NO. 147

COMMON INSECTICIDES AND FUNGICIDES, WITH DIRECTIONS FOR THE TREATMENT OF FARM PESTS.

BY H. GARMAN, ENTOMOLOGIST AND BOTANIST OF THE STATION.

The frequent demands for information concerning spraying, part of a general revival of interest in fruit growing in Kentucky, render desirable the publication of the following suggestions and directions.

Spraying cannot be expected to remedy all the difficulties in raising fruit at a profit. When an orchard is old and has been long neglected the first step in its renovation is likely to be pruning, stirring of the soil and fertilizing the land. Treatment such as this often does wonders by itself. It may be true that hilly land cannot be left uncovered during winters, owing to the danger of washing away the soil, but it is possible none the less in all situations to do something in this line, still keeping the surface bound by a cover crop in winter, and at least the ground immediately under the trees can be dug up and afterward protected from washing by mulching.

Spraying should be a part of this treatment of an orchard, and it should begin at once and be continued every year, as a precaution against pests rather than as a remedy. For experience has shown that spraying is cheaper as a preventive than as a cure. In regions in which everybody sprays, codling moth and scab and even San Jose scale give but little trouble, yet no one would think of omitting the precaution, and although a single individual in a community cannot hope to accomplish as much while his neighbors

neglect to spray as he would if all sprayed, yet on his own premises, and especially if he is somewhat removed from neighbors, he can establish a condition by constant spraying that will greatly lessen his chances of losing his crops. The fact has been demonstrated that a man can make money from a sprayed orchard, while his immediate neighbor with just as large an orchard on just as good land and made up of just as good varieties will fail.

There are three general purposes for which one must spray:

1. For gnawing insects, such as the Colorado potato beetle and the codling moth. For these pests some poison is commonly employed, such as Paris green or arsenate of lead.

2. For puncturing insects, such as plant lice, scale insects, and the chinch-bug. Coal-oil in emulsion is one of the most satisfactory preparations for these pests, but several others have some advantages for special purposes. The bark lice, such as the San Jose scale, remain on the bark over winter, and are at this season more completely exposed because of the absence of leaves. The dormant trees, too, will endure more caustic preparations than they will in summer, hence it is a common practice to spray in winter with the so-called lime-sulphur wash described below, an excellent remedy for most scale insects. The plant lice, again, sometimes occur on plants whose leaves are to be eaten, such as spinach and cabbage, and it may be desirable to avoid anything that will affect the flavor, or leave an objectionable residue. Comparatively mild preparations, such as tobacco extracts, may then be used to advantage.

3. For fungus pests, such as black rot of grapes, scab of apple, and the various mildews. These pests are plant parasites, and cannot be poisoned with Paris green. Oily preparations, too, have little effect on them. For most of them a good Bordeaux mixture, or some preparation of sulphur, is best.

Supposing then you own an orchard that has never been sprayed, and has been otherwise neglected. To put it in con-

dition for producing a crop, it should be pruned carefully, cutting out all unnecessary wood, and being especially careful to cut away completely all dead and diseased wood. Shriveled fruit clinging to the branches should at the same time be removed, and if scale of any sort is present on the bark the trees should receive a thorough spraying from the ground up with lime-sulphur wash. The ground should be broken and lightly fertilized, and as soon as the blossoming period is past in the spring the leaves and young fruit should be thoroughly sprayed with either Paris green or arsenate of lead. Ten days after the first spraying a second should follow, using this time Bordeaux mixture with Paris green or arsenate of lead added. Whether more spraying will be necessary or not depends on what pests give trouble in the locality. Bitter rot of apple comes when the fruit is pretty well grown and comes suddenly. One should be ready with an application of Bordeaux mixture at the first signs of its appearance.

Similar suggestions are given for other spraying called for on a farm under separate headings below, and I need only add here the general admonition: Be forehanded; spray thoroughly; use the best materials on the market, and if in doubt about their quality, send samples to the Station for analysis.

SPRAYING OUTFITS.

The question, What spraying outfit shall I get? has been asked the writer hundreds of times, and he would like, in this publication to answer it for as many as possible of those who are beginning fruit growing and farming and wish to adopt modern practices.

It depends entirely on the kind of spraying to be done and the extent of the work proposed as to what outfit is best.

If one has a few rose bushes or tomato plants about a dwelling, or even a few small fruit trees, he can get along very well with a small hand pump, known as a bucket pump. With a little extra hose and a pole, or bamboo rod, with which

to elevate the nozzle, it is possible to spray trees eight or more feet in height with such an outfit. Grapevines can be sprayed very well with a bucket pump, provided there are not many of them.

If there are many vines to spray, and a good stout man to do the work, a knapsack sprayer may be best. It is a very convenient outfit for spraying grapevines and may be used to advantage in spraying tobacco, potatoes, and other low-growing plants, which from the manner of their cultivation it is not practicable to go among with a team and wagon.

For extensive spraying, it is well to secure a strong pump attached to a barrel, or tank, that can be hauled about in a cart, or wagon. Hand pumps so attached are used for small orchards and other plants grown in a moderate way, and power pumps are demanded for extensive spraying and for that required by tall trees.

About most farms a useful sprayer is a barrel pump to be operated by hand. It serves for the orchard, for potatoes, and can be so managed as to answer for grapes and single shrubs, or trees, about the lawn. It can, in short, be made to do about all the work of the bucket and knapsack pumps, and in addition is very satisfactory for the orchard and field of moderate extent.

A man engaged in fruit growing, or potato growing, as a business, ought nowadays to have a power sprayer of some sort, either operated by the wheel of the vehicle carrying the outfit, as in the compressed-air sprayers, or by a gasoline motor. The cost of such outfits will keep them out of the hands of all but large farmers, truckers, and the fruit growing specialist.

A general purpose spray pump should be made of brass so that it will not be corroded by the copper sulphate used in Bordeaux mixture. If one wishes to spray only arsenate of lead, Paris green or lime-sulphur preparations, a pump of iron may be employed.

Nozzles, too, should be made of brass, and ought to be constructed so that they can be quickly cleared of solid particles that may lodge in the outlet.

Hose should be of the best. For trees it is well to have a sufficient length so that the nozzle can be elevated on the end of a pole among the branches. The precise length will depend on the size of the trees and on whether or not one sprays from a wagon, or trestle, or from the ground. For orchard work a length of 10 to 15 feet will serve when the pump is operated from a wagon bed. For shade trees of large size it may be necessary to have 50 feet or more, and in this case the pump must be a powerful one, such as Deming's Bonanza, if a hand pump, but preferably one operated by a motor.

The pumps will last longer and give better service if washed out with clean water whenever done using them. The hose ought always to be detached, drained and hung up in a cool place—a cellar is as good as any that is commonly available.

To be a little more specific as to outfits, but with no desire to recommend one make more than another, the following may be suggested:

For light spraying, such as that for rose bushes, grape vines, and the like, in yards about town: The Success Bucket Sprayer, made by the Deming Company, Salem, O.; The Lever Bucket Spray Pump, F. E. Myers & Bro., Ashland, O; The Premium Bucket Sprayer, The Goulds Manufacturing Co., Seneca Falls, N. Y.

For grapevines, potatoes in gardens, tobacco and other light spraying of moderate amount: The Deming Knapsack Sprayer, of the Deming Co., Salem, O.; The Handy Knapsack Sprayer, Goulds Manufacturing Co., Seneca Falls, N. Y.; The Myers Knapsack Spray Pump, F. E. Myers & Bro,, Ashland, O.

For small orchards and farms: The Century Barrel Sprayer, The Deming Co., Salem, O.; The Pomona Sprayer, Goulds Manufacturing Co., Seneca Falls, N. Y.; The Myers Double Acting Barrel Spray Pump, F. E. Myers & Bro., Ashland, O.

For tall shade trees: The Bonanza Double-Acting Spray Pump, The Deming Co., Salem, O.; The Deming Premier Power Sprayer, by the same firm; The Triplex Power Spraying Outfit, Goulds Manufacturing Co., Seneca Falls, N. Y.

For extensive field and orchard work: Power Sprayers made by the Deming Co., Salem, O.; The Goulds Manufacturing Co., Seneca Falls, N. Y.; The American Sprayer Co., Minneapolis, Minn.; The Aspinwall Four-row Potato Sprayer, Aspinwall Manufacturing Co., Jackson, Mich.

One contemplating getting an outfit for one or another purpose should send for the price lists of these dealers and choose that most nearly suiting his needs.

INSECTICIDES.

The materials used in spraying should always be of good quality. A Paris green must, to give the results assumed by the directions given below, contain the equivalent of about fifty per cent. of arsenious oxid. A good arsenate of lead paste should contain not less than twelve and a half per cent. of arsenious oxid, and should not contain more than fifty per cent. of water. Pyrethrum should not be very old, and cannot be expected to be very effective if it has been kept in an open package. Soaps contain very various amounts of effective ingredients. A good caustic potash whale-oil soap is as likely as any to be constant in composition and thus to give the same results each time when made up by a given formula.

Failure to get satisfactory results is probably in some cases the result of using poor or adulterated materials, though my experience in Kentucky indicates that fraud has been less frequently practised in this State than it has in some others.

PARIS GREEN.

Thus eight samples of Paris green analyzed in the Division of Chemistry of this Station some years ago ranged from 50.16 to 61.5 per cent. arsenious oxid with an average of 55.86 per cent. Five samples averaged 25.39 per cent. copper oxid, ranging from 8.70 to 30.54 per cent. The average of this ingredient is lower than it should be because of the deficiency in the sample containing only 8.70 per cent., which was adulterated with lime, of which it contained 19.48 per cent.

The disposition to sell adulterated and inferior Paris green seems to differ with locality, adulteration in general becoming more prevalent the farther it is from the centers of manufacture for the product. Thus Dr. Stubbs of Louisiana in 1899 found that thirty-eight samples ranged from 48.39 to 56.35 per cent. arsenious oxid, with an average of only 53 per cent. Dr. Traphagen of Montana obtained in 1900 an average of 58.57 per cent. arsenious oxid from six samples, and an average of 30.52 copper oxid.

In California Professor Colby in 1903 found the average of arsenious oxid very near what it should be by theory in pure Paris green (58.65 per cent.), but prior to 1901 in that state, it is evident from his analyses, this average was kept up by a general disposition to adulterate Paris green with white arsenic. In one sample reported water-soluble arsenic to the amount of 29.4 per cent. had been added.

A very satisfactory condition of the insecticide seems to prevail in New York where Professors Van Slyke and Andrews (1901) found an average of 58.10 per cent. arsenious oxid in 40 samples, with a range of 56.13 to 62.87 per cent. The copper oxid found by these men ranged from 26.53 to 31.14 per cent. and averaged 29.88. Water-soluble arsenious oxid ranged from 0.88 to 2.64 per cent., averaging 1.28.

A FIRST-CLASS PARIS GREEN.

From all these results it is safe to hold that a good Paris green should contain about 58 per cent. of arsenious oxid and

30 per cent. of copper oxid. Water-soluble arsenious oxid should not exceed 1.50 per cent.

Since the above was written, I have, through the courtesy of Dr. Brown of the Food and Drug Division of the Station, examined the results of recently made analyses of four Kentucky samples of Paris green and find that while they average 29.57 per cent. copper oxid and 55.82 per cent. arsenious oxid, they run high in water-soluble arsenious oxid, the average being 2.73 per cent.

ARSENATE OF LEAD.

The presence of soluble arsenic in Paris green and the consequent danger of burning foliage with it, has more than anything else led fruit growers to adopt arsenate of lead, when it can be secured, in preference for use on fruit trees. It is not at all hurtful to leaves, and has the further advantage of sticking, so that, once dried, the spray can be depended on to remain for some time and continue effective against all gnawing insects.

Analyses of the insecticide made at this Station showed it to contain in the dry material an average of about 65.59 per cent. of lead oxid and 26.58 per cent. of arsenious oxid. As put on the market it is generally in the form of a thick white paste resembling the white lead used by painters. It mixes readily with water, when it is ready for use at once. The quantity of water present in the paste may range widely. It should not exceed 50 per cent. In the samples examined here it averaged about 37.63 per cent.

Professor Colby of California found the arsenious oxid to range from 8.30 to 14 per cent. in six samples reported by him in 1906, the average per cent. being 11.57.[3] Seven samples reported by the same chemist gave an average of 37.64 per cent. of lead oxid. Most of them contained a considerable quantity of glucose, and other organic materials (4.57 to 12.70 per cent. with an average of 9.45). The water pres-

ent ranged from 27.60 to 54.70 per cent., with an average of 41.77.

Professor Street of Connecticut in 1907 found in eleven samples the arsenious oxid ranged from 11.29 to 21.91 per cent. and averaged 14.29 in the fresh material, the water ranging from 33.65 to 58.44 per cent., averaging 47.42. The lead oxid in these samples ranged from 25.59 to 44.05 per cent., averaging 34.79 per cent. Soluble impurities of all sorts ranged from 0.32 to 7.94 per cent. and the soluble arsenic oxid from 0.22 to 1.31 per cent. in the dry substance.

Professor Cathcart in 1909 reported fifteen analyses of arsenate of lead from samples obtained in New Jersey. The fresh material gave a range of 39.06 to 68.16 per cent. of water; of 6.07 to 19.71 per cent. of arsenic oxid; of 21.13 to 40.08 per cent. of lead oxid and 0.05 to 0.28 per cent. of soluble arsenic oxid.

A FIRST-RATE ARSENATE OF LEAD.

A high grade arsenate of lead ought, we may say from the various analyses of which we have the results, to contain about 17 per cent. of arsenic oxid, 38 of lead oxid, 0.22 of soluble arsenic oxid and 40 of water. A law now before the National Congress provides that lead arsenate shall not contain more than 50 per cent. of water, not less than 12.5 of arsenic oxid, and must not contain more than 0.75 of arsenic oxid soluble in water.

HOMEMADE ARSENATE OF LEAD.

The disposition to put on the market arsenate of lead paste having an excess of water in it, and sometimes glucose, which is not really needed to make it stick, leads people who do much spraying to undertake making arsenate of lead themselves. It can be produced more cheaply than it can be bought, and a reliable insecticide can be readily

enough made by any one of intelligence. The following formula may be employed*:

Acetate of lead	20 ounces
Arsenate of soda . . .	10 ounces

Dissolve separately and pour one after the other into a barrel of 50 gallons of water.

Test with a five per cent. solution of potassium iodide by filtering a little of the fluid from the barrel into a vial, then adding two or three drops of the potassium iodide. If sufficient lead is present a yellow precipitate is formed. If no precipitate forms, more acetate of lead must be dissolved and added to the fluid in the barrel.

LONDON PURPLE.

This by-product in the manufacture of dyes was at one time much used as an insecticide, but ranges somewhat widely in composition, and burns foliage badly unless lime is added. The destructiveness of the insecticide to foliage is due to about 15 per cent. of soluble arsenic commonly present.

It is used against gnawing insects, mixed with water, one pound in 150 – 200 gallons, with 3 – 5 pounds of lime added.

HELLEBORE.

This is an old insecticide kept by druggists and sold as a remedy for the rose slug and currant worm. It is the powdered rootstocks of a plant, *Veratrum album*, from Europe and Northern Africa. It is irritating when applied to the skins of insects and is poisonous when eaten. In use, about two tablespoonfuls are stirred into a bucket of water, and this is sprinkled over the plants with a watering-can, syringe, or else sprayed with a garden pump.

*At the suggestion of Dr. A. M. Peter, of the Chemical Division, I have reduced the quantity of acetate of lead in this formula below that commonly recommended (24 to 25 ounces). Actual tests show that with this reduction, an excess of acetate of lead is left in the water.

PYRETHRUM.

Persian insect powder, or insect powder, as it is sometimes called, is a yellowish powder made by grinding up the flowers of a plant belonging to the sunflower family. A domestic powder was formerly put on the market in this country under the name Buhach. It kills by contact, and being non-poisonous is a safe insecticide for use about dwellings, and on plants such as cabbage and lettuce, the leaves of which are to be eaten. It loses strength when exposed to the air, hence if it has not been kept properly may not give satisfactory results. It is used as a powder, or after stirring into water.

TOBACCO.

It is not as generally recognized as it should be that we have in tobacco an excellent insecticide for use against some of the most troublesome soft-bodied insects. For plant-lice especially it has proved very effective, and being harmless to plants, can often be employed when poisons are out of the question.

A decoction may be made of the tobacco stems (midribs) left from the stripped crop. A pound and a half of these in a wooden bucket with boiling water poured over them and left over night, makes a good preparation for use about the house on flowers and other ornamentals infested with aphides.

Manufactured tobacco extracts with a known percentage of nicotine are on the market, and are more certain in their effect because of the possibility of making up each time a definite solution. The Black-leaf extract of the Kentucky Tobacco Product Company of Louisville contains about three per cent. of nicotine, and in experiments made in the Insectary and about the Station has proved effective as a spray for aphides when used one part in seventy of water. It may be employed instead of the stems against the Grape Phylloxera on the roots of vines and the Woolly Aphis on the trunks and roots of apple trees.

TOBACCO EXTRACT FUMES.

Concentrated extracts (40 per cent.) of tobacco have proved especially good in my hands for the destruction of aphides in the Insectary. At times with the whole house occupied with plants, some of them very tender and others under experiment such as to preclude the use of a spray, concentrated tobacco extract fumes have proved most satisfactory in clearing all plants of the insects. For this purpose the weaker (3 per cent.) extracts are not effective. Two extracts of the above description have been used, one styled "Nikoteen" and made by the Scabcura Dip Company of Chicago; the other, named "Nico-fume" and made by the Kentucky Tobacco Product Company of Louisville.

The dose used by us recently for a section of a house containing 7296 cubic feet is 4 fluid ounces of nico-fume and 8 fluid ounces of water. Pieces of iron are heated red hot and with tongs are dropped into the fluid in a large pan or kettle. The door is closed and the fumes left over night.

TOBACCO SMOKE.

A smudge made by burning tobacco stems is often employed by florists as a means of ridding hothouses of plant lice, but has not proved as effective in my hands as the vapor. The smoke leaves a recognizable tobacco odor on rose petals, which is a further objection to it.

Sheets of paper which have been saturated with strong extracts are sold for use in fumigating hothouses, and are more convenient and certain than the stems, if properly prepared.

COAL-OIL OR KEROSENE.

This oil is a very valuable insecticide for special uses, but without dilution cannot safely be used on the leaves of plants. For ants coming up the walls of dwellings it may

sometimes be employed to advantage in its pure state, and for beds and other furniture infested with bedbugs it is one of the very best of insecticides.

When used on plants it is necessary to make an emulsion of it, which may be done by dissolving ½ pound of whale-oil or laundry soap in a gallon of boiling water, then adding to this two gallons of coal-oil and churning the two vigorously for ten minutes, using for the purpose a spray pump, the fluid being returned forcibly through the nozzle to the vessel from which it is being sucked up by the pump. One part of the emulsion may be mixed with nine of water before applying to plants.

The diluted emulsion is one of the very best of insecticides for destroying plant lice and bark lice, and may be used for any insect that can conveniently be reached by a spray. For summer use against bark lice it has a special value, since at this season of the year it is impracticable to use strong soap solutions and the lime-sulphur wash, both good sprays for winter use. The cost of kerosene for extensive spraying has led to the employment of the crude oils, which when emulsified answer the same purpose.

CRUDE OILS.

Like kerosene the crude petroleum is liable to do injury to plants. An emulsion may be made of it, and has been used with good effect for scale insects in winter, as well as for the destruction of the cattle tick, in the latter case being applied by dipping, by spraying with ordinary sprayers, or by the use of a special cattle-spraying machine, known as the Seabury Machine. Under trade names preparations of crude petroleum and soap have for some years been on the market where they are known as miscible or soluble oils. They can be diluted with water and used at once.

Homemade miscible oils can very readily be prepared by heating in a kettle, fish oil, crude carbolic acid and granulated caustic potash, then stirring into this crude oil, or paraffin

oil, and rosin oil, the latter being regarded as a help in making a permanent emulsion. When oil wells are near and much spraying is to be done emulsions are well worth making, but at present in Kentucky most fruit growers will prefer to buy the ready made miscible oils, such as Scalecide, made by the B. G. Pratt Co., 50 Church St., New York City, and the Target Brand Scale Destroyer, by the Target Brand Company, Martinsburg, W. Va. These preparations are about as effective for scale insects as any oil sprays, provided they are not too greatly diluted with water when used. In the hands of experimenters they have given good results used one part to 10, or 15, of water.

SOAPS.

Almost any of the soaps can be used against insects if proper care is exercised to make them of such strength that they will not damage foliage. The very strong solutions (1 to 2 lbs. in a gallon of water) recommended for use against scale insects in winter are unsuited for summer use, and quite often the solutions when diluted sufficiently to avoid burning leaves are not strong enough to destroy insects. Because of this the emulsion of kerosene is generally to be recommended for summer use.

Whale-oil soap, so-called, is regarded as better than most others for use against insects because of its uniformity in composition and the readiness with which it produces a slimy solution and perfect emulsion with kerosene. A caustic potash whale-oil soap seems to me about the best form that can be employed for the purposes of the entomologist. In winter it affords alone a very good wash when dissolved in water at the rate of one and a half pounds in a gallon, for most fruit trees, clearing the bark of scale and apparently having a good general effect on the health of trees. Dilute solutions of it can be used against scale insects and aphides infesting hothouse plants, but the coal oil emulsion seems to me better and safer for this purpose, though more trouble to prepare.

SULPHUR.

The ordinary flour of sulphur has for a long period been used as a remedy for red spider and mildew in hothouses, being commonly dusted over the leaves of plants. But it is not a very satisfactory insecticide when used in this way, and others have more or less completely supplanted it.

LIME-SULPHUR PREPARATIONS.

With lime, sulphur produces one of the very best insecticides and fungicides. For more than thirty years lime-sulphur preparations have been known in this country and for a longer period in England and probably in continental Europe. Somewhat recently washes of this sort have been generally adopted in the United States as a winter remedy for scale insects for which they have proved very satisfactory, a single thorough application sometimes restoring badly infested trees to a bearing condition. A formula for their preparation generally employed in my tests is given below:

Lime . . .	20 pounds
Sulphur . . .	14 pounds
Water . . .	40 gallons

The lime is slaked in a large iron kettle, the sulphur being added slowly at the same time and stirred thoroughly with the lime and water, then after adding twenty gallons of water the whole is boiled for an hour, then strained through burlap to remove the coarse particles, and finally enough hot water is added to make forty gallons.

SELF-BOILED LIME-SULPHUR WASH.

These concentrated washes burn foliage, and must not be used in summer. A so-called self-boiled wash has been advocated and tested very recently, but results obtained with it are conflicting, the bulk of evidence being against its effectiveness as a remedy for scale insects. For rotting and scabbing of fruit it is calculated to be more serviceable,

though it is doubtful if it will prove as effective for most fungus troubles as the well-known Bordeaux mixture.

A formula recommended by Mr. Scott, of the United States Department of Agriculture is the following:

Lime . . .	10 pounds
Sulphur . .	10 pounds
Water . . .	50 gallons

The lime is slaked in a barrel by pouring a gallon or two of water over it, using hot water if it is a sluggish lime, adding the sulphur when the lime begins to slake, stirring from time to time and cooling the preparation by adding more water as soon as the slaking is done. The object of this is to prevent too much of the sulphur going into solution, since in this condition it burns foliage.

The preparation is well worth trying, although its value cannot be said to have been as completely established as that of the concentrated lime-sulphur wash.

Ready-made lime-sulphur preparations may be bought, and can be used to advantage if one has but a few trees to treat and does not care to incur the expense of getting kettles.

PHOSPHORUS.

Proprietary preparations containing this substance as their active ingredient are to be bought of most druggists, and are effective against roaches and some other vermin infesting dwellings. They contain only a small percentage (about 1.50) of phosphorous, the rest consisting ordinarily of sugar, sirup and starch.

OIL OF CITRONELLA.

This oil has a rather pleasant but very persistent odor, and is frequently employed as a deterrent against mosquitoes. In sand and soil a few drops of it persist for weeks, and even months, which property recommends it for use against insects attacking the young corn plant immediately after it germinates, the oil being applied to the seed before planting.

The oil is obtained from a grass, *Andropogon nardus,* of Ceylon and other eastern countries, where it is said to be regarded as a remedy for rheumatism when rubbed on the affected parts.

STICKY PREPARATIONS, TANGLEFOOT, ETC.

Adhesive preparations are of value for insects which creep up or down the trunks of trees, and have become well-known in most households from their use in the form of sticky fly-paper. The sticky substance can be bought in cans and pails of the manufacturer, O. & W. Thum Co., Grand Rapids, Mich. It may be applied directly to the bark as a deterrent against the attacks of peach and other borers, or may be used on bands of paper, tin, or straw-board, secured about the trunk. For the elm leaf-beetle we have used at the Station a trough-shaped band made of carpet paper, or tin, securing its lower edge close against the tree, but leaving the upper edge free and at a distance of several inches from the trunk. The inside of the trough is smeared with the sticky material, which entraps large numbers of the descending larvæ. Used in connection with spraying arsenate of lead on the leaves, it affords a very satisfactory means of keeping the elm pest in subjection.

TAR.

This substance was once used for the canker worm of apple, being applied to the trunk to keep the wingless females from ascending. It hardens when exposed, and proved very injurious to the trees when applied directly to the bark. The latter difficulty can be avoided by using tarred bands, and the former by renewing the tar from time to time. The sticky papers can be made to serve every such purpose, however, and are much more convenient.

For soil-infesting seed-eating insects, such as the wireworm, tar may be used with good effect. A teaspoonful is stirred among about a peck of shelled corn after dampening

it with a little warm water. It may then be allowed to dry before planting.

BISULFID OF CARBON.

As sold by druggists and manufacturers this is a brownish fluid which quickly disappears in the air when exposed in an open vessel. Its disagreeable odor is due to impurities, since the odor of pure bisulfid of carbon is not unpleasant. The fumes are not only poisonous, but are inflammable, so that some care must be exercised in handling the fluid. It has proved of special service as a remedy for grain weevil, bean weevil and other insects attacking stored seeds, and has been quite extensively employed for the destruction of the Phylloxera of grapevines in Europe, for the Woolly Aphis, for ants, and even for the clothes moth. Its great value for such purposes comes not only from its effectiveness in destroying all insects, but also because it is not corrosive and is otherwise not injurious to seeds, fabrics and other objects fumigated. The offensive odor is soon gone if objects that have been exposed to the fumes are thoroughly aired. It cannot be used for fumigating plants infested with insects because of its destructive effect on the plants themselves.

About one fluid ounce should be used on each bushel of seed, and may be poured over the seeds or simply placed in a saucer or other open vessel set on their surface. It is absolutely necessary that the seeds be enclosed in a tight box or bin to get satisfactory results, and the time of exposure should not be less than two hours.

The bisulfid of carbon may be bought in quantity of Edward R. Taylor, of Penn Yan, New York.

HYDROCYANIC ACID GAS.

This gas is made from cyanide of potassium (98 per cent.), commercial sulphuric acid of good grade, and water. The gas produced is very poisonous as are also the cyanide of

potassium and sulphuric acid. When fumigating it is well to place a notice on the room or house warning people not to enter. After the fumigating is accomplished it is advisable to open up doors and windows and air out for ten minutes or more before entering.

The dose to be used depends on the space to be fumigated and upon the character of the plants to be treated. Dormant trees can be exposed for a time to very strong fumes. Growing plants must be treated cautiously with very mild doses. Some of them are very sensitive to the gas and will be slightly burned with any dose calculated to be of value in destroying insects. The condition of the air as to moisture may influence the results, since dampness favors injury from the gas.

For nursery stock it is customary to employ for each 100 cubic feet enclosed, the following:

Cyanide of potassium .	1 ounce
Sulphuric acid . .	1.25 fluid ounces
Water	3 fluid ounces

The box or house should be as nearly gas-tight as possible, with a very tight-fitting door. The water and sulphuric acid are placed in a deep open crock, then the cyanide of potassium, broken up into pieces about as large as a hickory nut, is poured into the crock and the door shut as quickly as possible. The fumes must be left about the trees not less than forty minutes, and fifty minutes, or an hour, is better. Short exposures in badly constructed houses have sometimes resulted in the sending out of living San Jose scale on trees.

In the hothouse the gas must be used with very great care to avoid injury to plants. Plants of the grass family (Gramineæ) endure more gas than most others tested by me. Corn, timothy, blue-grass and the like, are not very sensitive. The leguminous plants, such as clover, sweet pea and cowpea are very likely to suffer some injury with any but very light doses, and on this account it is best to use the less hurtful tobacco extract when practicable. The extract will not, how-

ever, destroy the adults of all hothouse pests, and has no effect at all on the scale insects nor on the immature white fly.

For the more hardy plants the following dose has been used, though with a little injury to some of them. For each 1000 cubic feet enclosed:

0.50 ounce cyanide of potassium
0.60 fluid ounce sulphuric acid
1.50 fluid ounce water

Start at eight o'clock in the evening and leave until ten-thirty, then air out.

For more tender plants, and for use against the adult white fly and the wheat and lettuce aphis:

0.25 ounce cyanide of potassium
0.30 ounce commercial sulphuric acid
0.75 ounce water

Start at eight o'clock p. m. and leave all night.

FUNGICIDES.

Insects are sometimes less difficult to suppress than the more or less invisible plant parasites, causing the various blights, mildews, rots and scabs. As a rule, too, fungi must be fought with other remedies, and these are not yet in all cases as satisfactory as could be wished. Some of the insecticides serve also as fungicides, and where they do not the two can often be combined in one preparation which will serve for both. The lime-sulphur wash is one of the best of those which serve to check both insect and fungus pests. Bordeaux mixture is not so good an insecticide, though when used in midsummer on foliage it often prevents much of the injury from gnawing insects. By adding arsenate of lead to it we get one of the very best insecticide-fungicide sprays yet devised.

BLUESTONE OR COPPER SULFATE.

This is the active and most essential ingredient of Bordeaux mixture. Concentrated solutions of it cannot be used

alone on foliage because of their caustic action. In winter on dormant trees it is sometimes used for fungus troubles, about two pounds being dissolved in a barrel of water. A weaker solution—one pound in 200 gallons of water—may be used on foliage in summer when fruit is well matured and it is not desirable to use sprays like Bordeaux mixture, which leave a residue. The bluestone may be quickly dissolved by pouring boiling hot water over it. When one is not hurried it may be dissolved by suspending in a loose sack in the water. It dissolves slowly if simply thrown into the water and allowed to settle.

To avoid to some extent the delays involved in dissolving bluestone it is well to buy a finely powdered grade now manufactured for the making of fungicidal preparations.

BORDEAUX MIXTURE.

A standard formula for the preparation of this valuable mixture is the following:

Bluestone	4 pounds
Fresh lime	4 pounds
Water	50 gallons

Dissolve the bluestone in 25 gallons of water, slake the lime separately and add water to make twenty-five gallons, then pour the two, bucket by bucket, into a third barrel so as to mix thoroughly. For peach and plum, which are more tender than apple and grape, the above formula may be changed to the following:

Bluestone	2.5 pounds
Fresh lime	2.5 pounds
Water	50 gallons

These are the best preparations known for mildews, rots, scabs, smuts, and the like, and where one is dealing with a fungus trouble, and is uncertain as to how to proceed, the chances are that he will accomplish as much by using this preparation as with anything that could be recommended. It is the best general purpose fungicide we have at present.

COPPERAS OR IRON SULFATE.

While this is less often used than bluestone, yet it has decided fungicide and antiseptic value, and because of its cheapness may sometimes be found serviceable. As now used it generally comes to the market as a waste product in the manufacture of steel wire, and may be bought for a cent or less per pound.

FORMALIN OR FORMALDEHYDE.

This very valuable preservative and antiseptic has been much used of late as a remedy for potato scab and to some extent for wheat smut. It is sold as a fluid containing forty per cent. of formalin. In this condition it is very acrid, and gives off fumes that affect the eyes and nostrils unpleasantly. Used on the hands it quickly destroys the outer skin. It cannot, therefore, be employed except when greatly diluted. But since it retains its active fungicide and bactericidal properties even when very greatly diluted, and is not so dangerous a poison in this condition as are corrosive sublimate and other antiseptic agents, it becomes very useful in the hands of those who wish to disinfect quarters in which have been lodged people, or animals, affected with communicable diseases. The wash or spray of the dilute formalin has always seemed to me much better for such uses than the fumes of formalin as generally produced.

On plants the action of even dilute sprays is very quickly destructive, and I doubt if it has a value for their treatment. But for seed wheat, likely to produce smutted heads and for potato scab it has proved very convenient and useful, it being only necessary to pour a pint of the 40 per cent. formalin in a barrel containing 30 gallons of water, stir thoroughly, and the potatoes in a sack can be set in the barrel for disinfection. They should be left in the fluid for two hours and can then be removed and spread out on grass or on a clean plank floor to dry, when another sack may be placed in the barrel. The treated potatoes must not be put in

barrels or sacks that have not been treated with the formalin. By having a number of barrels at hand the work proceeds rapidly.

Oats and wheat liable to smut may be treated by sprinkling the seed with dilute formalin (1 pint in a barrel of water) until every seed is moist, not wet, then leaving for several hours in a heap, finally spreading out to dry.

Fumes of formalin produced either by heat or by the use of permanganate of potash have been recommended as a remedy for potato scab, but my experience with the fumes has not been such as to warrant me in recommending them for this or for other purposes.

BICHLORID OF MERCURY.

A very poisonous chemical, valuable in dilute solutions (1 part in 1000) as a disinfectant, and particularly good as a remedy for potato scab. The whitish, crystallin, very heavy material is dangerous to have about, since it may attract the attention of children, or animals. It should of course always be kept labeled as a poison. It dissolves slowly in cold water, and it is best therefore to make use of heat, afterward turning the dissolved poison into the larger quantity of water required, best kept in a barrel. I have had good results in checking potato scab, using 4 ounces in 30 gallons of water and soaking the seed potatoes one hour. They were placed in the fluid in gunny sacks and afterward spread out on a barn floor to dry.

It is very essential that poisoned potatoes be not left where stock will eat them, and the poisonous fluid must be disposed of, after treating the seed, so that it will do no harm.

LIME-SULPHUR WASH.

This preparation of sulphur and lime has already been mentioned under insecticides. It has undoubted fungicide value both in concentrated and dilute preparations. For foliage the latter must always be used. Even the sulphur alone thickly strewn over leaves is a fairly good remedy for mil-

dew. A very small quantity of the sulphur dissolved in the presence of lime renders it more effective both as an insecticide and as a fungicide.

HERBICIDES.

Attention has of late been directed toward finding a substance that will destroy weeds quickly and leave land in a condition for crops. For many years common salt has been employed along walks and elsewhere to kill weeds, and can be made to do service in this direction if used in sufficient quantities, but always leaves the soil for some time unsuited to the growth of plants of any sort. I have tried it in excessive quantities for broom-rape of hemp and tobacco, and found it would keep the pest from growing one year, but also prevented the growth of hemp. The next year hemp grew well enough, but the seeds of the parasite left in the ground had apparently not been affected by the salt, and produced as many broom-rape plants as before. Crude carbolic acid is another cheap herbicide that can be employed with good effect in the destruction of weeds having strong roots from which new shoots appear when the tops are destroyed. Burdock, curled dock, woody plants, such as persimmon and sassafras, may all be killed by it.

The great practical difficulty in destroying weeds quickly over large areas comes from the fact that cultivated plants are like weeds in their susceptibilty to injury, only are less hardy and as a result are in general more likely to be severely injured by herbicides than are the weeds. For a long time to come, in all probability, it will be necessary to adhere largely to the old-fashioned methods of keeping weeds in subjection—namely, careful cultivation, rotation, and watchfulness and the prompt recognition and destruction of troublesome weeds when they appear.

IRON SULFATE.

This by-product has recently been tested by us on a large number of common weeds, with very various results.

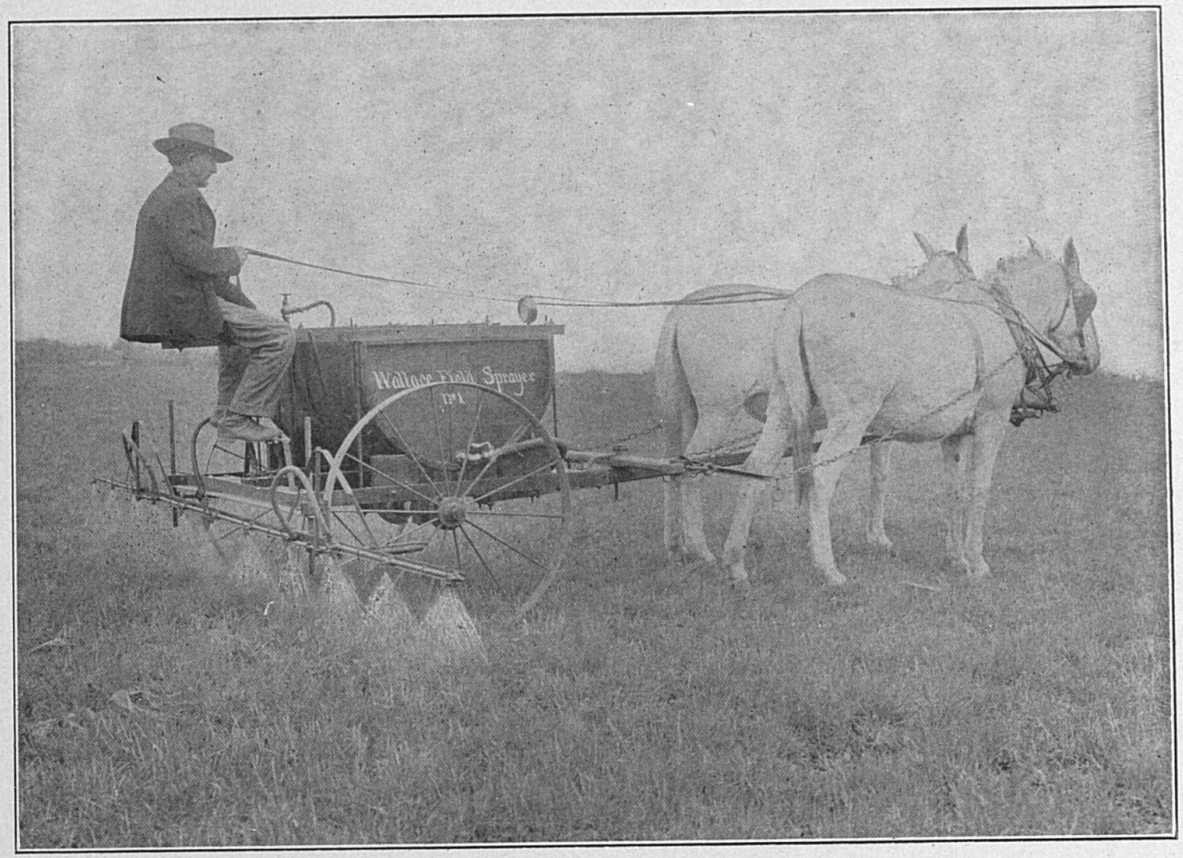


FIG. 1.—A compressed-air field sprayer in use spraying young white-top on the Experiment Farm.

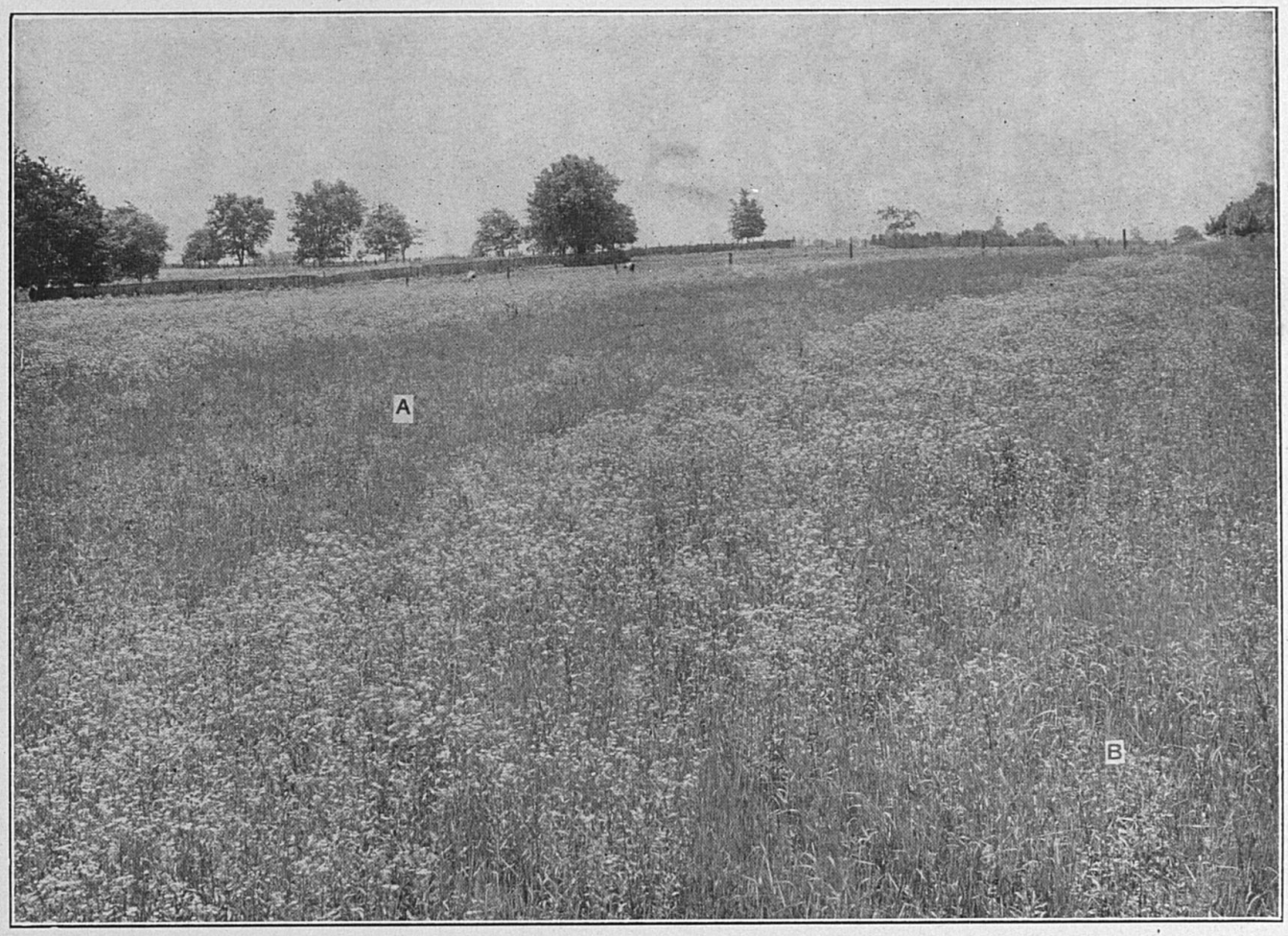


FIG. 2.—Showing the effect of spraying white-top in a timothy meadow with a twenty per cent. solution of iron sulfate, Experiment Farm, June 12, 1908. A and B, sprayed; intermediate strips, not sprayed.

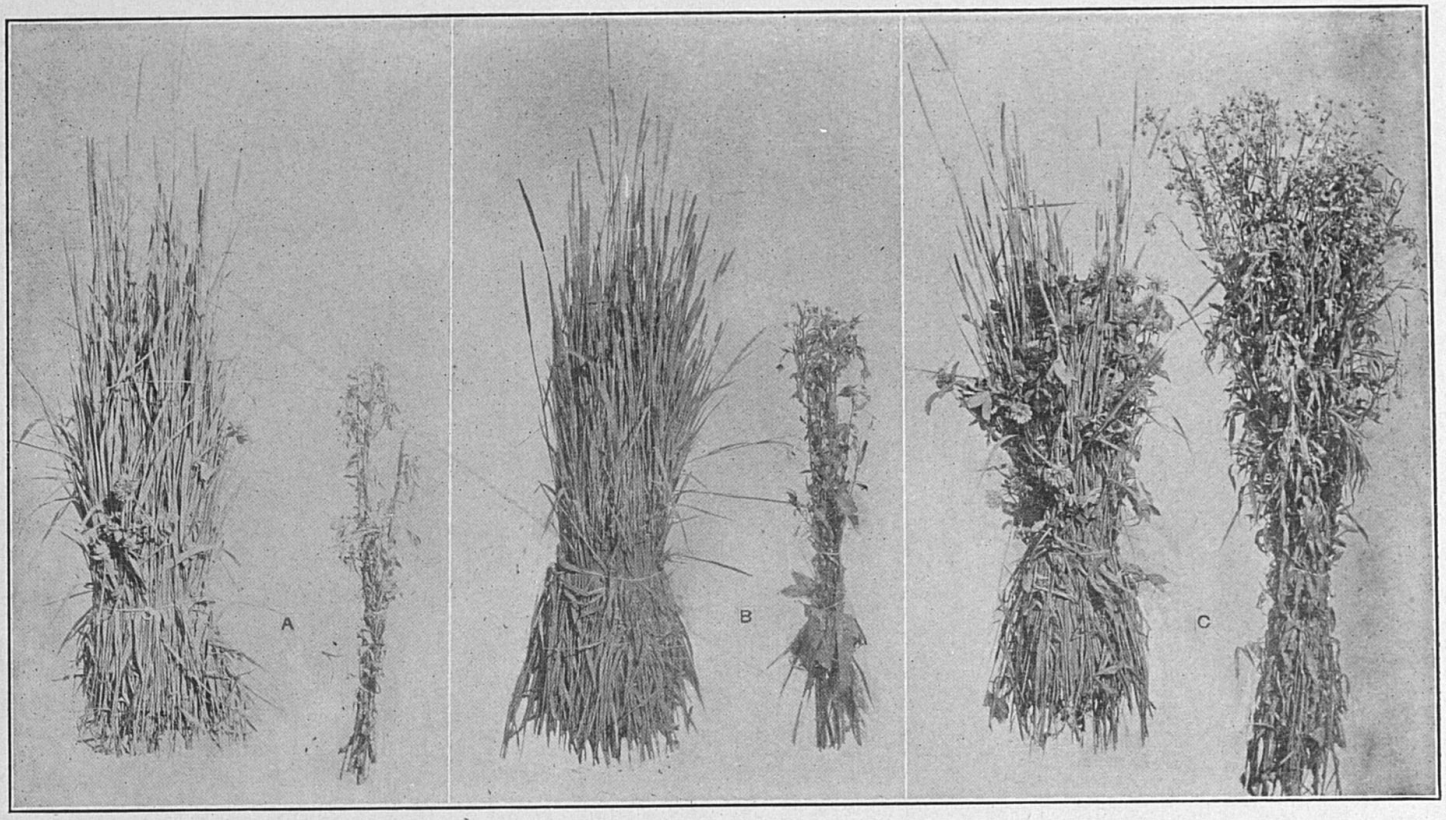


FIG. 3.—A, Timothy from four square feet in strip sprayed twice with twenty per cent. iron sulfate; white-top in this area shown at the right. B, Timothy and white-top from four square feet in strip sprayed once with twenty per cent. solution of iron sulfate. C, Timothy and white-top from four square feet of strip in same meadow, not sprayed. Note that the clover among the timothy seems to have been affected by the spray.

It has but little effect on some, and attacks others promptly. The grasses and grains are largely exempt from injury, and this has enabled experimenters in northern oat fields to do good work with it in destroying the wild mustard. Our fields are not infested with this weed, and indeed we have little occasion for the use in small grains of an herbicide for weeds of any sort.

In meadows and pastures, however, we are much troubled with white-top (*Erigeron annuus*) and with sour dock (*Rumex acetosella*). Both weeds are attacked by a twenty per cent. solution of iron sulfate, and with a couple of sprayings with a compressed-air sprayer, such as is here figured, it is possible to kill most of the white-top and to prevent the sour dock from producing seeds, at least until after the blue-grass seeds, timothy seeds and hay are harvested. This matter is of special importance because of the frequency with which sour dock seeds occur among timothy and other seeds. With the use of iron sulfate it should be possible to keep the weeds suppressed so that their seeds will not appear in the seed crop of the grasses.

The solution used by us may be prepared by dissolving a one-hundred pound sack of iron sulfate in a barrel (50 gallons) of water. This gives somewhat more than 20 per cent., but is near enough for practical purposes. The weeds should be sprayed when young to get best results.

COPPER SULFATE.

A solution, one pound in ten gallons of water, may be used on weeds along walks. It is just as effective as iron sulfate but costs more.

When the green scum (*algæ*) accumulates in excessive quantity on stock ponds, a solution of copper sulfate may be used with good effect, and can be distributed by placing some of the finely pulverized material in a loose sack and towing it about in the water.

LIME-SULPHUR WASH.

The concentrated lime-sulphur washes can, if desired, be sprayed upon weeds to good purpose, though the difficulty of preparation renders them less desirable than the simple solutions of iron and of copper sulfate.

DIRECTIONS FOR TREATMENT.

Something has been left to the judgment of those who will use the following directions. If I say, Spray on the first of May and again on the fifteenth, the directions may be explicit, but in practice will not work out well because April fifteenth may be the best time to spray first one year, May first another, and May fifteenth still another. Our seasons vary somewhat widely, and, moreover, there is a week or ten days difference in forwardness of season between Eastern and Western Kentucky. When insects and fungi attack a crop every year, spraying should begin, as elsewhere stated, just as soon as the blossoming period is past, whenever that may be, and on greatly neglected trees and vines ought to begin in winter. The times of making later applications, too, must vary with the general and local weather conditions. Definite dates may thus be misleading in practice, and have not been given.

APPLE.

CODLING MOTH AND CANKER WORM.—Spray as soon as the petals fall from the blossoms with arsenate of lead, 2.5 to 3 pounds in 50 gallons of water. Spray again with the mixture ten days later.

BORERS.—Cut out with a sharp knife whenever observed. If trees are properly pruned and otherwise cared for borers give little trouble.

LEAF APHIS.—Spray with tobacco extract, one part of a 3 per cent. solution in 70 parts of water. Or, in place of this, spray with dilute coal-oil emulsion, ½ pound of whale-oil, or good laundry soap, 1 gallon of water, 2 gallons of coal-oil; for use add nine parts of water to one of emulsion.

LEAF-HOPPER.—Spray with the coal-oil emulsion as given under leaf aphis.

SAN JOSE SCALE.—Spray in winter, or just before leaves expand, with lime-sulphur wash, lime, 20 pounds; sulphur, 14 pounds; water, 40 gallons. In summer use dilute coal-oil emulsion as directed under leaf aphis.

WOOLLY APHIS.—Avoid nursery trees with knotted roots; if suspected, dip in tobacco extract, one part, 3 per cent. in 70 parts water. Spray when aphis appears on trunk or branches. Clear away soil and soak roots with the extract when common on roots, or else use tobacco stems freely, covering with soil.

BROWN AND BITTER ROT.—Spray with lime-sulphur wash, or Bordeaux mixture, in winter, after pruning and removing from twigs all dried up fruit. Spray with Bordeaux mixture in midsummer after fruit is well grown. If giving trouble and nothing has before been done for it, use Bordeaux when spraying the second time for codling moth, stirring 3 pounds of arsenate of lead in a barrel of the mixture.

CROWN GALL.—Do not plant trees affected with the disease. Return them to the nurserymen. When an orchard tree is found to be badly affected, dig it up and burn it. Use copper sulfate freely in cavity, and in a year or two plant a sound tree.

SCAB.—The treatment recommended for the rots serves for this disease also.

TWIG BLIGHT.—Cut away all diseased wood and burn, whenever seen. Cut blighted wood from all pear in the neighborhood. The two diseases are identical, and are conveyed from one to the other. In cutting, sever twigs five or six inches below the dead wood. The disease will extend as sure as any of the bacteria are left in the bark.

ASPARAGUS.

RUST.—Remove all old growth and burn. If badly affected cut off tops and burn, then spray new growth with Bordeaux mixture.

BEAN.

APHIS ON ROOTS.—Clear away the soil as far as practicable, then saturate the roots with tobacco extract, or use ground tobacco stems liberally, covering afterward with soil.

WEEVIL.—Keep seeds in a cool place throughout winter. Place in tight box and fumigate once about a month after storing, and again just before planting in spring. Use one ounce of bisulfid of carbon on a bushel of seeds.

BEET.

LEAF BEETLES.—Several species, some flea beetles, others blister beetles, attack the leaves of beets in Kentucky, and can be kept in subjection by spraying with dilute coal-oil emulsion or by a free use of pyrethrum, one part to three of wood ashes or road dust. Poisons are not to be recommended because the leaves are sometimes eaten.

BLACKBERRY.

ANTHRACNOSE.—Cut out old canes as soon as the crop is harvested and burn. Trim the plants as desired, then spray with Bordeaux mixture. Spray again in spring just before the leaves unfold.

RED RUST.—Treat as for anthracnose. If a plant or two becomes affected it may be well to grub out and burn before the disease spreads.

CABBAGE AND CAULIFLOWER.

APHIS.—Spray from time to time with tobacco extract (3 per cent.) one part in seventy of water. Destroy the stumps left after the crop is harvested by gathering up and burning.

CUTWORMS.—Spray young plants with arsenate of lead, or enclose for a time with a cylinder of tin kept coated with tanglefoot. Tin cans with the bottoms cut out make a good substitute for the cylinders.

A poisonous bran mash is sometimes used for these insects. It may be made as follows: Stir a teaspoonful of Paris green in a quart of water, then add a half pint of sirup, and moisten with the mixture eight or ten pounds of bran. Place this in heaps among plants liable to attack, placing most of it along the edges adjoining grass land from which the cutworms come.

Such poisonous baits cannot safely be used when poultry is allowed to run at large, and are to be avoided as far as possible also because of their destruction of birds. A safer bait is succulent clover, cut and dipped in Paris green water, then placed in bundles about the endangered plants. It must be renewed frequently.

WORMS.—Spray the young plants once or twice with arsenate of lead. Later use coal-oil emulsion, or, if but a small number is to be treated, dust from time to time with Pyrethrum, one part in three of wood ashes, or road dust. Destroy the stubs left in the field in fall as soon as the crop is harvested, so as to prevent additional worms maturing and wintering about the land.

ROT.—Spray with Bordeaux mixture from time to time. See that none of the disease goes into the places of storage. Burn all refuse as soon as the crop is harvested. Put new plantings as far as practicable on land where the disease has not become established.

CANTALOUP.

APHIS.—Spray several times with three per cent. tobacco extract, one part in seventy of water.

STRIPED CUCUMBER BEETLE.—Spray with arsenate of lead, 3 pounds in fifty gallons of water, or enclose in frames made of six inch fence boards with cheese cloth tacked over tops.

MILDEW.—Spray repeatedly with Bordeaux mixture, beginning before the disease gets under way, if possible.

CUCUMBER.

APHIS.—Spray as directed under this head for cantaloup.

STRIPED CUCUMBER BEETLE.—Spray as directed under cantaloup.

MILDEW.—Treat as directed under cantaloup.

CELERY.

WORMS.—The green, looping worm (*Autographa brassicæ*) is often very destructive to celery as it is also to cabbage. The celery worm (*Papilio asterias*) is common at times. Spray with hellebore when plants are young, using two tablespoonfuls in a wooden bucket of water. Apply Bordeaux mixture later, both for the rust and as a as a deterrent against the worms.

RUST.—Spray at least three times with Bordeaux mixture, if plants are grown in the sun. The disease is much less troublesome on celery grown under slat shelters. These are only practicable, however, during dry sunny weather, and should be so constructed that the tops can be removed at other times.

CHERRY.

APHIS.—Spray twice with tobacco extract (3 per cent.) one part in seventy of water.

SLUG.—Spray as soon as the fruit is set and the leaves fully expanded, with arsenate of lead, 2.5 pounds in fifty gallons of water.

LEAF SPOT.—Spray twice with Bordeaux mixture (4 pounds of bluestone, 4 pounds of lime, 50 gallons of water), the first time as soon as the leaves are fully expanded, the second time in midsummer, about August 1.

MILDEW.—Spray as for leaf spot.

CORN.

See our Bulletin No. 145 for the treatment of corn pests.

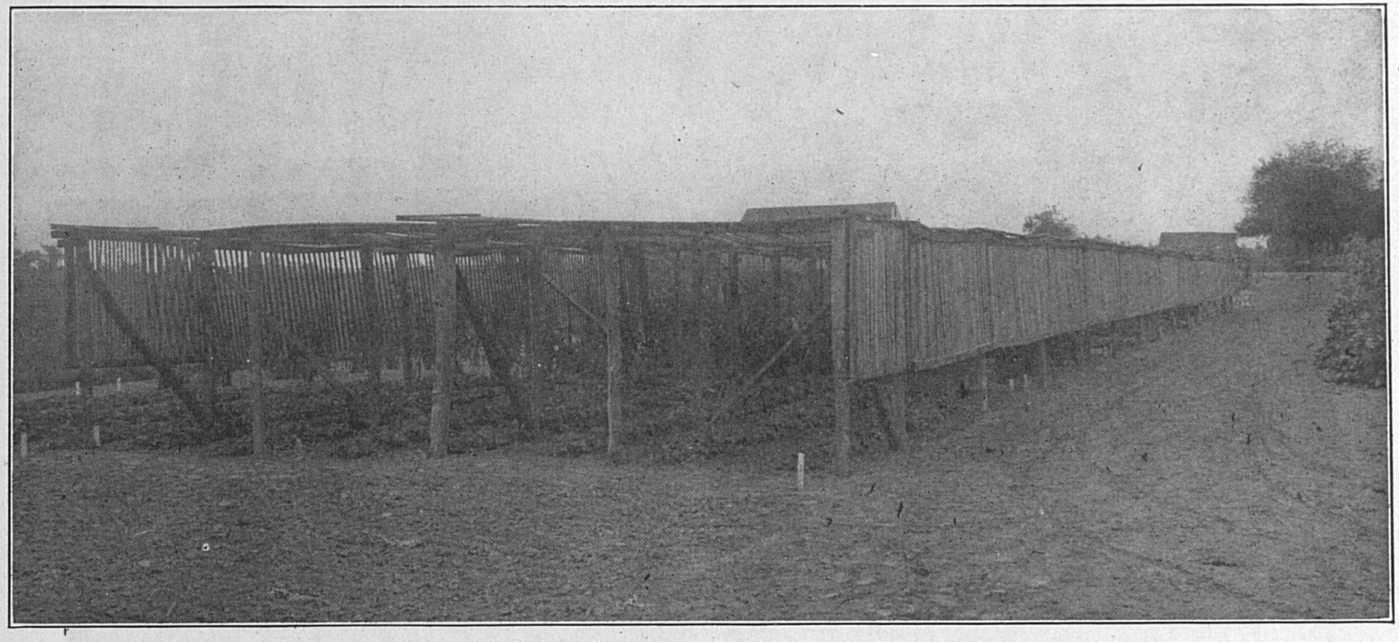


FIG. 4.—A slat shelter used by the Division of Entomology and Botany in 1904 in experiments with celery rust and tomato rot.

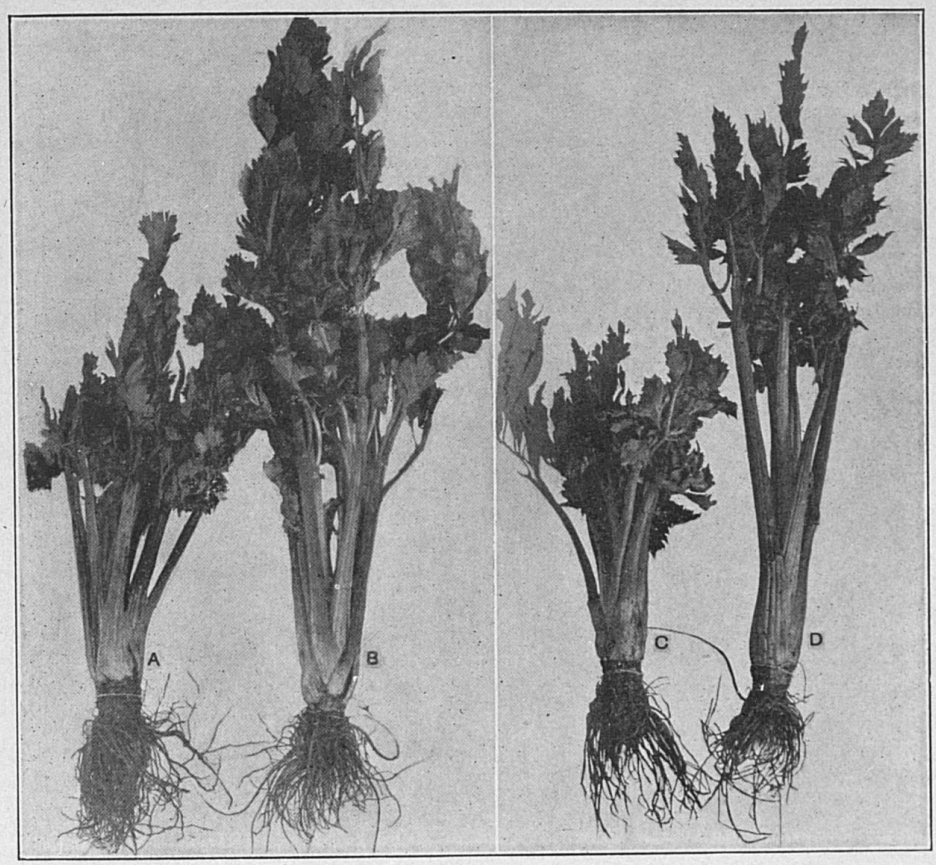


FIG. 5.—Showing the effect of growing celery in the sun as compared with growing in the shade, in 1904. A, Golden Self-branching, grown in the sun; B, Golden Self-branching, grown in shade; C, Giant Pascal, grown in the sun; D, Giant Pascal, grown in shade.

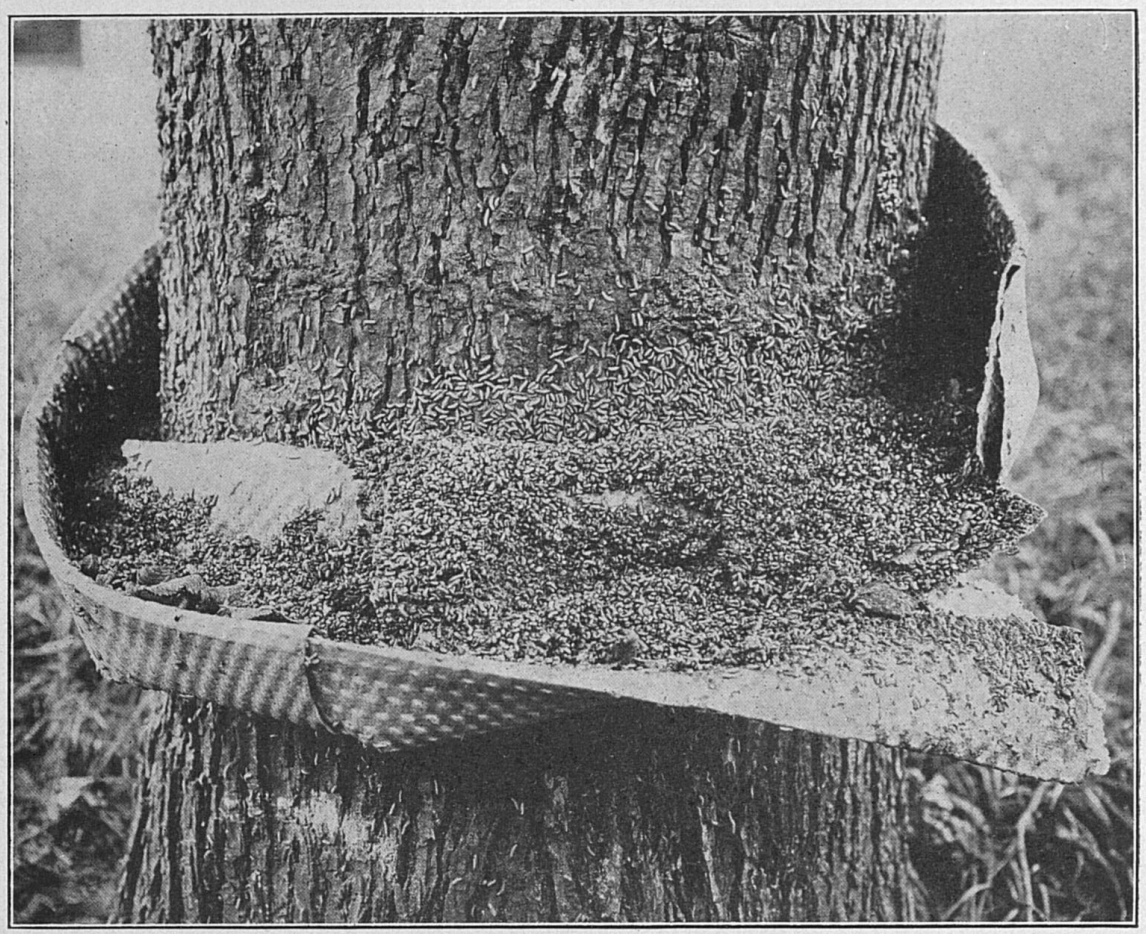


FIG. 6.—A trap for the Elm Leaf-beetle, made of strawboard and smeared with tanglefoot. Torn open July 10, 1909, to show the larvæ that were caught.

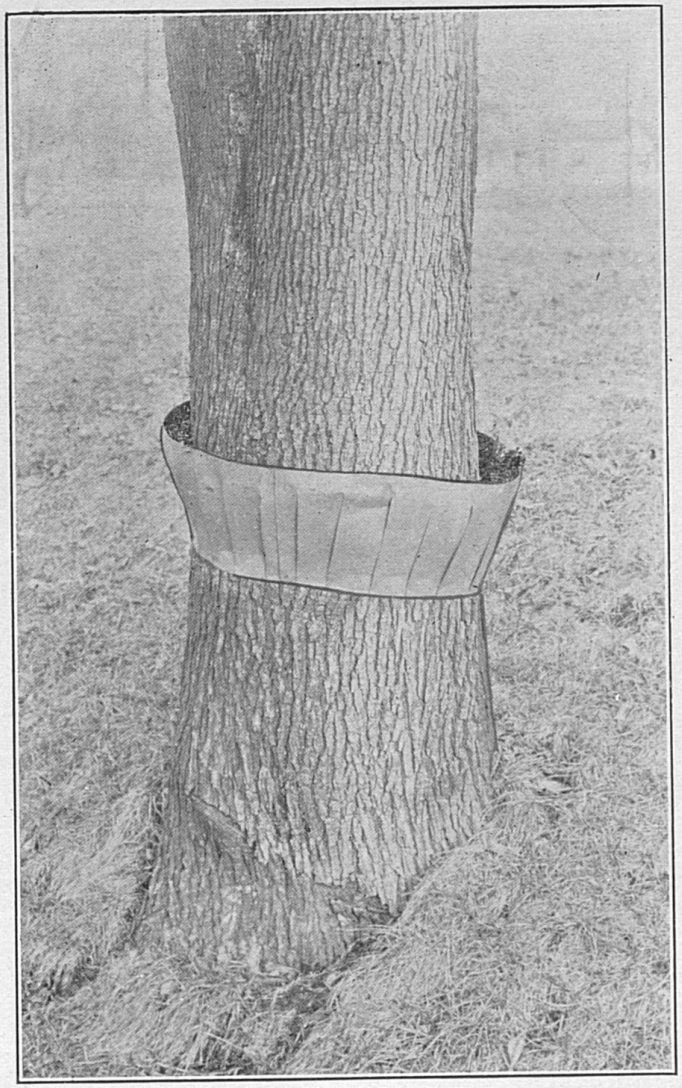


FIG 7.—A trap for the Elm Leaf-beetle, made of tin and smeared with tanglefoot. The lower edge should be secured about the tree with wire, and will require padding to fill the deeper crevices in the bark so as to prevent the larvæ passing through.

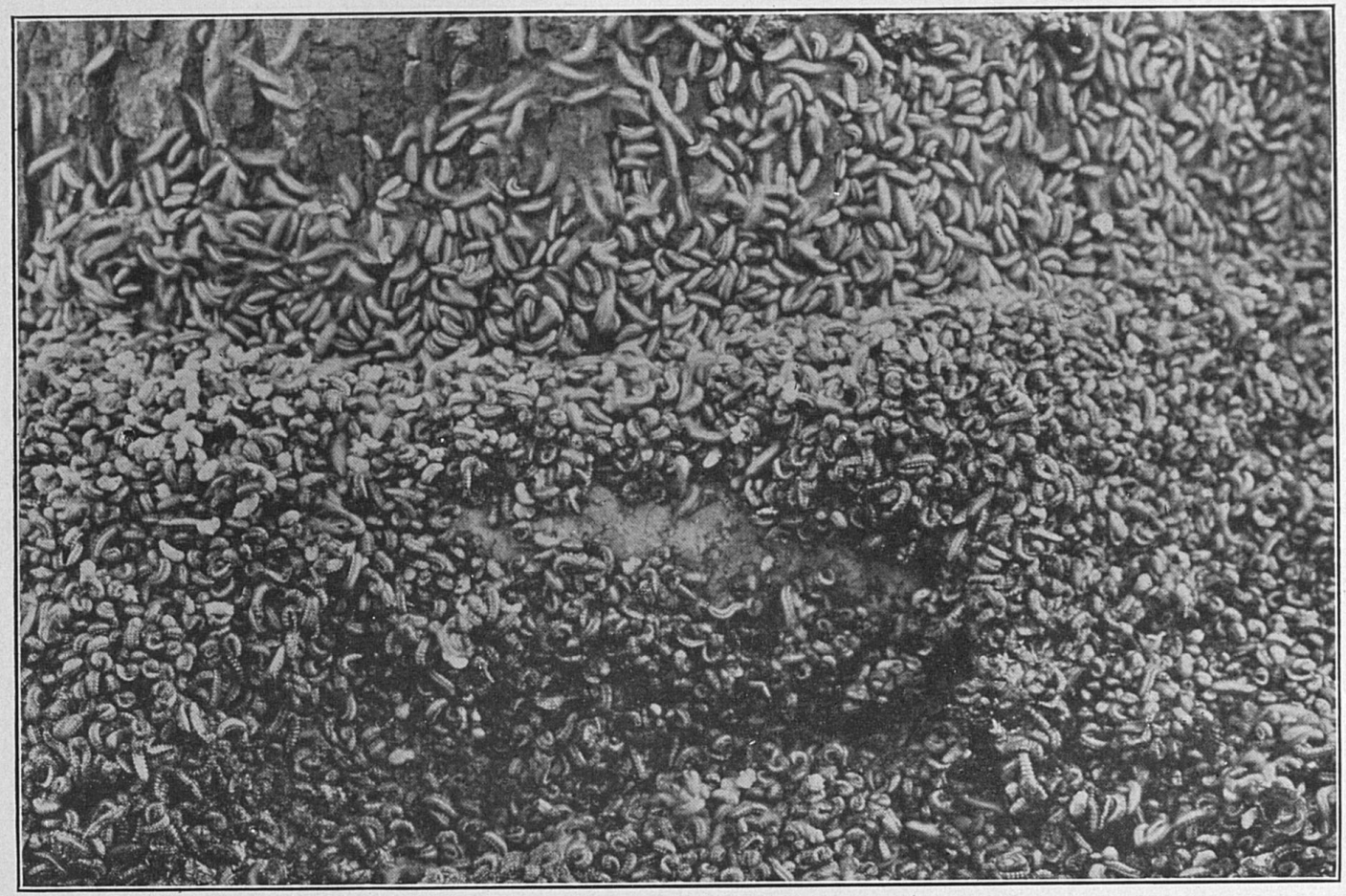


FIG. 8.—From a natural size photograph of Elm Leaf-beetle larvæ caught in a strawboard trap, July 10, 1909.

COWPEA.

WEEVIL.—Keep seed in a cool place at all times after harvesting. Fumigate once about a month after harvesting with bisulfid of carbon (1 ounce to each bushel of seed), and again just before planting. See that none of the adult beetles escape to the field from your storage quarters.

CURRANT.

WORM.—Spray once or twice with powdered white hellebore, two tablespoonfuls in a wooden bucket of water. Watch for the first appearance of the worms and spray promptly.

LEAF RUST.—Spray with Bordeaux mixture as soon as the leaves are fully expanded, and again about August 1.

GOOSEBERRY.

WORM.—Treat as directed for the currant worm. It is the same insect.

MILDEW.—Spray as soon as the leaves are out with Bordeaux mixture, or the self-boiled lime-sulphur wash. Spray again in midsummer.

GRAPE.

APHIS.—Spray with the tobacco extract, 1 to 70, or else with dilute coal-oil emulsion.

LEAF-HOPPER.—Spray with coal-oil emulsion, beginning when the insects are young.

LEAF BEETLES.—Spray young nursery plants with arsenate of lead, 3 pounds in 50 gallons of water. In the vineyard, use coal-oil emulsion, diluted.

LEAF-ROLLER.—Use arsenate of lead in the nursery. In the vineyard the insect may readily be destroyed by hand, and if attended to in season need not give much trouble. The arsenate of lead should only be used there early in the season, if at all.

SCALE.—Spray after pruning, in winter, with the lime-sulphur wash. Or else spray with strong soap solution 1½ pounds of laundry soap in a gallon of water.

ANTHRACNOSE.—After pruning in winter, spray the vines thoroughly with Bordeaux mixture. Spray again as soon as the fruit is set, and once again in midsummer.

BLACK ROT.—Spray as directed under anthracnose. Where only a few vines are to be treated it is practicable to enclose the bunches early in the season with paper sacks, securing them, with a pin, about the stem at its attachment to the vine. Splendid bunches may be secured in this way.

MILDEW.—Spray as directed under anthracnose.

LETTUCE

APHIS.—In cold frames and hothouses fumigate with concentrated tobacco extract (40 per cent.), using 0.60 ounce of extract in 1.25 ounce of water for each thousand cubic feet enclosed, and producing the fumes by dropping a piece of hot iron into the pan containing the fluid.

Out of doors, use the weaker extract, (3 per cent.), as a spray.

ROT.—In doors this must be controlled by underdrainage, by avoiding the use of too much water in the house, by care in ventilation and in keeping the proper temperature (about 70 to 80 degrees F.).

MELON.

STRIPED BEETLE.—This insect attacks the young plants as it does those of cucumber and cantaloup. Spray the plants with arsenate of lead, 2.5 pounds in 50 gallons of water. Or make wooden frames with cheese cloth tacked over the tops and keep them over the plants until the latter get a start.

OATS.

GREEN FLY.—Spray in the early spring with tobacco extract, or coal-oil emulsion, using preferably a compressed-

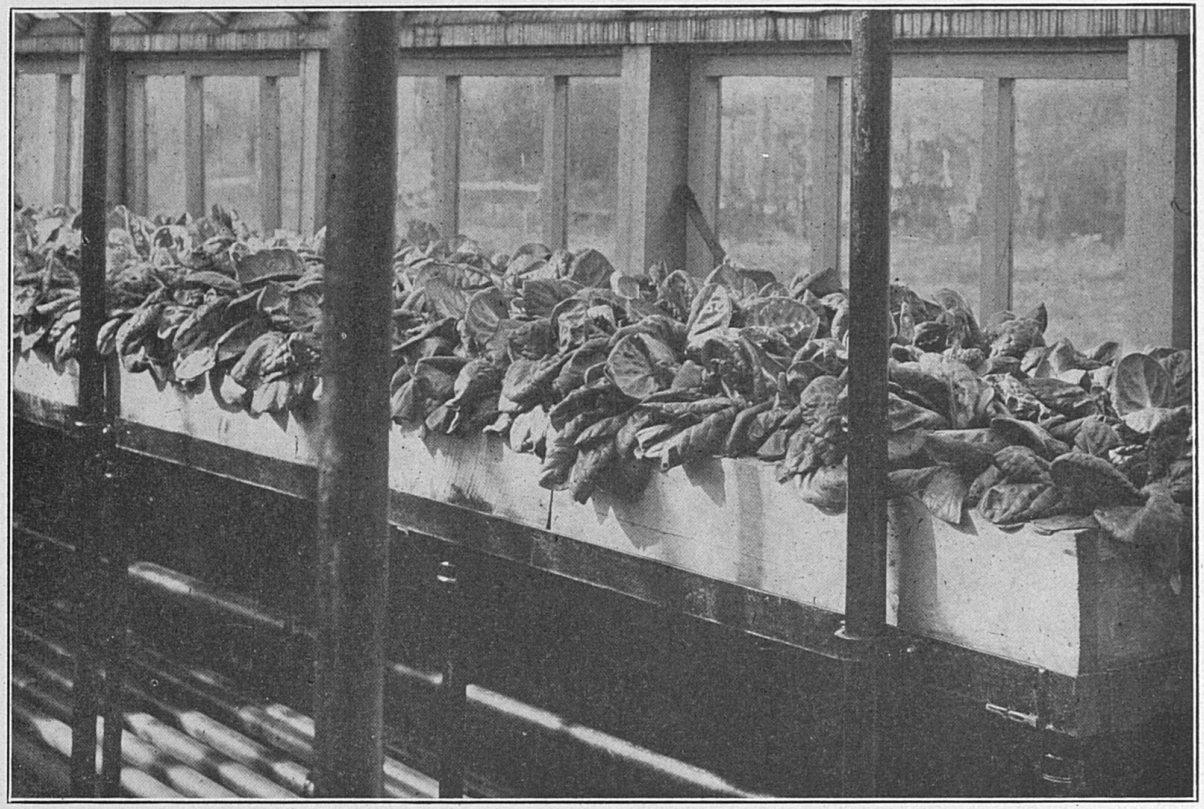


FIG. 9.—A bench of lettuce grown in the conservatory of the Division, watered by underdrainage to prevent rot, and fumigated with tobacco extract. Completely free from both rot and aphides.

air, or gasoline engine field-sprayer. It will require about one barrel of fluid to spray an acre.

SMUT.—Place seed in a heap on a clean floor, then sprinkle with formalin, one pint in 40 gallons of water and shovel over to get every seed moist, leave in a heap three hours, then spread out to dry.

PEA.

WEEVIL.—Treat as for the cowpea weevil. See above.

PEACH.

CURCULIO.—Spray as soon as the fruit is set and the leaves are completely expanded, with arsenate of lead, 2.5 pounds in 50 gallons of water.

BORER.—Wrap the trunks during the summer with paper, and smear the paper with tanglefoot. Heap tobacco stems about the base. Remove the wrapping in late October and cut out any worms that may have got around the edges of the paper.

BLACK SPOT.—Spray with very dilute Bordeaux mixture (2—2—50) or else use the self-boiled lime-sulphur wash. Spray when the fruit is set, and once or twice later, as seems necessary.

ROT.—Remove all dried up fruit in winter. Prune carefully. Spray with concentrated lime-sulphur wash. When the fruit is set, spray once or twice with dilute Bordeaux mixture (2—2—50), or with the self-boiled lime-sulphur wash.

PEAR.

SLUG.—Spray with arsenate of lead, 2.5 lbs. in 50 gallons of water.

BLIGHT.—Cut away whenever seen, as directed under twig blight of apple.

LEAF BLISTER.—Spray with lime-sulphur wash in winter, and in summer, beginning as soon as the leaves are out, with coal-oil emulsion.

PLUM.

APHIS.—Spray with the 3 per cent. tobacco extract, one part in seventy of water.

CURCULIO.—Spray as soon as the fruit sets and the leaves are fully out, with arsenate of lead, 2.5 pounds in 50 gallons of water. Apply again if it seems necessary when fruit is a quarter to a half inch in diameter.

BLACK KNOT.—Cut off affected twigs whenever seen and burn, making cut five or six inches below diseased part, then spray with Bordeaux mixture. If badly diseased, burn whole tree.

ROT.—Treat as for peach rot.

POTATO.

BEETLES (of all sorts).—Spray as soon as adult Colorado potato beetles begin to place eggs, with arsenate of lead, 3 pounds in 50 gallons of water. Repeat for late brood when this appears.

BLIGHT.—Spray as soon as the plants are well grown with Bordeaux mixture (4—4—50 formula) and once or twice later, as seems necessary.

SCAB.—Soak the seed in formalin, one pint in 30 gallons of water, for two hours, then spread out on grass or a clean floor to dry. If preferred, use corrosive sublimate as directed in the account of that fungicide given above.

RASPBERRY.

SLUG.—Spray with arsenate of lead, 2.5 pounds in 50 gallons of water.

ANTHRACNOSE.—Proceed as directed for anthracnose of blackberry.

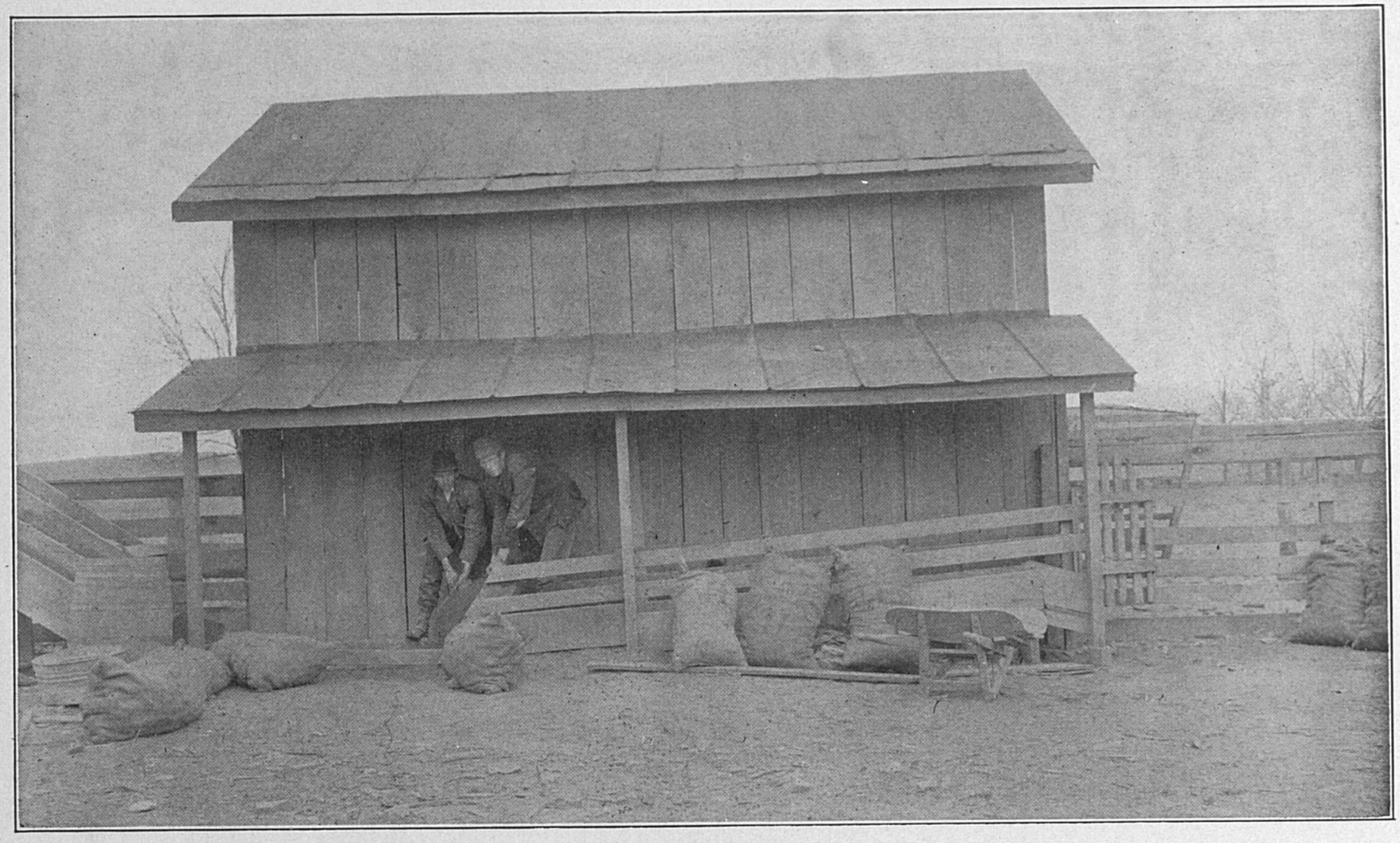


FIG. 10.—Showing how an old sheep-dipping vat can be utilized for dipping seed potatoes in formalin solution to prevent scab. Photograph made in the spring of 1909, on the McKee Brothers' place in Woodford County, Kentucky.



FIG. 11.—Lower view showing manner of spraying tobacco with arsenites, employing a knapsack sprayer. Upper view showing a field of tobacco on the Experiment Farm with "Jimpson weed" planted along the edges to be used in poisoning the tabacco worm moth.

ROSE.

APHIS.—Spray with tobacco extract, three per cent., one part in seventy of water.

SLUG.—Spray with two tablespoonfuls of white hellebore in a wooden bucket of water, or else use arsenate of lead, when flowers are not wanted, at the rate of 2.5 pounds in 50 gallons of water.

MILDEW AND BLACK SPOT.—Spray as soon as the leaves are out with Bordeaux mixture (4—4—50) and once or twice later, if necessary.

STRAWBERRY.

CROWN BORER.—Plow up and burn the plants. Get new plants from beds that are not infested, taking only the young plants, and late in the fall after the beetles are gone, or very early in the spring before they are active Start new beds at a distance from the old ones.

LEAF ROLLER.—When the crop has been picked, spray with arsenate of lead, or else mow the leaves, and when dry add a little straw and burn over the bed.

LEAF BLIGHT.—Spray with Bordeaux mixture, beginning as soon as the crop is removed, and repeating once or twice, as may be necessary. Mow the leaves and burn occasionally as suggested for Leaf Roller.

TOBACCO.

CUTWORMS.—Spray with arsenate of lead, 3 pounds in 50 gallons of water.

FLEA BEETLE.—Treat as for cutworms.

WORM.—Spray with Paris green, 1 pound in 130 gallons of water, or with arsenate of lead, 3 pounds in 50 gallons of water, beginning as soon as the young worms appear, and spraying no more than is necessary.

TOMATO.

WORM.—Spray with arsenate of lead, or remove by hand.

ROT.—Spray with Bordeaux mixture, or grow under slat shelter as directed for celery.

WHEAT.

GREEN FLY.—Spray with 3 per cent. tobacco extract, one part in seventy of water, beginning in fall, if necessary, and continuing in spring while plants are young. Use a power sprayer of some sort, if possible.

HESSIAN FLY.—Plant wheat from October 5 to October 10, never earlier. Cut badly infested wheat so high as to leave flax seeds in stubble, then burn as soon as practicable after harvesting crop. Avoid badly infested land.

SMUT.– A. Pour wheat in a heap on a clean floor, then sprinkle with formalin and water, one pint to forty gallons of water and leave for two hours, then spread out to dry. It requires less than a gallon of the solution to moisten a bushel of wheat.

B. Dip the wheat, contained in a sack, in the fluid, drain off at once and set aside for a couple of hours, then spread out to dry.

C. Dip for a minute or two in bluestone solution, 5 pounds in 30 gallons of water, drain off the surplus solution, then spread out on a floor at once, dusting with a little air-slaked lime.

HOUSEHOLD PESTS.

HOUSE FLY.—Allow no manure heaps to accumulate near dwellings. Scatter manure over land as rapidly as practicable. Use lime and bluestone about stables and outhouses frequently. Screens on doors and windows are almost a necessity when stables are near. Pyrethrum puffed into kitchens at night helps. Sticky fly paper is useful, coupled with other treatment.

The important precaution is to prevent the breeding of flies near dwellings.

MOSQUITOES.—The yellow fever mosquito and our common brown species (*Culex pipiens*) are very generally reared in rain barrels and other vessels about premises, and it is only necessary in cities for health boards to insist that such breeding places be done away with. Coal-oil poured pretty liberally on the water in such barrels will destroy the wigglers; but the open barrels ought to be abandoned as a means of keeping water. If for any reason one wishes to keep barrels from drying out he can do so by filling with water and adding a pint of formalin, or a couple of pounds of bluestone. The formalin is best, as bluestone will corrode the iron hoops in time. Small pools in which the malaria mosquito breeds may from time to time be covered with coal-oil. Bluestone, which tends to destroy the algæ among which the young malaria mosquito lives, is calculated to lessen its numbers. When such pools are near, screens should be kept on both doors and windows.

RATS AND MICE.—Sprinkle Paris green on cheese, or bread, and place about their haunts. Moisten grain, sprinkle with Paris green, and use in the same way. A little caustic potash placed in their runways will often drive them away, but is only available where they are burrowing in earth under floors, etc.

A bacterial culture now on the market under the name "Danysz Virus" has recently been tested by us. It is grown on the gelatin, agar, in a test tube, exactly as are bacterial cultures everywhere. The contents of the tubes are washed out in water and with this, stale bread is moistened and placed where the vermin can get it. When rats become infected they are disposed to leave their haunts and wander away to die.

The virus does not affect poultry and other animals, it is claimed, but I cannot, from personal observation, vouch for the truth of this claim.

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KENTUCKY
AGRICULTURAL EXPERIMENT STATION

OF THE

STATE UNIVERSITY.

BULLETIN No. 148.

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1. Seed Testing Apparatus.
2. A Study of Conditions under which our Germination Tests are made.

LEXINGTON, KENTUCKY,
MAY 23, 1910.
41

Kentucky Agricultural Experiment Station.

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LEXINGTON, KY.

BULLETIN No. 148.

I. Seed Testing Apparatus and Some Modifications Originating in the Division of Entomology and Botany.

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

After testing many different trays, of glass, metal, and plaster, for the germination of small field seeds, with which we are chiefly concerned, we have finally adopted two receptacles that give as good results as any we have tried.

Ordinary four and a half inch Petri dishes are used for some of the tests, the seeds being placed between discs of blue blotting paper in some cases; in others, between two discs of cloth with a layer of sand beneath and another above. These dishes have several advantages over some other receptacles used. The covers fit over the dishes, so that they are not displaced in handling; the moisture is retained as completely as is desirable; they may be placed three or four in a stack, thus economizing space; and when a number of these stacks are placed side by side in a wooden tray or flat, all may be handled at one time without disarranging any of them. The sunlight may be kept away by the simple expedient of inverting a second tray over the one containing them.

Kept thus in a hothouse, the germinating seeds are subject to the conditions most favorable to their development. The alternating temperature considered desirable for blue-grass and some other seeds is obtained to perfection by this means, and results obtained by us compared with those secured by the most perfect of other methods indicate that in the matter of accuracy of results, the procedure here outlined will give the truth with reference to the viability of seeds about as well as it can be secured by any, except an actual test by sowing.

For blue-grass and numerous other small seeds, we are now using very largely, and with excellent results, an ordinary plain glass jelly tumbler, on the top of which is placed a bobeche or candle-drip glass, this in turn with a disc of blue blotting paper bearing the seeds, and this again covered by a plain three-inch watch glass. Water in the tumbler is brought up to the blotting paper, on which the seeds are placed, by a piece of candle wick, the two extremities

of which are passed through the round opening in the bottom of the candle glass and spread out on its upper surface beneath the blotting paper. By filling the tumbler two-thirds full of water when starting the test, no further attention is required, beyond counting and removing the germinating seeds, until the end of the test. Twenty-eight of these tumblers with their complements of seeds may be placed side by side in one of the wooden trays used by us for hothouse work. When in use, they are placed in the hothouse and covered by a second tray, inverted over the other, to exclude the sun, for it must be remembered that the heat from direct sunlight allowed to concentrate within the glass vessel will become so intense as to cook the seeds.

The advantages of this method of handling the seeds are the following: (1) The whole tray may be carried about conveniently without slopping the water over its edges, as is likely to be the case when water for all the tests is contained in a metal tray. (2) Each test is completely independent, and can be removed to a table or desk at any time for inspection, without dragging the candle wick out of the water. (3) The glassware may be sterilized in an autoclav, in case molds have appeared and seem likely to make trouble. (4) The watch glasses are sufficiently low to permit one to see just what a lot of seeds is doing, may be easily removed and returned, and give no trouble by drawing up an excess of moisture.

A single outfit complete, consisting of tumbler, wick, candle glass, and watch glass, ought to cost 8 to 10 cents, according to the quantities of each, bought at one time.

One of the most laborious tasks involved in testing seeds for purity results from the difficulty of removing every one of the small foreign seeds and the inert matter from the pure seeds. At first we adopted the bellows-blower worked by the foot, commonly employed in laboratories in getting an intense heat for burning organic matter from substances being analyzed. The air-blast obtained by this apparatus is not as completely under control as is desirable for nice work, a steady flow of air being wanted that may be varied to suit the weight of different materials to be removed from a sample. Our first change from the old apparatus was that

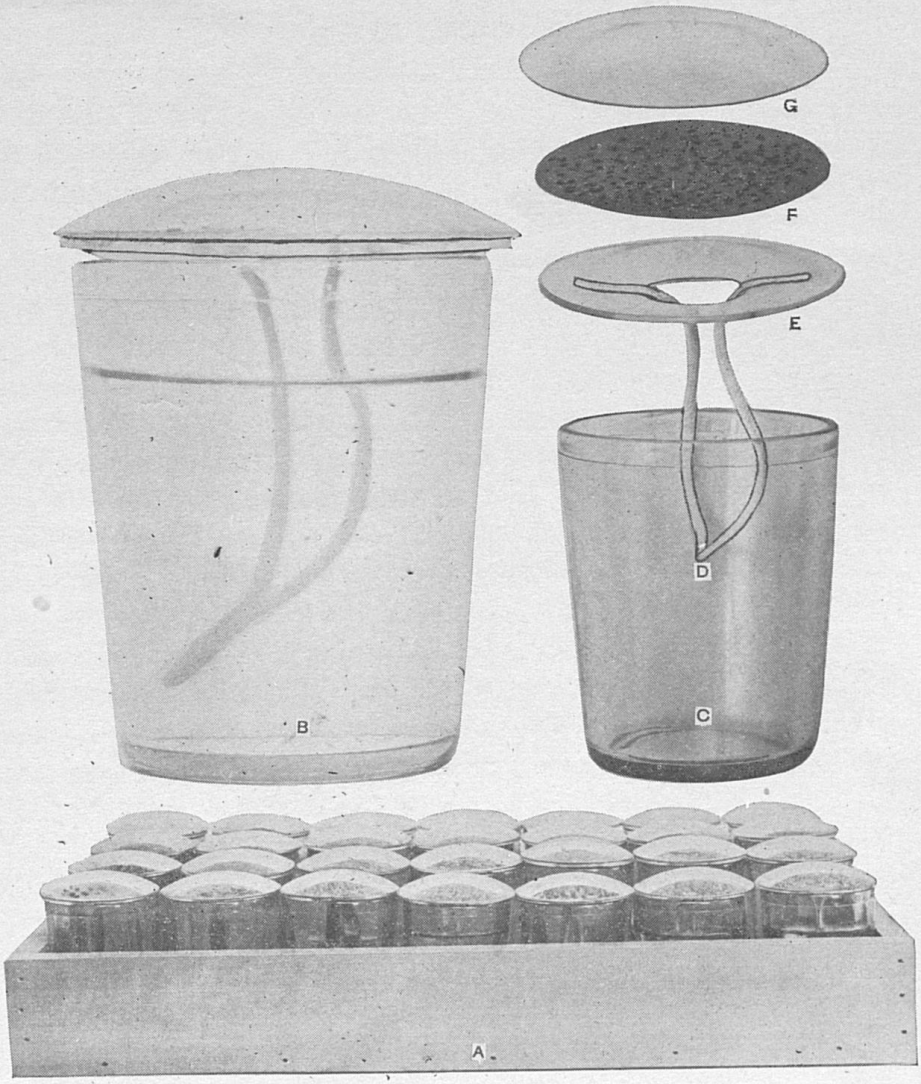


FIG. 1.—*A*, a tray with twenty-eight jelly tumblers each with a seed sample being tested for germination; *B*, a single glass, shown as fitted for testing seeds; *C*, a tumbler with the other accessories separated from it; *D*, the candle wick; *E*, candle-glass; *F*, disc of blotting paper bearing seeds; *G*, watch glass used as a cover.

of connecting with a compressed air motor operated by electricity in the basement, and already in use in the chemical laboratory. The difficulty of controlling the pressure nicely still remained, but was overcome by Mr. Vaughn of the Division, who introduced a mercury gauge registering a couple of pounds of pressure. With this gauge, it is possible to determine the pressure needed to remove impurities from the different seeds and afterward make use of the same pressure for all samples of one sort. The worker is thus not likely to leave in a part of several samples under comparison, impurities that are removed from others. It seems to me that if a standard gauge and blower of this sort could be adopted, it would contribute not a little toward uniformity of results among seed inspectors.

Otherwise than in the addition of this gauge, our blowing device is in essentials like that used at the United States Department of Agriculture. But the bent glass tube, through which the seeds are blown, is constructed with its two arms of nearly the same length. When fixed in an upright position for use, the sample of seeds is placed in one end, while the free end is held near the surface on which rests the beaker, or other vessel, receiving the impurities blown over. A design of the blower used in our laboratory follows. It is not regarded as perfect, but may have in it suggestions that will prove serviceable to workers in other laboratories.

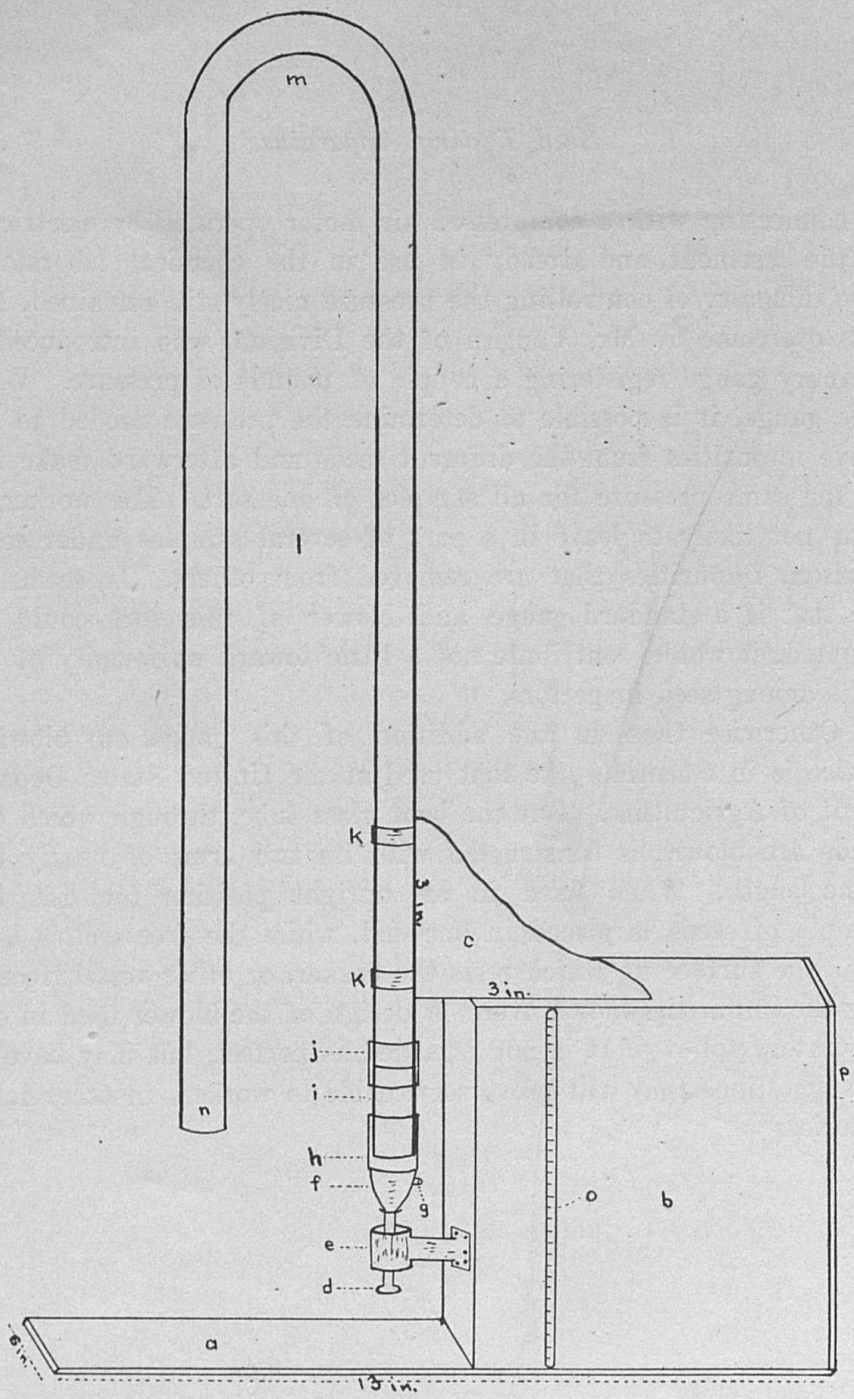


FIG. 2.—*a*, Wooden platform 6x6x½ inches continuous with the bottom of the box, *b*; *b*, wooden box, 6x6x6 inches, of half-inch stuff, door at *p*; *c*, block secured to top of box to hold an upright U-tube of glass; *d*, a spiral screw with milled-head below and disc above, working in *e*, which is a metal bar and ring, secured to the side of box by its base; *f*, wooden base for *h*, which is a glass cylinder ¾ inch long glued to *f*; *g*, an inlet pipe for air current; *i*, a glass cylinder fitting loosely at its lower end inside *h*, and at its upper end closely in *j*, which is a ring of metal fitting closely on the upper end of *i*, and on the lower end of the glass tube *l*, so as to make a perfect joint; *k*, *k*, rings securing *l*, to the block *c*; *l*, a glass U-tube with inside diameter of ½ inch and measuring 18 inches from bottom of *i* to inside of bend at *m*; *n*, lower free open extremity of U-tube; *o*, a graduated mercury U-tube, the other arm of which is enclosed in the tank of the pressure guage represented by Figure 3.

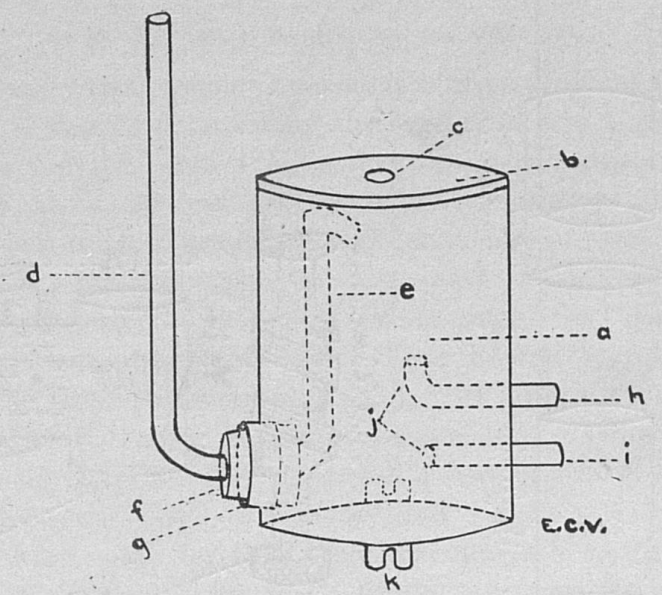


FIG. 3.—*a,* A cylindrical metal tank 3 inches in diameter and 4 inches high, when in use to be secured within the box *b* of Figure 1; *b,* a screw cap, with valve at *c,* opening at a pressure of two pounds to the square inch; *d,* outer arm of mercury tube ⅛ inch inside diameter and about 5 inches long, graduated in tenths of an inch; *e,* inner arm of same tube, about 3 inches long; *f,* a rubber stopper through which tube passes, pressed into opening from within; *g,* a metal cylinder, ½ inch long and 1 inch in diameter, screwed firmly in side of tank as near bottom as practicable, and directly opposite tubes *h* and *i; h,* inlet tube for air at least ¼ inch inside diameter, fixed firmly and permanently in tank about 1½ inch from bottom; *i,* outlet tube for air, at least ¼ inch inside diameter fixed like *h,* but a half inch lower; *j,* inner ends of air tubes; *k,* a metal strap secured to bottom of tank and projecting at each side so that by means of it the tank can be fastened securely to the bottom of the wooden box (*b* of Fig. 1). When in place the graduated arm of the mercury tube comes through the side of the box and is represented at *o,* Figure 1; openings on the opposite side of the box must be made for the outer ends of the air tubes *h* and *i* of Figure 2. Designed by Mr. Vaughn.

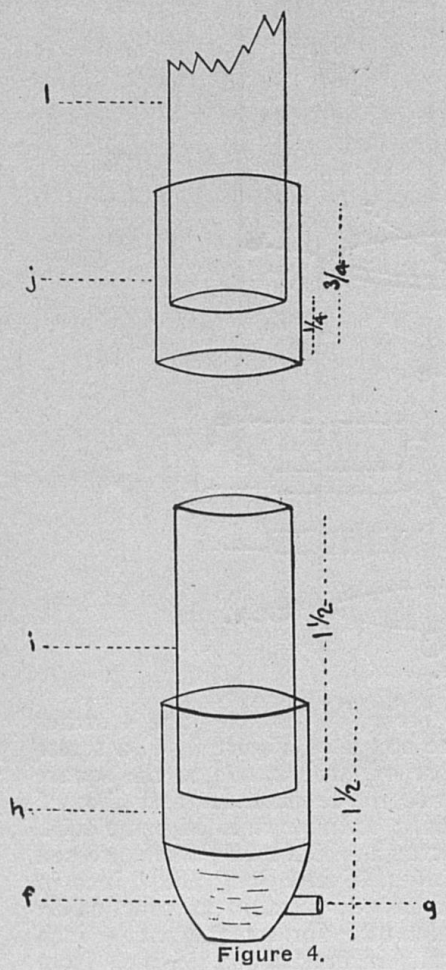


Figure 4.

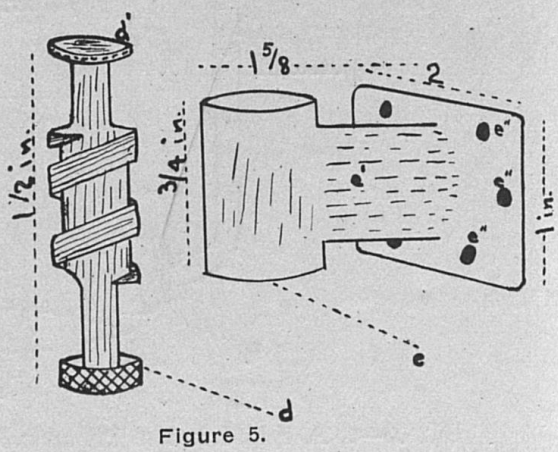


Figure 5.

FIG. 4.—*f*, Wooden base with inlet tube *g* for air; *h*, glass cylinder ¾ inch long with diameter such that it fits very loosely over the end of *i*—the inside diameter of *h* should be ⅛ inch greater than the outside diameter of *i*; *i*, a glass cylinder 1½ inch long and of the same inside and outside diameters as the lower end of the large U-tube, *l*; *j*, a metal ring fitting snugly over joint between *i* and *l*.

FIG. 5.—An enlarged outline of the fixture secured to side of box below the U-tube *l* of Figure 1; *d*, milled head, *d*, disc upon which rests the wooden base *f* of Figure 1. The screw has threads ⅛ inch wide and 3-16 inch apart.

2. A Study of Conditions under which our Germination Tests of Seeds are made.

By H. Garman, Entomologist and Botanist.

In February, 1909, some tests of seeds were made in our Conservatory with a view to determining the conditions under which the best results are secured. Samples kept in the headhouse at all times gave about 30 per cent. less in germination than those alternated between the headhouse and hothouse and those kept at all times in the hothouse, the alternated samples and those kept constantly in the hothouse giving about the same percentage for seeds of the some lot. Some interesting results obtained at the United States Department Seed Laboratory and presented by Mr. E. Brown at the Boston meeting of Official Seed Analysts, held last December, suggested a further test of our conditions, which was made in January and February, 1910. The tables following speak for themselves, but attention is directed to the fact that the clovers, including alfalfa, are much less sensitive to differences of light and warmth than the grass seeds, and that of the latter, timothy is less influenced than the species with seeds enclosed in a closely adherent glume. Blue-grass seems to be the most peculiar in its requirements, and does not give satisfactory results unless it is humored.

It should be explained that seeds taken from the same lot were used in all the tests of seeds of a given species. Thus all the seeds of blue-grass tested were from one bulk lot. All the seeds of red-top, timothy, etc., were also alike in everything except the conditions under which they were kept while being tested. Three samples of each species were tested under each set of conditions. The details for each sample are given in the first table and finally the averages are presented in a single table for convenience of comparison. In turn these are followed by several diagrams showing the behavior of the grass seed samples.

In looking over the tables and diagrams it will be observed that in every case the grass seed sample kept in the dark in the head-

house gave the lowest percentage of germination. The samples kept in the headhouse in light during the day gave a better percentage in every case, though it was only slightly so in the case of timothy. These results appear to support the contention of Canadian seed analysts to the effect that light favors the germination of grass seeds, but some difference of temperature was noted by Mr. Kinney, as between the air in the covered trays and the air outside in the room, and it is possible, as claimed by those in charge of the seed work at the United States Department of Agriculture, that the more constant temperature within the covered trays may account for the lower percentages rather than the absence of light. The writer does not wish to commit himself to either view at present, but gives the results for what they may be worth considered in connection with those secured by others.

Clover and alfalfa seeds kept under identical conditions with those under which the grass seeds were tested showed no difference of consequence in germination.

All the tests were carried out by Messrs. Vaughn and Kinney in the experimental conservatory of the Division.

The temperature of the hothouse during the period covered by the tests ranged from 58 to 84 degrees F. during the day, with an average minimum of 63.8 and an average maximum of 76.2. At night the range of temperature in the hothouse was from 57 to 70, with an average minimum of 59.1 and an average maximum of 65.6 degrees F.

In the headhouse the temperature was more even, ranging by day from 55 to 72 degrees F., with an average minimum of 63 and an average maximum of 67.9 degrees F. At night the headhouse temperature ranged from 56 to 74 degrees F., with an average minimum of 63 and an average maximum of 67.9 degrees F.

BLUE-GRASS SEED TESTS.

JANUARY 21 TO FEBRUARY 18, 1910.

TREATMENT.	Germ. % 3 days	% 6 days	% 12 days	% 18 days	% 28 days	% average of 3 tests
1. Kept in hothouse in light during day, in headhouse at night.	0	25.5	41.5	45.5	48.5	
1. Kept in hothouse in light during day, in headhouse at night.	0	25.	42.5	48.	50.	
1. Kept in hothouse in light during day, in headhouse at night.	0	28.5	43.5	48.	51.	49.83
2. Kept in hothouse in dark during day, in headhouse at night.	0	7.	9.5	19.	40.5	
2. Kept in hothouse in dark during day, in headhouse at night.	0	6.	9.5	15.	32.	
2. Kept in hothouse in dark during day, in headhouse at night.	0	6.5	10.	16.5	47.	39.83
3. Kept day and night in headhouse in light.	0	11.5	17.5	19.	19.5	
3. Kept day and night in headhouse in light.	0	8.	14.5	16.5	17.	
3. Kept day and night in headhouse in light.	0	6.5	14.5	16.	16.	17.5
4. Kept day and night in headhouse in dark.	0	3.	3.5	3.5	3.5	
4. Kept day and night in headhouse in dark.	0	4.	4.5	4.5	4.5	
4. Kept day and night in headhouse in dark.	0	2.5	2.5	2.5	2.5	3.5
5. Kept day and night in hothouse in light.	0	27.5	50.5	53.5	56.	
5. Kept day and night in hothouse in light.	0	24.	44.	46.5	54.	
5. Kept day and night in hothouse in light.	0	25.	48.5	51.	61.5	57.17

RED-TOP SEED TESTS.

JANUARY 21 TO JANUARY 28, 1910.

TREATMENT.	% 3 days	% 6 days	% 8 days	% average of three tests
1. Kept in hothouse in light during day, in headhouse at night.	82.	97.	99.	
1. Kept in hothouse in light during day, in headhouse at night.	76.5	95.	95.5	
1. Kept in hothouse in light during day, in headhouse at night.	75.	95.5	96.5	97.
2. Kept in hothouse in dark during day, in headhouse at night.	41.5	52.	53.	
2. Kept in hothouse in dark during day, in headhouse at night.	41.5	50.5	51.	
2. Kept in hothouse in dark during day, in headhouse at night.	44.	53.	53.	52.33
3. Kept day and night in headhouse in light.	43.	48.5	48.5	
3. Kept day and night in headhouse in light.	43.	51.5	53.	
3. Kept day and night in headhouse in light.	41.5	50.5	52.	51.17
4. Kept day and night in headhouse in dark.	46.	48.5	48.5	
4. Kept day and night in headhouse in dark.	42.5	45.	45.	
4. Kept day and night in headhouse in dark.	42.5	44.	44.5	46.
5. Kept day and night in hothouse in light.	78.	93.	94.	
5. Kept day and night in hothouse in light.	66.	89.5	92.	
5. Kept day and night in hothouse in light.	72.5	98.	99.	95.

ORCHARD GRASS SEED TESTS.

JANUARY 21 TO FEBRUARY 4 1910.

Treatment.	% 3 days	% 6 days	% 12 days	% 14 days	% average of three tests
1. Kept in hothouse in light during day, in headhouse at night.	20.	70.	74.	75.	
1. Kept in hothouse in light during day, in headhouse at night.	22.5	69.5	75.	75.5	
1. Kept in hothouse in light during day, in headhouse at night	20.	67.5	72.5	72.5	74.33
2. Kept in hothouse in dark during day, in headhouse at night.	23.5	54.5	70.5	71.5	
2. Kept in hothouse in dark during day, in headhouse at night.	23.5	59.	73.5	75.	
2. Kept in hothouse in dark during day, in headhouse at night.	16.	64.	78.5	82.	76.17
3. Kept day and night in headhouse in light.	10.5	48.5	56.	56.	
3. Kept day and night in headhouse in light.	12.5	47.	53.	53.5	
3. Kept day and night in headhouse in light.	16.	54.	60.5	62.	57.17
4. Kept day and night in headhouse in dark.	18.	33.	44.5	44.5	
4. Kept day and night in headhouse in dark.	20.	36.5	45.	46.	
4. Kept day and night in headhouse in dark.	15.5	34.5	43.5	43.5	44.67
5. Kept day and night in hothouse in light.	18.	68.	76.	76.5	
5. Kept day and night in hothouse in light.	17.5	66.	72.	72.	
5. Kept day and night in hothouse in light.	20.	77.	83.	83.	77.17

TIMOTHY SEED TESTS.

JANUARY 21 TO JANUARY 28, 1910.

Treatment.	% 3 days	% 6 days	% 8 days	% average of three tests
1. Kept in hothouse in light during day, in headhouse at night.	70.	93.	94.	
1. Kept in hothouse in light during day, in headhouse at night.	68.	91.5	92.5	
1. Kept in hothouse in light during day, in headhouse at night.	60.	91.	92.5	93.
2. Kept in hothouse in dark during day, in headhouse at night.	62.5	93.	93.5	
2. Kept in hothouse in dark during day, in headhouse at night.	60.	89.5	91.5	
2 Kept in hothouse in dark during day, in headhouse at night.	68.	87.	88.	91.
3. Kept day and night in headhouse in light.	81.	92.5	93.5	
3. Kept day and night in headhouse in light.	74.	94.	95.5	
3. Kept day and night in headhouse in light.	78.	92.	92.5	93.83
4. Kept day and night in headhouse in dark.	76.5	86.	87.	
4. Kept day and night in headhouse in dark.	78.	89.5	89.5	
4. Kept day and night in headhouse in dark.	77.5	87.5	89.5	88.67
5. Kept day and night in hothouse in light.	72.	86.	88.	
5. Kept day and night in hothouse in light.	80.	91.	91.	
5. Kept day and night in hothouse in light.	73.	90.	91.	90.

ALFALFA SEED TESTS.

JANUARY 21 TO JANUARY 26, 1910.

TREATMENT.	% 3 days	% 6 days	% average of 3 tests
1. Kept in hothouse in light during day, in headhouse at night.	85.	92.	
1. Kept in hothouse in light during day, in headhouse at night.	91.5	95.	
1. Kept in hothouse in light during day, in headhouse at night.	91.	94.5	93.83
2. Kept in hothouse in dark during day, in headhouse at night.	86.5	92.	
2. Kept in hothouse in dark during day, in headhouse at night.	88.	93.5	
2. Kept in hothouse in dark during day, in headhouse at night.	89.5	92.5	92.66
3. Kept day and night in headhouse in light.	89.5	94.5	
3. Kept day and night in headhouse in light.	90.5	95.	
3. Kept day and night in headhouse in light.	89.	94.	94.5
4. Kept day and night in headhouse in dark.	85.5	90.5	
4. Kept day and night in headhouse in dark.	88.	92.	
4. Kept day and night in headhouse in dark.	91.	95.5	92.66
5. Kept day and night in hothouse in light.	88.5	93.5	
5. Kept day and night in hothouse in light.	90.5	95.	
5. Kept day and night in hothouse in light.	87.5	94.	94.17

RED CLOVER SEED TESTS.

JANUARY 21 TO JANUARY 26. 1910.

Treatment.	% 3 days	% 6 days	% average of 3 tests
1. Kept in hothouse in light during day, in headhouse at night.	83.5	92.	
1. Kept in hothouse in light during day, in headhouse at night.	80.	92.	
1. Kept in hothouse in light during day, in headhouse at night.	74.	91.5	91.83
2. Kept in hothouse in dark during day, in headhouse at night.	89.5	94.5	
2. Kept in hothouse in dark during day, in headhouse at night.	90.5	95.	
2. Kept in hothouse in dark during day, in headhouse at night.	91.	94.5	94.66
3. Kept day and night in headhouse in light.	86.5	92.5	
3. Kept day and night in headhouse in light.	89.5	95.	
3. Kept day and night in headhouse in light.	87.	90.	92.5
4. Kept day and night in headhouse in dark.	86.5	91.5	
4. Kept day and night in headhouse in dark.	85.5	90.5	
4. Kept day and night in headhouse in dark.	88.5	92.	91.33
5. Kept day and night in hothouse in light.	64.5	90.	
5. Kept day and night in hothouse in light.	80.	88.	
5. Kept day and night in hothouse in light.	74.5	92.5	90.17

ALSIKE CLOVER SEED TESTS.

JANUARY 21 TO JANUARY 26, 1910.

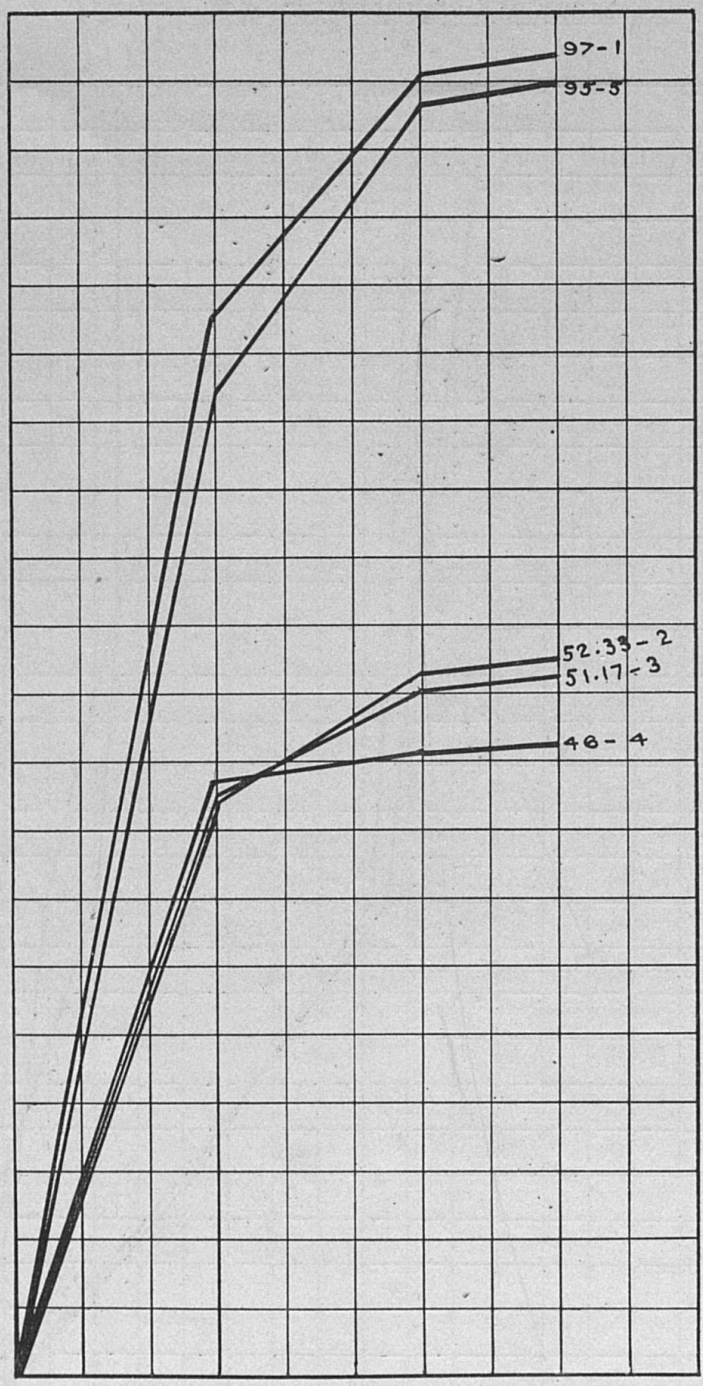
TREATMENT.	% 3 days	% 6 days	% average of 3 tests
1. Kept in hothouse in light during day, in headhouse at night.	65.5	79.5	
1. Kept in hothouse in light during day, in headhouse at night.	54.5	78.	
1. Kept in hothouse in light during day, in headhouse at night.	70.	82.5	80.33
2. Kept in hothouse in dark during day, in headhouse at night.	75.	85.5	
2. Kept in hothouse in dark during day, in headhouse at night.	70.	83.	
2. Kept in hothouse in dark during day, in headhouse at night.	77.	90.5	86.33
3. Kept day and night in headhouse in light.	72.5	84.5	
3. Kept day and night in headhouse in light.	58.5	83.5	
3. Kept day and night in headhouse in light.	72.	86.5	84.83
4. Kept day and night in headhouse in dark.	78.	88.	
4. Kept day and night in headhouse in dark.	77.5	88.	
4. Kept day and night in headhouse in dark.	70.5	83.5	86.5
5. Kept day and night in hothouse in light.	63.	89.	
5. Kept day and night in hothouse in light.	64.	84.5	
5. Kept day and night in hothouse in light.	60.5	81.5	85.

SHOWING THE INFLUENCE OF TEMPERATURE AND LIGHT ON THE GERMINATION OF SEEDS.

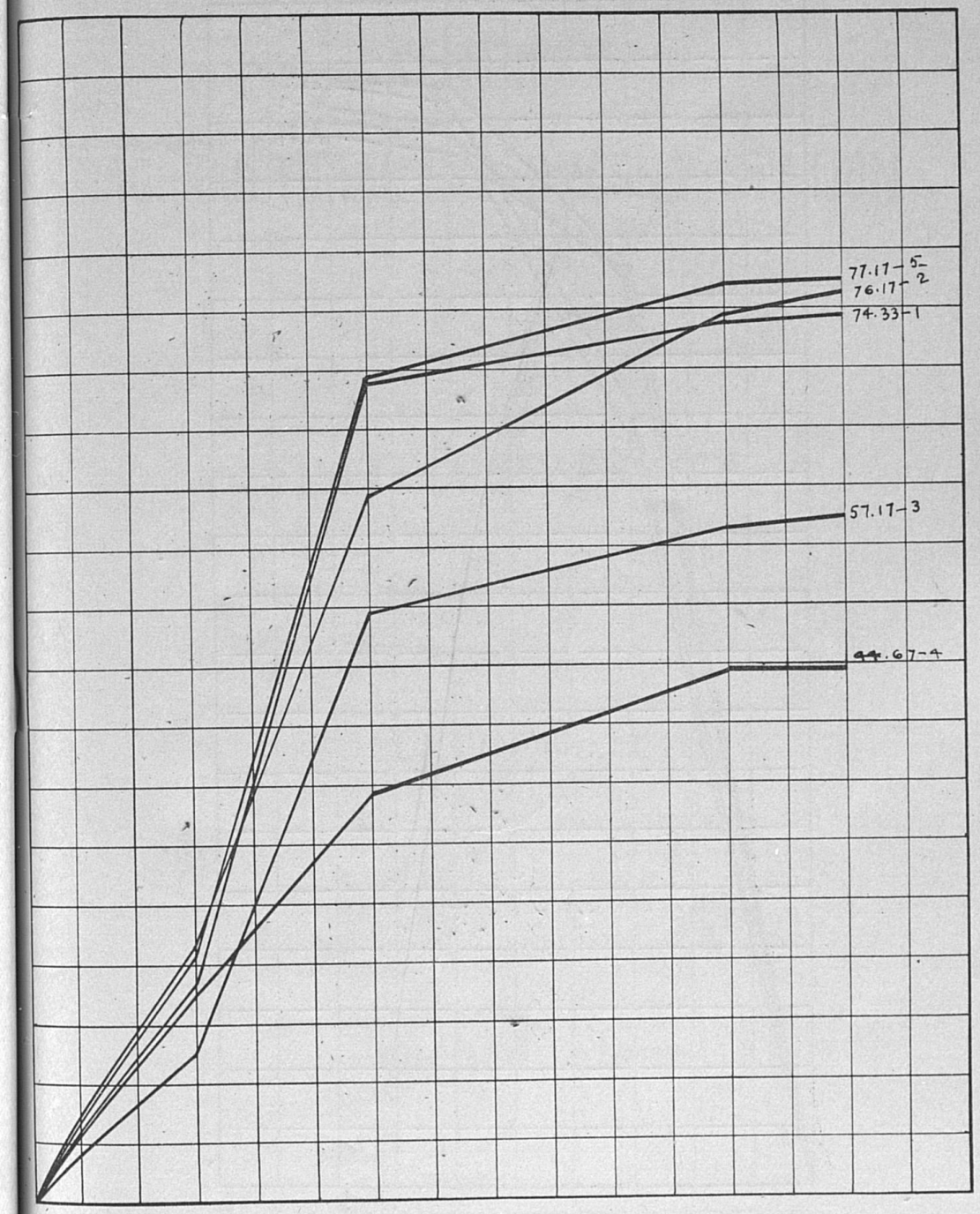
EACH PERCENTAGE IS AN AVERAGE FROM THREE TESTS OF THE SAME SEED.

	1. In hothouse in light during day, in headhouse at night.	2. In hothouse in dark during day, in headhouse at night.	3. In headhouse day and night in light.	4. In head house day and night in dark.	5. In hothouse day and night in light.
Blue-grass	49.83	39.83	17.5	3.5	57.17
Red-top	97.	52.33	51.17	46.	95.
Timothy	93.	91.	93.83	88.67	90.
Orchard Grass	74.33	76.17	57.17	44.67	77.17
Alfalfa	93.83	92.66	94.5	92.66	94.17
Red Clover	91.83	94.66	92.5	91.33	90.17
Alsike Clover	80.33	86.33	84.83	86.5	85.

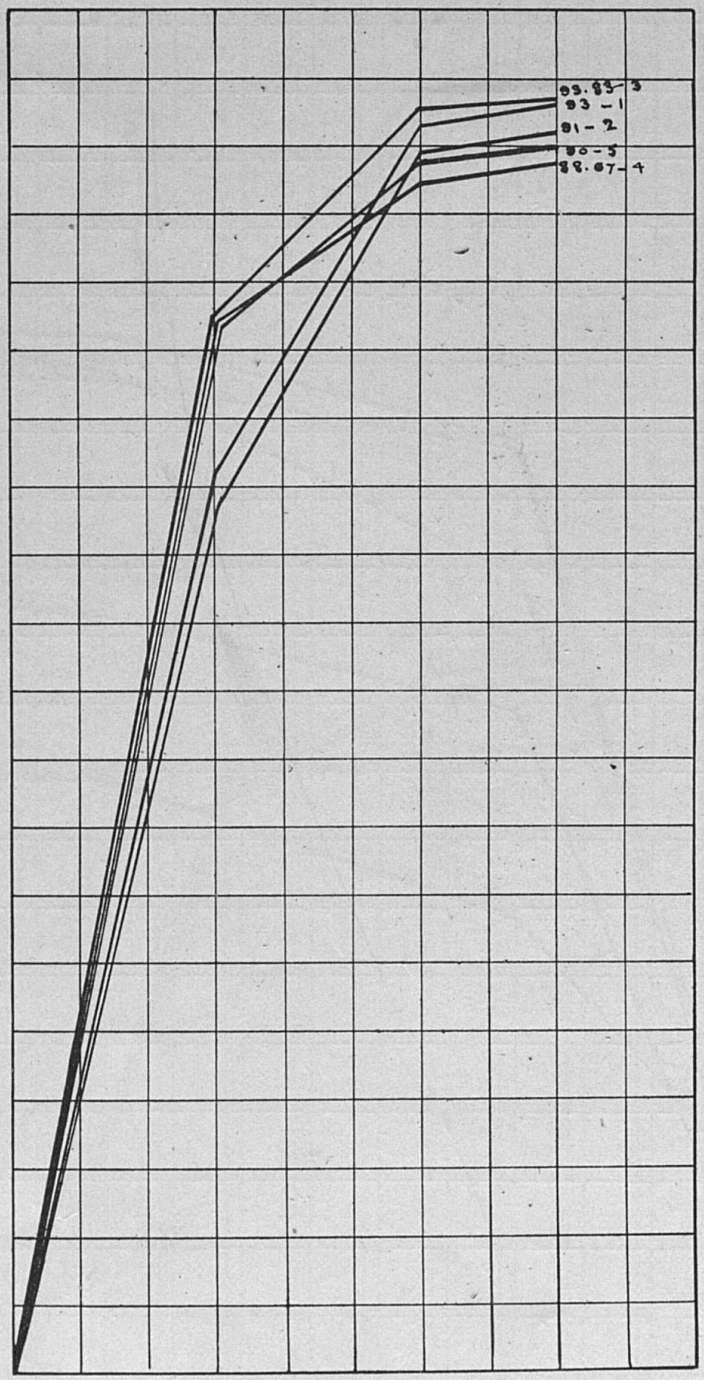
Each angled line represents an average of three tests of blue-grass seeds from the same bulk lot. 1, In hothouse in light by day, in headhouse at night; 2, in hothouse in dark by day, in headhouse at night; 3, day and night in headhouse in light; 4, day and night in headhouse in dark; 5, day and night in hothouse in light.



Each angled line represents an average of three tests of red-top seeds from the same bulk lot. 1, In hothouse in light by day, in headhouse at night; 2, in hothouse in dark by day, in headhouse at night; 3, day and night in headhouse in light; 4, day and night in headhouse in dark; 5, day and night in hothouse in light.



Each angled line represents an average of three tests of orchard grass seeds from the same bulk lot. 1, In hothouse in light by day, in headhouse at night; 2, in hothouse in dark by day, in headhouse at night; 3, day and night in headhouse in light; 4, day and night in headhouse in dark; 5, day and night in hothouse in light.



Showing results of germination tests of timothy seeds. Each angled line represents an average of three tests of seeds from the same bulk lot. 1, Kept in hothouse in light during day, in headhouse at night; 2, kept in hothouse in dark during day, in headhouse at night; 3, kept day and night in headhouse in light; 4, kept day and night in headhouse in dark; 5, kept day and night in hothouse in light.

KENTUCKY
AGRICULTURAL EXPERIMENT STATION

OF THE

STATE UNIVERSITY

BULLETIN No. 149

Bleached Flour

LEXINGTON, KENTUCKY,
Sept. 1, 1910

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KENTUCKY AGRICULTURAL EXPERIMENT STATION,
Lexington, Ky.

BULLETIN No. 149

BLEACHED FLOUR.

By R. M. Allen.

INTRODUCTORY.

This bulletin gives the collaborated views of sixty-five Kentucky millers, and other information concerning the purpose and effect of the bleaching practice in milling and in the trade. The inquiry was made in connection with the bleached flour cases, pending under the State Food and Drugs Act. It was desired to learn the trade's understanding of the "patent," "straight," "clear," and other grades of flour; the difference including color between these grades; the extent to which color influences the market value of the flour; and the observation of the millers as to the purpose and the general effect of bleaching. These opinions were given in reply to a circular sent to the millers.

There are many problems in milling, among them, the drying of damp and aging of new wheat, the color of the grade or brand produced, the aging of the flour after grinding, and its protection from spoilage. Artificial processes were supplied and have been used by the millers, to a greater or less extent, to dry, age and preserve the wheat and flour, and to make the different grades of flour in the wheat berry and from different wheats look like that grade or quality which commands the highest market value.

The artificial bleaching process has been called into question under the food laws because of the fact that it adds a poisonous,

antiseptic ingredient, injures quality, and makes the flour to appear of better grade. Concerning this process a milling firm of high standing and long experience writes: "There can be no honest milling as long as we have bleaching." This view is concurred in by a majority of the millers. The bulletin gives the statements from those who favor, as well as those who oppose the process.

Color.

Among the ways in which consumers are informed as to the quality and character of food are: (a) statements made in the label and by the salesman; and (b) the color, odor, taste and other physical properties, observable in the product itself. Sometimes misstatements are made in the label, together with a manipulation of the product to match; or, the product may be made, through added color, bleaching or otherwise, to appear better than it really is, or be manipulated to conceal damage and inferiority, without making misstatements in the label; yet, the consumer is deceived, although the deception practiced in the product may be absent from the labeling. It is the purpose of the food laws to prevent deception not only in the label but in the product itself.

Color is a chief factor in judging the quality of a particular food and there are, therefore, very few products in which attempt is not made to falsely indicate some genuine quality, much desired by consumers, through the means of added color. The trade, and often the executor of a food law, regards color only as an arbitrary quality, designed to please the eye and without significance, forgetting that the red in fruits, the whiteness in flour, the amber in aged spirits, the yellow in butter and so on have attached themselves to a particular product because that color was first associated with, and taken thereafter to be indicative of, a desired quality, process or product, or of a certain degree of excellence and superiority.

Color in Flour.

Color is the first quality looked for in buying flour for the

reason that the color is understood to be indicative of the quality and grade, and of the age of maturity of the flour. The miller of a particular brand of flour watches closely the output of his competitor; obtains frequent samples for comparison; and strives always to make his own brand whiter. There are other tests, such as the doughing, to determine the strength of the gluten, and the baking test, employed by most of the larger millers and buyers, but the color must accompany.

On this point, Mr. A. L. Goetzmann, Secretary of the Millers' National Federation, stated, in the public hearing on bleached flour, before the Secretary of Agriculture and Board of Food and Drug Inspection, in Washington, November 18, 1908:

"Without question the first quality of a given flour looked into by a buyer abroad or at home is its color. This by no means is the sole determining factor, but it may be said truthfully that if two flours of equal strength, made from the same quality of wheat, milled equally well, that which is the better color is always given the preference."

The owners of the bleaching patent and some of its users urge this apparent arbitrariness on the part of the consumer, in the matter of color, as a justification of a process to produce the whiter color in the flour. It must be observed, however, that the mere touching up of high grades of flour does not represent the practical side of the bleaching process. And, even were the bleaching only employed for the purpose and to the extent thus claimed, it will be found that the preference of the consumer for the whiter flour, in such instance as described by Mr. Goetzmann, is not arbitrary, but is still based upon an appreciation of and demand for the finer quality, as between high grade brands. And, aside from the color, there still remains the question of an added poisonous substance, and its harmful effect to the flour, even though in less degree.

In the consideration of all such questions the *degree* of the inferiority caused by an added unlike substance, or of harm from an added poisonous substance, or of deception from an added color or bleaching treatment is advanced as an element to be considered in construing the food laws. In order to entertain such assumption, however, it is necessary to draw the line, beyond which the added substance or the process ceases to become harmful or to work an

inferiority or a deception, the impracticability either of determining or maintaining should be apparent to all. In the first place, such a line would necessarily have to be drawn beyond the usefulness of the added substance or process to the manufacturer of a product; for, if the purpose in using the objectionable substance or process is accomplished to the extent of any commercial advantage in the product, then, to just such an extent must it operate to the disadvantage of the consumer. Again, the enforcement of the food laws according to the *degree* of the added objectionable substance or process, must either mean no enforcement at all, or render food products constantly liable to search and seizure, according to the varying opinions of individuals, for approaching the degree considered to be harmful or fraudulent. There would be little benefit to the trade and much trouble, and little or no protection to the consumer, under such an impracticable construction of the food laws.

Coming back to the practical side of the question, there are many reasons for the consumer's demand for whiteness. Dark colored flours are invariably understood to possess poor bread making qualities, because, among other reasons, of the difference between the quality of the gliadin and gluten in the grades of the flour contained in the wheat berry, and in different varieties of wheat. The proportion of digestible protein and available energy in that part of the flour, known as the patent, is claimed to be larger than in the entire wheat or in the Graham flour. Whatever the reasons, however, it is sufficient that consumers have established this preference; and they are, therefore, entitled, under the Food and Drugs Act, to receive flour of the character and quality represented by the color.

There are four main grades of flour, as brought out by this inquiry, the patent, the straight, the clear and the low grades or "red dog."

The "patent" is made from that part of the berry containing the higher per cent of starch and the better quality of gluten and gliadin, and this grade is farthest removed from the undesirable aleuron, on the one side, and the germ, on the other—parts of the wheat berry in which the gluten is in its least desirable form for bread making purposes, and most susceptible to spoiling.

The "clear" is taken from the glutenous part of the berry, and is that part remaining after the patent and low grades have been separated. The straight is the patent and clear combined. The term "straight" is used by some of the mills to indicate the "clear" grade, or rather, much of the so-called "straight" grades of flour have had the "patent" removed. The "patent" is whiter than the "straight," and still whiter than the clear and the low grades and always commands the higher price in the flour markets. There are many private brands of flour, made by combinations of different varieties of wheat and of the different grades of flour in the wheat berry and sold under distinctive brands. But, with respect to such flours, as is the case with flours labeled "patent," "straight," "hard wheat," "winter wheat," and so on, color is the first quality considered. In this connection it should be noted that the Durum wheats produce a more yellow flour and are richer in gluten, and for this reason may be more nutritious; but such flour should be sold in the market on its own merits and not under the guise, by treatment or labeling, that it has been produced from some other variety of wheat.

Both the wheat and the flour undergo a ripening or aging process. This ripening is affected by the length of time the wheat remains in the sheaf and stack before threshing, and by its subsequent treatment in the elevator. Properly aged wheat makes better flour than the new wheat, and the flour itself is whiter and more desirable for baking purposes several months after grinding than when fresh. In addition, therefore, to the importance of color in connection with the grade, it is also an indication of proper aging—another desirable quality.

Flour a Complicated and Delicate Substance.

The wheat berry is so arranged as to protect and feed the sprouting germ. There is, first of all, the outside branny covering, and, next to this, the inside covering called aleuron; corresponding, respectively, to the shell and inside membrane of an egg. Inside these layers are the endosperm or flour proper and the germ. It

is the purpose of milling to separate the bran, aleuron and germ from the endosperm and further separate the endosperm into the different grades and private brands. The outside layers and the germ are not so desirable for bread making, and, besides, render the flour most susceptible to spoilage. In close milling, therefore, not only the color and breadmaking qualities of the flour, but also the keeping qualities must be kept in view.

That part of the endosperm lying next to the aleuron is richer in gluten; and, as this shades toward the middle of the berry, the per cent of starch increases and the digestible and breadmaking quality of the gluten is said to improve.

Flour is a very complex body, and the effect of a process, like that of artificial bleaching, should be shown to be harmless to each of the numerous and delicate substances—the vegetable lecithin, the gliadin, gluten, soluble proteids and other nitrogenous compounds, the enzymes and so on, for example—which go to make up the life and nutriment, before such a process can be pronounced harmless to the flour.

The Purpose and Effect of the Bleaching Process.

The Alsop bleaching process, described elsewhere in this bulletin, was recommended by its salesmen and has been used by the millers, to make all the grades of flour whiter, and to make the straight and clear grades as white or whiter than the unbleached patent. This process produces in a few minutes an effect resembling that of flour which has been milled from old wheat and stored after milling for a period of several months; and it does this, not by developing and ripening the elements of the flour, as does the natural aging, but by arresting the further development, either way, of the delicate qualities which go to make up the life of the flour, and thus to a certain extent, destroying them. By arresting this life the flour is also preserved against spoilage. When the bleachers were first introduced into the mills, there was neither no law against them nor any objection to their use; and the millers were not only induced, by means of the apparent results which the bleacher pro-

duced, but, later, compelled to install the new process. Then began a competition, with a poisonous bleaching gas, to make the brands of flour produced by one mill whiter than the brands produced from the mill of the competitor.

Investigations Under the Food Laws.

With the introduction of the bleaching process it became necessary under the State food laws, and later under the Federal law, to inquire into the effect of the process upon the flour and its general purpose. Professor E. F. Ladd, Food Commissioner and Chemist of North Dakota, Dr. A. L. Winton, formerly of Connecticut, now chief of the Federal Food and Drug Laboratory at Chicago, Dr. A. S. Mitchell, formerly State Chemist of Wisconsin, and now chief of the Federal Food and Drug Laboratory at St. Paul, and Professor James H. Shepard of the South Dakota Experiment Station, were among the authorities who early investigated the purpose of the bleaching and the effect upon flour and bread and reported against the practice. Litigation resulted under the food laws of North Dakota, with a decision against the bleaching process. Following this, the subject was considered by the Secretary of Agriculture and the Federal Board of Food and Drug Inspection, and held to be an adulteration prohibited under the Federal Foods and Drugs Act. Cases under the Federal Foods and Drugs Act and based upon this finding are now in process of litigation. The decision by Judge Foster of the United States District Court at New Orleans, March 15, 1910, based upon strong testimony, although ex parte, and the instructions of Judge McPherson and verdict after a full and prolonged hearing in the United States District Court at Kansas City, July 6, 1910, against the Alsop bleaching process are given elsewhere.

Judge McPherson's able instructions refer, among other questions, to the meaning of the food law with respect to "added poisonous or other added deleterious ingredient." He says on this point: (Words in black by the court).

"It will be noted that the act does not say, 'any added poison,' but does

say 'any added poisonous ingredient.' The word 'poisonous' as an adjective conveys a descriptive meaning and is used in a qualitative sense, and not in a quantitative sense. That is, it refers to the kind of substance, and not to the quantity of the substance. This idea or meaning is further emphasized and rendered more certain by the qualifying clause, 'which may render such article injurious to health.' It does not say 'which does render such article injurious to health,' but manifestly it was the purpose of Congress to include in this distinction all ingredients of a poisonous character to which in their essential nature, might be ascribed the tendency to affect health injuriously.

This statute is essentially a remedial one, for the correction of known or supposed abuses with respect to the adulteration of food and other articles of human consumption. It is primarily a statute of prevention. Its meaning is made clear when its purpose is known and borne in mind.

It is not conceivable that the Congress of the United States, when it passed this act, intended that producers and vendors might continue to add poisonous and other injurious substances to food so long as the quantity added was not sufficient to produce observable poisonous or injurious effects upon the health of consumers, nor is it conceivable that Congress intended to require that the Government before proceeding to condemnation of an article of food as adulterated must prove that it contains added poisonous or other added deleterious ingredient in such a quantity as would render such article injurious to health. It is known to everyone that there is no method of ascertaining or measuring the effect of the consumption of such substance in food upon the public health or upon the health of any particular individual.

It is clear that it was intended by Congress to prohibit the adding to food of any quantity of the prohibited substances.

The fact that poisonous substances are to be found in the bodies of human beings, in the air, in potable water, and in articles of food, such as ham, bacon, fruits, certain vegetables, and other articles, does not justify the adding of the same or other poisonous substances to articles of food, such as flour, because the statute condemns the adding of poisonous substances. Therefore the court charges you that the government need not prove that this flour or food stuffs made by the use of it would injure the health of any consumer. It is the character—not the quantity—of the added substance, if any, which is to determine this case."

This holding rings true. It is, with the whole of the instructions, one of the most comprehensive statements concerning the meaning and purpose of the food laws ever made. It upsets that executive construction of the Federal Foods and Drugs Act, permitting the use in foods of such antiseptics as benzoate of soda. It points out the mistake of trying to settle this question in a scientific search for that amount of a poisonous ingredient which, when used in foods, may not

affect health, the determination of which involves in an immaterial and hopeless scientific controversy.

Dr. Alfred Stengel, practitioner and Professor of Chemical Medicine in the University of Pennsylvania, well puts this point in his testimony in the New Orleans bleached flour case:

"I would define a poison as a substance which, if taken into the body, is capable, through its direct action, of exercising deleterious influences. The fact that such substances may be ingested in the body in such minute quantities as not to cause appreciable discoverable effects does not remove such substance from the class of poisons, in my opinion, since it merely indicates that human ingenuity has not yet devised a way of seeing the immediate effects. As an illustration of my opinion upon this subject, I would cite the poison known as tetanus-toxin. It is my opinion that no matter how much a solution of tetanus-toxin may be diluted, and no matter how small a volume may be ingested into the system, the ingestion of such substances will have a deleterious effect upon the system, even though the detection of such effect may be beyond human ingenuity."

Patent litigation has brought out considerable information concerning the purposes and effects of the bleaching processes. The English case of the Flour Oxidizing Company, Ltd., vs. J. & R. Hutchinson, before Mr. Justice Warrington in the Chancery Division of the High Court of Justice, is a very good example of such class of litigation. In such cases the defendants have generally urged the various points brought up under the pure food laws, but the decisions of the courts, especially that of Mr. Justice Warrington, are based upon the claims made in the patent of the plaintiff, under the patent laws, and not under the pure food laws.

It has been brought out in the investigations under the pure food laws that the majority of the bakers, not only of this, but of other countries, are opposed to the bleaching process because of the effect upon the flour.

The writer knows from personal interview that a number of the chief flour inspectors for boards of exchange in the larger cities—such inspectors having a long and extended experience in the grading of flour—are opposed to the process, because of certain deleterious physical effects noticed upon the flour, and because of the fraud which the process works. During an interview with an extensive manu-

facturer of starch and gluten flour in New York City, the writer was informed by the head of the firm that bleached flours could not be used by that firm because of the deleterious effect upon the gluten; and this manufacturer stated further that this objection was based upon an experience with bleached flour in his plant.

Action Taken Under the Kentucky Law.

The Director of the Kentucky Station issued a regulation against the bleaching of flour in June, 1909. Since that date, a very thorough inspection has been made of all the flours sold in Kentucky; and, as a result of this inspection, cases have been reported for criminal prosecution to the State courts. The facts with respect to a number of the interstate shipments were reported to the United States Attorney for the Eastern District of Kentucky, under Section 5 of the Federal Foods and Drugs Act, which Section provides for such action on the part of the State officials.

The prosecutions begun in the State Courts, the seizure of interstate shipments of bleached flour, at the request of this office, by libel from the United States Court for the Eastern District of Kentucky, and the notice to offending millers that the trade would be given a general warning with respect to each brand of flour found to be bleached, have about stopped the shipment into and the manufacture and sale of bleached flour within Kentucky.

The bleaching of flour is unquestionably a fraud, whatever the grade bleached. It is not disputed that the process adds a small amount of a poisonous ingredient to the flour, and which added substance is not eliminated by the baking process. It is claimed by undoubted authority that the bleaching injures various qualities of the flour and the bread baked from the bleached flour. It is admitted by all that the nitrous acid gas acts as a preservative; and, even, therefore, if the process were not fraudulent, or objectionable from the standpoint of injury to health, the law would require the facts as to this preservative to be made known in the label. The present action on the part of the State seeks, as it should, to prohibit the practice altogether.

Investigations being made in this division by Professor La Bach

and Dr. Healy concerning the effect of the bleaching process on the flour will be published when completed in a separate bulletin.

Mr. J. W. McFarlin, one of the field agents of this Division, has made extended observations with respect to the bleaching process throughout the Kentucky mills. He was the first member of the Division to call attention to the objectionable features of the bleaching practice, and the facts which led to his conclusions, will be given in his testimony during the trial of the bleached flour cases, now pending in the State courts and published in the 1910 reports.

This bulletin is published in order to fully advise the trade that the facts are being reported to the courts, in each and every instance where the manufacture or sale of bleached flour is discovered.

OPINIONS OF MILLERS AGAINST BLEACHING AND AS TO THE MILL AND TRADE MEANING OF THE TERMS "PATENT," "STRAIGHT" AND "CLEAR."

B. Squires, Star Roller Mills, Cloverport:

"Patent" flour means the white of the grain, or a very little of the germ, and includes about 60 per cent of the flour from a given batch of wheat.

"Straight" flour means the first and second grades run together.

"Clear" is the second grade and includes about 35 per cent of the flour, leaving 5 per cent, known as low grade. There is a decided difference in color and otherwise between the patent and the clear.

A bleacher is not used because we do not use anything but good grain. Agents in attempting to sell this mill a bleacher represented that the bleaching would enable the miller to make approximately 100 per cent patent. The bleaching practice is for the purpose of making patent flour out of inferior wheat and low grade flour, that otherwise could not be used except at a discount.

Color is a factor in the flour market to such an extent that some people will buy by color alone regardless of other qualities.

When the bleachers were in use I frequently had calls for all my low-grade flour and damaged wheat. But since they have gone out of use I have not had a single call. Now if the bleaching process should be installed in all of the mills to make patent flour out of inferior grain and low grade flour, it is still an imposition on the public and ought not to be allowed.

W. N. Neville, Island Mills, Arlington:

"Straight" flour is 98 per cent of the whole flour. The "patent" is about 75 per cent, and the "clear" constitutes about 24 per cent of the flour from a a given batch of wheat.

Agent claimed in trying to sell a bleacher that the process would produce 100 per cent patent.

If the wheat is right the flour will be right in color as well as quality.

I do not think that flour ought to be bleached. Let every mill use good wheat and let each grade stand upon its own merits.

If flour is all right, the color will be all right; but if the flour is not good, bleaching will not make it good.

Dawson Milling Company, Dawson Springs:

"Patent" flour is the best and whitest flour in the wheat. "Clear" flour is a grade just a little darker, and there is considerable difference between these grades.

We make 90 per cent patent and the rest is straight or clear flour.

We think that bleaching injures the quality of the flour; that is, after baking it becomes hard and dry.

The agents for the bleaching process claim that it makes a whiter flour and that we can use our lower grades of flour with it.

Bread made from bleached flour becomes hard and dry after baking and has a gray color. We believe that the bleaching kills the flavor and makes a lifeless bread.

William Ogdon, Milford:

Is of the opinion that bleaching process not only whitens the flour, but takes the life out of it. Has not operated a bleacher.

College Milling Company, Franklin:

"Patent" flour is the best the mill produces. "Straight" flour is a grade below the patent; and "clear" is a grade next below the straight.

The bleaching process is not wholesome and deceives the buyer. The agents for bleaching process represent that it will enable a mill to make the output all patent.

The bleaching makes the low grades look like a fine patent flour; and the main purpose of the process is to increase sales and to secure a good price for poor flour.

Color is the governing item in the sales to retailers. Some buyers feel the flour, taste it and bake it. Baking is the true test.

Ballard & Ballard, Louisville:

"Patent" is a flour made from purified middlings, and is the best flour that can be made by the mill; and it is all flour of one quality that can be made from a given amount of wheat.

"Straight" is all of the flour which can be made from a given amount of wheat, excluding about 10 per cent of a low grade.

"Clear" is that part not good enough to be grouped as a patent and too good for a low grade.

The patent is whiter and makes a better loaf of bread or biscuit than the straight. The difference between the patent and clear is more marked.

Puts 50 per cent into patent, 40 into clear, 10 per cent into low grade. The straight being a combination of patent and clear, about 90 per cent.

The bleaching process would permit the straight to be sold as a patent in most markets, and enables the miller to sell a greater per cent of his flour as a patent. Where color is the criterion, which is the case especially in the South, bleaching increases the market value of the flour.

We are opposed to the bleaching of flour, because, aside from the chemistry question of whether or not it is deleterious to the health of the human being, bleaching not only permits of, but invites fraud and deception in the manipulation of the different grades. **There can be no honest milling as long as we have bleaching.** Finally, we do not consider bleaching a legitimate part of milling.

L. Brewer, Brewer's Mill, Mayfield:

"Patent" flour is the white or starchy part of the wheat, separated from the remainder.

The "straight" or "bakers'" is generally the second grade, not quite so white, but is richer in albumen and sugar.

I divide my flour in the proportion of about 50 per cent patent, 40 per cent straight or bakers', and 10 per cent middlings or low grade.

The manufacturers of bleaching machines claim that the bleaching process whitens and ages the flour, and thereby makes a better bread.

I have tried bleaching. It is a humbug. It changes the color of the flour from a rich, creamy tinge to a bone white, but does not cook up any whiter; adds nothing to quality, and tends to weaken the flour. Strength and purity are the true tests of flour; and flour made pure and white in a natural way, by taking all the impurities out of the wheat by proper milling, is a better flour than flour that has come in contact with the poisonous bleaching gas.

The people don't want it. The small millers don't want it, and only the manufacturers of bleaching machines and the big millers want it. The big miller wants it because it gives him a chance to sell a second grade flour for a patent, and an advantage over his smaller competitor. Like the blending of corn flour with wheat flour, it tends to demoralize the milling business. Cut it out.

A. R. Burks Mill Company, Loretto:

"Patent" flour comes from the best part of the grain of wheat. "Straight" flour is next best. "Clear," next.

By the use of a slick you can see quite a difference in color between the patent and the clear, and more when it is cooked.

We put 30 per cent of the flour into patent, 60 per cent into the straight and 10 per cent into the clear.

The agents for the bleaching process claim that it will enable a miller to put all grades into the patent. Color is regarded by the trade, and bleaching is for the purpose of producing a whiter color.

Believing there was more or less poison in the process of bleaching flour, we held off putting in a bleacher for that cause.

C. H. Aubrey, Stithton:

"Patent" is the best flour made. "Straight" is all of the flour in the wheat run together. The patent is whiter than the straight. Puts 60 per cent of the flour into the patent, 30 per cent into the clear and 10 per cent into the low grade.

The bleaching process will enable one to make a straight that will sell for a patent.

A. L. Lamb, Red Cross Milling Company, Clay:

Almost all consider "patent" to be a per cent of the white part of the grain. This mill puts 60 per cent of the flour into the patent, 35 per cent into the clear and 5 per cent into the low grade.

Straight flour should be made from all the flour ground out of the wheat, except the low grades. I have been milling since 1874 and have seen many improvements; but I have doubted the bleaching process being a real help to consumers. If we will clean the wheat properly, and grind it so as not to kill the flour, the bread will be good. Poorly cleaned wheat will not make a bread that will give satisfaction, *although the bleaching may have hid a part of the poor work done*. One man using a bleacher remarked to me that he was putting 90 per cent of his flour in his patent sack since using the bleacher. The only one deriving any benefit from the bleacher is the manufacturer of the machine—a costly luxury for the miller and flour consumer.

Joseph W. Williams, Ewing:

"Patent" is a high grade flour; "straight," a medium grade. Patent is much whiter, also much more starchy. This mill puts 50 per cent into the patent, 40 per cent into the straight or clear, and 10 per cent into the low grade.

The agents of the bleaching process claim that it will make an increase of 25 per cent in patent.

M. A. Grace & Co., Peoples Roller Mills, Georgetown:

"Patent" flour is 60 per cent of the best flour in wheat; "straight" is 100 per cent, and "clear," 40 per cent of the flour in wheat. The patent is a small

per cent whiter than the straight. The patent is whiter and rises better than the clear.

The agents for the bleaching process represent that it will whiten the flour and make very nearly all of the output into patent. The purpose of the bleaching is to make more patent; also to use inferior wheat and make good flour, *and to get more money for the low grade*.

It would be better not to bleach flour. It takes the wheat taste out of the flour. The bleaching whitens and makes good bread, but it is not as sweet as when made from straight grade flour. I think that it would be better to put the bleacher out of existence, for our Kentucky mills especially. The people of this day and time are always ready to use some cheap article so as to get business. It does not make any difference to them if the process is not healthy, so long as they are doing business and making a profit.

Chas. A. McGowan, Uniontown Roller Mill Company, Uniontown:

"Patent" flour is the low grade and clear flour taken out; say, 10 per cent low grade and 25 per cent clear. "Straight" flour is the whole run together. "Clear" flour is the elimination of the low grade. The patent is much whiter. The wheat milled regulates the amount of flour put in the different grades more than anything else. To make patent, however, the low grade and the clear should be eliminated from the whole stock.

The agents of the bleachers try to convince the users of the process that they can make the whole stock into "patent." Our opinion from the experience that we have had in coming into competition with bleached flour is that the main and sole purpose is to get the whole stock off as patent flour; and the users of bleachers can increase their profits on a cheaper article and still fool the public. A really white flour in a dry state attracts the buyer and causes him to think it superior to the natural color. Our own trade judges the flour by the baking qualities.

Our opinion as to the bleaching process is that it is a fraud.

J. P. Compton, Philpot Mill, Philpot:

"Patent" flour is about 80 per cent of the whole stock, good and white. "Straight" flour is about 98 per cent of the whole stock and not so white.

The agents of the bleaching process state that it will whiten all grades.

Geo. T. Thompson, Crown Mills, Warsaw:

In Southern States "patent" flour is the whitest flour. "Straight" flour is supposed to be a blend of clear and patent. "Clear" flour is the grade taken off in making patent. The patent takes from 65 per cent to 85 per cent of the whole stock; the straight, 98 per cent.

I do not use a bleacher, never did, and perhaps never will, because I regard it as a substitute for poor milling. The agents of the bleaching process claim that it will enable the miller to sell the "clear" as a "patent" flour.

Color affects the market value of flour from ten cents to one dollar per barrel. My opinion is: There is nothing you can add to the natural winter wheat that will increase its flour value, produced in a natural way, by correct milling.

On the practical side of milling for forty years. Am still young.

C. Morrison, Glasgow Milling Company, Glasgow:

"Patent" flour is the best flour, made from the best grades of middlings and obtained from certain separations and purifications of certain stock and certain portions of break flour. "Straight" flour is the whole stock, or practically so. "Clear" flour is the second grade made from the remaining stock after the patent. The patent is whiter than the straight, and of purer quality, being made from first grade stock. This mill puts about 75 per cent of the stock in the patent, and about 25 per cent in the clear, or what is termed straight grade, not straight flour.

We would be glad to use the bleacher, because our trade wants it and prefers the white flour. When we did use the bleacher we used the same per cent we make now, but could tone up the color nicely by bleaching. One of the arguments used by the agent for the bleacher was that we could make a greater per cent of patent flour, or rather that we could run more to the patent grade. Most of our trade would pay more for the bleached flour because it is whiter, or would always take the bleached flour at the same money. The trade clamors for white flour.

As to our opinion: We do not think that the Alsop process does any harm to the flour. Neither do we think it adds anything to the quality as regards taste and lightness or raising qualities, when wheat is perfectly dry. We are inclined to the opinion that when wheat is slightly damp the bleaching process is some advantage, as it possibly has a tendency to dry or drive out the dampness from the flour to some extent. We are also of the opinion that use and practice of bleaching have enabled some millers to put straight flour on the market as patent flour, because it could be made white enough to sell as patent, especially since the ruling against the bleaching process; and some mills have quit the use of the bleacher. * * * We think, in all probability, that we are having to compete with bleached flour on our market now shipped from other places, judging from the prices at which it is sold.

A. K. Hawkins, Thompson Roller Mills, Georgetown:

"Patent" flour is the best grade we make. "Straight" flour, the best wheat will make. The patent has the richest color. This mill puts 20 per cent into

the patent, 75 per cent into the clear, 95 per cent into the straight and 5 per cent into the low.

Marion Milling Company, Marion:

"Patent" flour is the best grade, granular flour, and should contain only the granular flour. The "straight" is the granular and soft stock run together. The patent is a shade or two whiter. "Clear" designates the soft stock only. This mill puts 65 per cent of the stock into patent, and 98 per cent into the straight. The clear comprises from 30 per cent to 35 per cent of the whole flour.

A bleacher is not used, because we believe it to be a fraud. The agents of the bleaching process claimed that it would transform the straight, or 58 per cent of the flour, into a patent flour. The bleacher changes the flour at once from the natural yellow to a chalky white. The bleacher enables the manufacturer to sell his patent lower, from the fact that he sells the greater part of his clear as patent. A mill without a bleacher, unless favorably located, is just simply put out of business. If the practice of bleaching continues our mills will be compelled to install them or go out of business.

J. E. Staff, Corydon Milling Company, Corydon:

Has used a bleacher, which increased the per cent of patent. The agents of the bleacher claimed that you can use off grades of wheat; make more and better patent; and that the flour so bleached is not so liable to get bugs and weevils in it. The bleacher takes away the yellow tint and gives the flour a bluish color.

For my part, I hope that the bleacher will never come back any more. But are we not having bleached flour in our State today? We think that if they are shipping bleached flour into our State, that we should be allowed to operate our bleacher, in self protection.

V. A. Brock, Sparta Roller Mills, Sparta:

"Patent" flour is the very best in the wheat. "Clear" flour is a term some use for straight. The quality of wheat determines to some extent the amount put in these different grades.

The agents of the bleaching process claim that it ages the flour and makes it whiter than fresh ground flour.

I have handled considerable bleached flour, and I find that it does not make as good sponge.

The bleacher evidently enables the miller to sell an inferior article as the genuine, and to sell more or less straight flour as patent.

R. L. Callahan, President, Callahan & Sons, Louisville:

As you probably understand, we are not in the strict sense of the term manufacturers of flour. We buy all of our flour from mills over the country and we handle it here and we pack it, so that while we in a sense would be classed as manufacturers, we are not the actual producers of the flour from the raw material.

Our knowledge of bleaching, then, is not of the same complete nature as would be that of a miller. We can only attempt to give you in a general way such information as we have on this subject. We, therefore, answer your questions as follows:

"Patent" flour, according to your view of the case, is what we would term the cream of the wheat, that is, the best portion of the berry, leaving out the straight flour and leaving out the clear flour.

The difference in color between the patent flour of any grade of wheat and the straight is that the patent flour properly manufactured is much clearer in color, and should not contain any evidence of specks or streaks. The coloring should be uniform throughout, whereas, the straight flour is much darker in hue.

There is a much greater difference between the coloration of patent flour and clear flour than there is between patent and straight flour. Clear flour, as ordinarily used, is really a low grade, and the color is very much darker than would be a patent.

We do not now, nor have we ever, operated a bleacher since the bleaching process first came into use.

We took the position at the outset that we did not want any bleached flour, and that we would never handle any bleached flour as long as it was possible for us to obtain flour that had not been so treated. Our reason was that based on baking and such information as we could get in our own observation, the bleaching of flour did not offer any advantage to the consumer.

The only advantage in the use of a bleacher is to the manufacturer of the flour from a monetary standpoint. It enables him to make a much larger percentage of so-called patent flour from the wheat than he otherwise could, and this is accomplished by putting the straight and the clear flour, and, in some cases, lower grades of flour, into the patent, and so changing its appearance by the bleaching process that to all intents and purposes, so far as appearance goes, such a mixture could not be discovered. It would be useless to argue that this was any benefit to the patent flour or to the consumer.

As long as only a few mills had bleachers there was a distinct advantage to those mills; but as soon as the bleaching of flour became general, and all millers put on the same basis, I do not believe that there was any longer any advantage whatever in the bleaching process except to the manufacturers of the outfit, who evidently reaped a very rich harvest.

During the time when all of the mills were bleaching flour, the low grades of flour which have been offered to us for years, practically disappeared from the market. It was just about coincident with the extensive use of bleachers, and also coincident with the enforcement of the law against bleaching, that these same low grades of flour made their reappearance on the market. It would be a waste of time for me to draw for you our conclusions from these facts just stated. No miller would argue that a low grade of flour was as good as a patent flour. The purpose, therefore, is to so change its appearance that its appearance would be practically that of a patent flour, and it could, therefore, be more effectually hidden.

Charles E. Bates, Bates Brothers, Bagdad:

"Patent" flour is that portion of the mill's run of flour made from the middlings, the choicest streams of flour.

"Straight" flour is the whole run of the mill.

"Clear" flour is the complement of patent and low grades.

Patent is more creamy in dust and more white in dough. There is a difference in the stage at which the patent and clear are produced, difference in cleanliness as regards specks, crease dirt, etc.; the most noteworthy difference, perhaps, is in color and degree of stickness; in all, the patent excelling in desirable qualities. This mill divides the stock in about half and half, patent and clear, according to the character of the wheat.

This mill operated a bleacher. The increase of patent by reason of the bleacher was apparently possible only so long as the competitor had no bleacher, the basis of division being color. *Only the millers' art and the farmers' art can increase patent.* After one year of strenuous effort to sell unbleached flour against the bleached product of our competitors, we were "driven in." We bought a bleacher and quadrupled our first year's business. We are now suffering badly by following the ruling of our State Food Commission.

The qualities of flour are judged by the lightness and whiteness of the biscuit and cakes and the flavor or goodness of them.

We have never heard of a case where the use of bleached flour is known to have caused any human being harm as a result of his eating it.

We regard the art in line with the well known and recognized business principle of giving one's product as salable a form or condition as possible. The stage of deception is past, provided only our authorities will give perfect freedom to all, both law abiding and law breaking, to bleach. *No better opportunity was ever offered than this year for the law breaking miller to deceive by claiming for his whiter flour a svperior grade of imported wheat.* * * *

We would have been very much pleased had the process never been invented. It has added its increment to the complexity of the milling business, and so far as we can see, has not added a proportionate increase to the world's

happiness. But since it is here, and if it does nobody any harm, we feel that the sooner the obstacles now in the way of all bleaching be removed, the better for everybody.

Anderson & Spilman, Danville Roller Mills, Danville:

The trade understands "patent" flour to be the whitest made; "straight" flour not being quite so white. The patent includes about 60 per cent of the whole stock; clear, about 30 per cent; low grade, about 10 per cent.

The bleacher permits a 20 per cent increase in the patent, and the agents for the bleacher represent that that process will permit the miller to work off low grade wheat flour to better advantage.

Color is the first item with the trade in judging the quality of the flour. It would be better for all millers to cease bleaching. If one miller bleaches and his neighbor does not, the bleacher is a great advantage.

J. J. Cozatt, Parksville Roller Mills, Parksville:

"Patent" flour is the whitest and best flour.

"Straight" flour is the whole product of the grain. The patent is whiter and softer. We make about 70 per cent of the stock into patent and 30 per cent into second grade.

The agents for the bleacher claim that the process will make a whiter flour, and a larger per cent of patent. The bleaching process takes the rich, creamy appearance from the flour. The trade wants the whitest flour, together with the raising and baking qualities.

I think that a great many mills are bleaching their straight flour and selling it for patent.

T. A. Sandefur, Henderson Roller Mills and Elevator, Henderson:

"Patent" flour is that flour manufactured from first middlings, the choicest part of the wheat.

"Straight" flour means that there has been no separation made.

"Clear" flour is the grade from the soft, starchy stock, next to the bran.

The patent is much whiter than the other grades. This mill puts about 58 per cent of the whole stock into the patent, 40 per cent into the clear and 2 per cent into the low grades.

A bleacher would permit us to make about 37 per cent increase in the patent, and to show at the same time, in the dust, a better color than our 58 per cent patent. The main purpose of the bleaching is to work off lower grades of flour that may have accumulated.

Most of the sales are on color. Unless your flour shows up in color the trade will not consider any good qualities that it contains. *Ninety-nine per*

cent of sales to small dealers are made on color and not on quality of goods.

In regard to the bleaching of flour, I refrained from doing so as long as possible, till I found my best customers were clamoring for whiter flour as was being manufactured by competitive mills. I installed an Alsop Process bleacher about one year before Secretary Wilson's decision on bleached flour. I operated same until May, 1909. I found it a great benefit to me. I could make a straight flour and bleach it and it would be whiter than my patent is today. However, I do not claim that it was better for the consumer.

In regard to fixed grades, there is only one grade of bleached flour, i. e., patent. You may have two or more brands, but the qualities are about the same.

Away with the bleacher!

A. J. Rice, McBrayer's Roller Mills, Lawrenceburg:

"Patent" flour is from 25 to 50 per cent of the flour stock.

"Straight" flour is all grades run together, less 5 or 10 per cent of the low grade.

"Clear" flour is all flour clear of specks less than the patent grade. The patent is whiter and has more starch than the straight, and is still whiter than the clear. This mill puts 20 per cent into the patent, 70 per cent into the clear, and 10 per cent into the low grade.

I consider the bleacher of no value and a fraud on the public. It enables the miller to get rid of his low grades as a higher grade. It is detrimental to the flour.

Color is the only item by which the quality of the flour is judged in the trade, because it removes the natural oils of the flour.

I think the bleacher was gotten up to sell, and after they were introduced mills bought them because the other fellow had one. Do not think it adds one single cent to the value of flour, but think it detracts, and only pays the miller in getting rid of his low grade of flour to a better advantage.

C. F. Cooper, Miller, Farmers' Union Milling Company, Fulton:

"Patent" flour is about 40 to 50 per cent of the whole stock, and is some whiter than the straight.

The mills make from 25 to 35 per cent more patent with the bleacher than otherwise, but it is all imagination. The agents for the bleachers claim that we can make from 75 to 90 per cent patent with the process, whereas we are only making from 40 to 50 per cent without it.

In some markets flour is sold altogether on color. Some of the buyers dough up the flour.

The trade is the cause of the bleacher. The trade called for whiter and cheaper flour. No mill can get more than 40 to 50 per cent of patent flour out

of wheat. If they run more than that they will lower their grades. The patent flour of today is no better than second or straight grade was twenty-five years ago.

The writer has had experience with bleacher, and I think that the trade is just as well satisfied with the flour since bleachers were taken out as before. I do not think that the bleacher injures flour unless it is bleached too heavy. It humbugs the people into thinking they are getting a whiter and better flour.

W. F. Cromwell, Crown Roller Mills, Morganfield:

It is a hard proposition now to tell what "patent" flour is since bleaching came into use.

"Straight" flour is all the stock run together. This mill puts 65 per cent of the whole stock into patent; 35 per cent into "clear;" 90 per cent into "straight." The agents for the various bleaching processes claim that it will make 100 per cent patent.

The main purpose in bleaching flour is to "give something for nothing," that is, to make all the flour straight, bleach it and sell it for patent, and have no clear and no low grade on hand—all sold as patent.

Everything depends upon color. The trade puts more stress upon color than anything else.

The bleaching process should be stopped, as it is a deception practiced upon the trade and against the mills in the long run. Twenty years ago you could tell what patent flour was, and today you cannot. It may run from 35 per cent all the way up to 100 per cent of the stock. This bleaching process cuts a big figure in the pockets of those who use it on account of the big percentage in the patent, and this is the reason that so much fuss has been made.

E. H. Stapp, Miller and Manager, Kevil Milling Company, Woodville:

"Patent" flour is strictly middlings flour, that is, flour made by grinding the middlings, and constitutes about 60 per cent of the whole stock. In the South, the trade calls the other 40 per cent "straight," while in the North it is called "clear." The "patent" or strictly middling flour is stronger and whiter. The agents for the bleacher claim that this process can make the 100 per cent as white as the 60 per cent of middlins, and thus enable you to undersell your competitor who does not bleach.

The bleaching process certainly makes the flour whiter, but does not add to the strength or the quality of the loaf of bread. The process of bleaching flour is to enable the miller to considerably increase his per cent of patent, and thus get more money out of it. The trade generally judges flour by sample. Bleached flour will sell for about 10 per cent more than the same flour un-

bleached. The trade judges the quality of flour almost entirely by color; the bakers, by the baking test.

The bleaching process is a deception. It enables a miller or merchant to sell a *straight* flour *bleached* for as much as a miller *that doesn't bleach* his patent. It whitens flour; or, when tested in the usual way, makes a straight whiter than a patent. It was introduced about six or seven years ago. It has knocked grades—old established grades—out altogether. The general effect on the flour market is very great. When a miller, who doesn't bleach, offers an unbleached high patent flour to a merchant at, say, $6.00 per barrel, he, the merchant, will bring out a "bleached" straight, or a 100 per cent bleached patent, as he calls it, which cost him, say, $5.00 per barrel, and it will show up whiter than your 60 per cent unbleached, high patent; and no argument you can give him will convince him that your flour is stronger, better and will make a better loaf of bread. Give us all the privilege to bleach; or, better still, *enforce the law.*

C. W. Bransford, Proprietor, Bransford Mills, Owensboro:

"Patent" flour is flour made from the middlings of wheat; "straight" flour is the patent out and low grade in; "clear" flour is the patent and low grade both out. The patent is much the whiter.

This mill never changed its per cents one particle while we used the bleacher. We used it to simply age our flour, and to prevent designing salesmen from discrediting our flour by sampling it with bleached flour while our flour was fresh. The agents for the bleacher claim that the practice will enable you to make a 95 per cent patent whiter than a 45 per cent. This is true in the flour dust, but it will not appear that way in the bread. The bleaching practice takes the life out of the flour, and, I believe, in a measure destroys its nutrition. If the flour is treated just enough to age it, I do not believe it suffers any deterioration.

The main purpose in bleaching flour is to enable millers to buy all kinds of cheap wheats, particularly Western wheats, mix them together and grind and sell the product for the highest patent. They could not do this without the bleacher, as the Western wheats make a yellow flour. These wheats sell for less money than the wheat grown east of the Mississippi Valley.

Color is the chief factor in determining the market value of the flour.

I am decidedly opposed to the use of the bleacher, or any other artificial means of whitening flour. The discoloration of flour is due to the impurities in it, and these get into the flour from improper cleaning of the wheat to start with, and, after they get in, they are allowed to remain because of poor milling, due to the incompetence of the miller, or inadequate facilities (more properly, machinery) for eliminating them. These deficiencies are largely overcome by the bleaching process, but while the bleaching gives the flour the much desired white color, it decreases its baking and nutritive value.

The bleacher made its first public appearance in March, 1904, and was the

logical successor of the various adulterants, such as meal, starch and barytes, etc., that were used to whiten and cheapen flour. The use of the adulterants and the bleacher has resulted in there being no fixed grades of flour.

Andrew Edinger, Edinger and Company, Louisville:

"Patent" flour is from 50 per cent to 60 per cent of the whole stock; "clear," from 30 to 40 per cent; low grades, from 10 to 12 per cent. The clear is much darker and will bake darker bread than the patent.

As we understand it, the main purpose of the bleaching is to raise the grade by making it whiter. The qualities of the flour are judged by the color and granulation, and principally in the baking of the sample. We do not believe that the bleaching makes the flour any better. We buy our flour mostly by baking the sample, and sell it under our brands.

W. O. Rouse, Walton Roller Mills, Walton:

The agent of one bleaching process claimed 98 per cent of patent. The main purpose of bleaching the flour is to get a greater per cent of white flour. Color affects the market value of the flour from 25 to 50 cents per barrel.

Up to your ruling, we bleached to compete with flour coming into our territory. But, as far as we are concerned, we would rather not bleach, as our trade has gotten used to the flour not bleached. We believe that it ought to be cut out altogether.

J. B. Wilford, Bowling Green:

"Patent" flour is 40 to 60 per cent of the whole, taken from the head of the mill. "Straight" flour is 100 per cent. "Clear" flour is from 40 to 60 per cent, from the tail of mill. The patent is whiter, the straight more of a cream color.

The agents for the bleaching process claim as high as 90 per cent patent. The purpose of the bleaching is to increase the per cent of patent.

My opinion is that bleaching is only to whiten the low grades, thereby enabling millers to blend lower grades with the higher patent, and thereby making more first patent. Do not think that it adds to the general quality; rather has a tendency to depreciate its value to consumers.

J. F. Walcott & Co., South Carrollton:

"Patent" flour is a grade of flour that is separated from the second and third grades. The patent is very white. The straight is not so white. The

best grade of flour that we can make is on a basis of 55 per cent patent, 40 per cent straight, and 5 per cent low grade. On this basis we have no trouble to compete with bleached flour with our first patent.

With the bleacher a mill can make 90 per cent patent and without it, a mill can only make 55 per cent good patent flour. It does not help a full patent. The main purpose in bleaching flour is to bring the low grades up to a patent color, without helping the flour at all. Unbleached flour is better than bleached, for the reason that it has more life in it. If the law allows the bleacher to come back, it will drive us to put one in, in order that we may bleach our straight and sell it at patent prices. I do not think the bleacher is what the people want for health.

E. F. Ogden, Slaughterville Milling Co., Slaughterville:

"Patent" flour is flour made from purified middlings and such break flour as is of equal color and strength. Patent flour contains about 60 per cent of the whole stock; straight, about 30 per cent; clear, about 10 per cent. There is a perceptible difference between the baking qualities of the patent and the straight and also in the water test. The clear is much darker than the patent.

The agents of the bleaching process state that it will enable one to whiten the straight so as to make 90 per cent patent.

I am of the opinion that bleaching simply enables the miller to make a larger per cent of white flour of less strength, which he can put on the market as patent flour.

Charles Broeker, Charles Broeker & Co., Owensboro:

The best flour a mill will make is considered "patent" flour. "Straight" flour is all of the stock run together. "Clear" flour is the flour taken out in making patent. Patent flour is lighter than straight; straight, lighter than clear.

The agents of the bleacher claim that the process will increase the per cent of patent flour. The main purpose of the bleacher is to deceive the public in the greed for gain.

The baking quality is the main test of all flour.

Bleaching, in my opinion, is a miller's dream; just like the girl with the peroxide hair. It is a deception and a fraud.

The Bines Milling Co., Walter Bines, Herndon:

"Patent" flour is perfectly clear flour, strong and of good color. "Straight" flour is that not good enough for the patent, and the "clear" is a lower grade than the straight.

Patent flour is two or three times whiter than straight, and stronger. This

mill puts about 55 per cent in the patent; 40 per cent into the straight, and 5 per cent into the clear.

We do not believe that bleaching is of any advantage, other than enabling millers to make a large percentage of so-called patent flour, deteriorating baking qualities. The agents for the bleaching process claim a higher per cent of patent. The purpose of the bleacher is to turn the low grades into high grade flour.

The market test for flour depends upon conditions and market locality; if sold in the South, on color test.

We do not believe in the bleaching process. It lowers the quality, by the fact that a higher percentage of patent is claimed. The buyers do not seem to have as much confidence in the same goods as formerly. We have never used a bleacher, or believed that we had any use for one.

R. C. Poage Milling Company, Ashland:

"Patent" flour is 75 per cent of the stock. Straight flour is the second grade and the patent run together.

This mill has operated a bleacher, because competition demanded it. The bleaching process whitens the flour, but many of the customers claim that it deadens it to some extent. We hope that the bleachers will never be installed again, as they enable the miller, who wants to, to put a cheap white flour on the market and compete with the better grades. Some mills are putting bleached straight in competition with unbleached patent.

Edward Williams, E. I. Williams & Co., Sanders:

We know of no "patent" flour. The word should not be used; usually known as best grade; in days gone by it was middlings flour.

"Straight" flour means all grades mixed.

This mill does not use a bleacher from the fact that we desire to give our customers pure wheat flour.

We have had agents for the sale of bleachers to tell us to put in a bleacher and we could sell our straight for a patent. The bleaching process makes the bread dry out quicker. The whiter the flour the better it sells, provided the bread rises. We are of the opinion that bleaching should be done away with, as we can make flour good enough for any living person without doctoring it.

D. E. Stahl & Son, Barlow Mills, Barlow:

"Patent" flour is white flour, which makes it sell. About one-half of the stock is put into the patent, and one-half into the "clear."

The main purpose in bleaching the flour is to make a big per cent of pat-

ent. Our home trade goes greatly on color. Of course, the raising quality has lots to do with it.

We sometimes have a customer to quit a mill because it is bleaching, claiming they are afraid of bleached flour.

Byers & Jenkins, Riverside Mills, Adairville:

"Patent" flour is the top or first class product of good wheat. "Straight" flour is all the grades together, less a small per cent of low grade. The patent is whiter and clearer. About 50 per cent of the stock is put into the patent, 45 per cent into the second grade, 5 per cent low grade.

The agents of the various bleaching processes claim that any kind of dirty wheat and low grade flour can be used and make it white so it will sell for patent flour. The main purpose in bleaching flour is to sell more of the product as patent or high grade, to fool the public. Color adds from 25 to 50 cents per barrel to flour.

Bleached flour appears in the dry state whiter, but when mixed much of the difference disappears. There can be no good in it except to allow the miller to sell a great per cent of his low grade at a high price, making in many instances 95 per cent patent.

J. C. Walters, Miller, Kuttawa Milling Company, Kuttawa:

"Patent" flour is the whitest, and is the per cent that has the most starch. "Straight" flour is not as white as patent flour. "Clear" flour is not handled in this market. Patent flour is whiter than straight flour. This mill puts 50 per cent of the stock into patent, and 50 per cent into straight.

The agents for the bleaching processes state that it increases the amount of patent flour, giving the miller 25 cents per barrel.

Whitest flour is what 90 per cent of the trade want if buying without having had a baking test.

Bleaching is a fraud and should be suppressed.

W. M. Dudderar, Miller, McKinney Roller Mills, McKinney:

The "patent" grade is the cream of the flour, and bears the same relation as skimmed milk, to "straight" flour. The patent is whiter. This mill puts about 40 per cent of the stock into the patent, 50 per cent into the straight, and 5 per cent into the low grade.

The agents for the bleacher claim that this practice makes the flour much whiter, doubles the amount of patent flour, and improves the raising qualities. The main purpose in bleaching flour is to make the flour whiter and to increase

the amount of patent flour. Having never used a bleacher, I can speak only from observation.

There is no doubt but that it makes the flour much whiter and increases the amount of the so-called patent 25 or 30 per cent. Therefore, millers who are not able to put in a bleacher are at a disadvantage in the market. There is a craze among women for white flour, and what the women want generally goes. It does not matter what other qualities flour possesses, it must be white or it is no go. The bleacher was introduced in this section six or eight years ago. The general effect of the practice on the market has been to materially disarrange fixed grades and put the small mills at a great disadvatage, as they have had to lower prices to compete with the bleached flour.

The Boston Mills Company, Boston:

Strictly speaking, and before the advent of the bleacher, "patent" flour is made from stock that has passed through the purifier. "Straight" flour is made from all the stock. "Clear" flour is the flour drawn off from the patent. The patent is whiter and stronger flour. This mill puts 40 per cent of the stock into patent; 90 per cent into the straight; 60 per cent into the clear.

We mill select wheat only, and have no use for a bleacher. Few mills that have bleachers operate them when running on choice, clean, sweet wheat. The bleacher permits one to more than double the amount of patent, or about 90 per cent, and make an increased yield from off grade wheat.

The agents for the bleacher claim the practice will age and clear flour rapidly, to permit the grinding of off grades and damaged wheat without detection in the flour, and to make off grade stock wheat enough to include patent.

We believe the main advantage in the bleacher is to enable the miller to work up undesirable stock and sell as "patent" flour what would otherwise have to be sold on its merit as low grade goods. The effect is to whiten the flour only, and this whitening takes effect on the outside of the particle or granule of flour. The only advantage to the miller, dealer and consumer is to make all parties believe by color and appearance that they are getting patent flour, when in reality a great part of this "patent" is drawn from lower off grade stocks; or it is made from inferior wheat, and by the bleaching process the miller is enabled to dispose of this flour as from first class wheat.

Most flour is sold on "color," and the value of the flour practically depends on this item alone, in the matter of sale. The miller would judge from strength, texture and color, but the buyer and consumer depend practically upon "color" alone. The bleaching process has tended to put a false value on "patent" flour, as the miller is enabled to get a large quantity of white, clear flour from otherwise low grade stock, and to run this into "patent" on the basis of "color" alone.

The ultimate consumer bears the real burden, as, in the case of a bleached

product, he does not get what he thinks he has purchased. The miller who is making flour from choice stock and making "patent" without artificial means, cannot meet competition from the bleached flour, hence the necessity of cutting down the grade, or "milling closer" to meet this competition, all at the expense of the consumer.

B. M. Jones, Miller, The West Louisville Mill and Elevator, West Louisville:

"Patent" flour is any per cent under 100 that you want to call patent. "Straight" flour is 100 per cent flour. "Clear" flour is the per cent of flour that is not patent, or, low grade. The difference in color between the patent and straight depends upon the per cent of patent you make. I make a 96 per cent patent and the straight grades, and, of course, there is very little difference.

The main purpose in bleaching is to make your flour a little whiter than the other man's. Color affects the market value of the flour; so do the baking qualities and clearness from specks.

My opinion is that the mills do not need the bleacher. It does not make the flour any worse; but if one man gets it, of course, every one will.

W. M. Farless, Henderson:

"Patent" flour is the best grade; "straight" flour, the second best; "clear" flour, the third best. Patent is a shade whiter than straight, but often the straight is a good baker. The clear is about as white as straight, but not so strong. This mill puts 75 per cent into the patent; 98 per cent into the straight and 20 per cent into the clear. This mill has, but does not operate, the Alsop bleaching process. The agents for this process represented that it would age the flour in color to what it would be after it had been milled several months The purpose in bleaching flour is to whiten all grades.

The whiter flour will sell best to all domestic trade. We millers have had a hard time of it since we quit bleaching, from the fact that the law has been, and is being, violated. I understand that some States allow bleaching if labeled "bleached." I think if the national law could control, it would help a great deal, and look forward to the time the Government will try the cases on hand and settle things. For so long as Western millers dump hard wheat flour in our territory bleached, they will get the business unless we bleach. However, this is not the subject. Will say while I was bleaching I ran my grades as I do at present; straight flour has 2 per cent low grade out. When making patent I run 75 per cent patent, 20 per cent clear, 5 per cent low grade.

W. H. Falwell, Miller, R. W. Thompson, Water Valley:

"Patent" flour is all flour made from purified middlings that are free from

specks. "Straight" and "clear" flour are all that flour that will not go into the patent. This puts about 75 per cent of the stock into the patent and the rest into the clear, that is, when we have good No. 2 wheat.

The agents for the bleaching process claimed that it would improve the color of the flour, and would not damage it in any way.

In some localities the people like a slightly yellow cast to their flour; *but most people will pay more for flour if it is white.* I do not think that bleaching hurts the breadmaking qualities of the flour, but it enables the miller to improve the color of his flour and by that means make a larger per cent of high grade flour. We have never installed a bleaching outfit at our mill. As to what is considered "patent" flour, it has become the custom of millers to run all of the flour that is free from specks and that shows up well as to color, into the patent. The remainder goes into the straight and clear.

J. F. Albert, Manager, Nolin Milling Company, Nolin:

"Patent" flour is a portion of the best flour made by this mill, or a certain per cent of the best. "Straight" flour is all the flour made run together. "Clear" flour is that part remaining after the patent is taken out. The patent is whiter and clearer than the straight. This mill puts 60 per cent of the stock into the patent; 95 to 100 per cent into the straight; 35 to 40 per cent into the clear.

The bleaching process makes a whiter flour is about all you can see. The trade demands white flour, and when some of the mills began to bleach, others had to follow in self defense. If all would quit the practice it would save trouble and expense.

The quality or grade of the flour is determined mostly by color and strength.

We find it our experience of some two or three years in using a bleacher that nothing is gained by its use but a whiter flour, and we cannot find any bad effects from use of same as far as we have been able to detect. No changes should be made in grades, but some made a larger per cent of patent flour with bleacher. We are now running our grades with no bleacher exactly the same as we did with the bleacher.

W. M. Atkinson, Washburn-Crosby Milling Company, Louisville:

"Patent" flour is made from that portion of the wheat termed "middlings" when in process of milling. "Straight" flour is a combination of all flour streams in the mill. There is a fair to wide difference in color between the patent and the straight, governed by the manufacturer. The bleaching process whitens the patent and makes the clear grade more gray. The main purpose in bleaching the flour is to whiten. It is difficult to determine to what extent the color affects the market value of the flour. Strength and baking qualities are the means other than the color by which the trade judges the quality of the flour.

Myers & Se ttle, Glasgow, R. R. No. 7:

We do not operate bleacher in our mill. We do not believe that they are any good in making and bleaching flour, because flour will bleach itself in a short time after it is manufactured. We manufacture whole wheat flour only, and let it bleach itself in the flour bins, which is but a short time. I think in bleaching flour by a process it is no good only to the manufacturer who sells the bleacher. And as to the questions you ask on the other side of the sheet, I could not answer correctly, as I do not handle a bleacher. But flour is better, I think, not bleached by a process. When flour bleaches itself, alone without a bleacher, it is all right.

A bleacher will bleach flour all right, and will cause the mills to make a little more per cent patent, and that is all the good we see in one. But as far as we are concerned, I would not be bothered with one. Flour is far better when it bleaches itself alone, we think.

Smith, Keen & Smith, Burksville:

Our trade here does not like bleached flour.

S. T. Beyd, Hodgenville Roller Mills, Hodgenville:

"Patent" flour is the whitest portion of the grain. "Straight" flour is where a small per cent of patent is taken off. "Clear" flour is the first as it comes from the wheat, all together. The patent is slightly whiter than the clear.

The main purpose in bleaching flour is to get a greater portion of it into the patent. Had not given the matter any great amount of thought.

OPINIONS OF MILLERS FAVORING BLEACHING AND AS TO THE TRADE MEANING OF THE TERMS "PATENT," "STRAIGHT" AND "CLEAR."

The millers favoring the bleaching process do not give as good reasons as do the millers opposed to the practice, in fact, the following opinions of the millers favoring the process, alone contain sufficient evidence to show that the purpose and results of bleaching constitute a violation of the Food and Drugs Act.

J. H. Baughman & Co., Stanford:

This mill puts 33 1-3 per cent of the whole stock in patent; 67½ per cent in low grades.

The agents for the bleacher represent that the process will enable us to make 60 per cent of the whole stock into first patent, whereas we are making only 33 1-3 per cent. Patent flour is worth more money.

Mills have greater demand for patent flour than low grade. When bleacher is used, you have less low grade. The patent flour markets have more money, and mills can make 25 per cent more profit by the use of the bleacher.

It is very difficult to market dark flour. An inexperienced person will judge flour almost entirely as to color, while one of experience will be governed by the texture. Large buyers usually want baking samples before placing orders for flour they have not been using.

We were one of the last mills to put in an Electric Bleacher. We were not able to compete with our brother miller in price and quality without the use of bleacher. We used bleacher about eighteen months, when the Government decided bleaching conflicted with the pure food laws.

After using bleacher we had considerable complaint as to color of flour we marketed. The difference was very noticeable both in flour and bread. In our opinion the use of bleacher has not disarranged the grades of flour to any great extent for you can not bleach poor stock successfully.

From our experience in bleaching we are of the opinion that bleaching does not injure the flour in the least.

The Patton Milling Company, per W. B. Wellman, Secretary, Catlettsburg:

We understand "patent" flour to mean any high grade of flour produced by the modern process of milling, which was formerly a patented process. We understand a "straight" flour to be all the flour less the feed. "Clear"

flour is well dressed flour remaining after one or more grades have been taken off ahead. The difference between patent, straight and clear flour in color and otherwise, depends upon the streams from which each is made, but ordinarily, the so-called patent is whiter than a straight, and a straight, whiter than a clear. Often a straight is stronger, and is sometimes of better bread-making quality than the so-called patent. Also, straight grade from some mills is whiter than the so-called patent from other mills.

Percentage of different grades varies according to requirements. If a party wants a very white, weak flour for pastry, 15 or 20 per cent grade, made from first reduction milling, or break flour, would answer the purpose. If a strong flour for bread-making purposes is wanted, but not so white in color, a 90 per cent grade, if well milled, would be superior, and would bet ter meet the requirements of good bread-making flour.

The bleacher is used because when the flour is properly bleached the objectionable coloring matter is eliminated, and it gives better results. The use of the bleacher does not in itself permit an increased percentage of patent, or any grade of flour. The matter of percentages depends upon requirements as stated in answer to question 5.

The bleaching process people claim their process will improve the quality and color of flour.

The principal effect noticeable from bleaching is the improvement in color.

The main purpose in bleaching flour is the same as in bleaching sugar; it gives the flour a better appearance, and the people want it. The principal effect of color on the market value of flour is that if the flour is not of satisfactory color, it fails to give satisfaction.

Besides color, the trade judges quality of flour by the kind of bread and biscuits it makes. Since practically all mills have installed the process, there is no disarrangement in grades, principally because no grades have ever been fixed.

W. A. Burkhart, Vine Grove Roller Mills, Vine Grove:

"Patent" flour is supposed to be a rich flour and white in color. "Straight" flour is supposed to be full 100 per cent of all flour from wheat. "Clear" flour is supposed to be the yellow taken from the patent. Patent flour is whiter and richer than the straight, and more superior to the clear. This mill puts about 47 per cent of the stock into the patent, 70 per cent into the straight, and 23 per cent into the clear.

Mill has operated a bleacher but does not now. The agents for the various bleaching processes represented, claim the process to make flour white and dry. The bleacher conditions the flour for immediate use, especially when using damp or new wheat.

Color affects the market value of the flour to a great extent. Yellow

flour cannot be sold against white. Unbleached flour cannot be sold against bleached flour.

I use the Alsop process. I do not think it damages the flour if used as it should be. It dries out damp flour and gives it a better baking quality and helps to carry the flour trade on during the harvest. Helps to condition the new flour.

J. Andrew Cain, Hope Mills, Versailles:

"Patent" flour has a broad meaning principle; a good high grade flour. "Straight" flour constitutes 95 per cent of the stock. "Clear" flour means the low grades. There is more difference in color between the straight and the patent under the slick than in the bread. This mill puts about 60 per cent of the whole stock into the patent, according to quality of wheat.

The agents for the bleaching processes claim, the same as other men for improved machines, that the bleacher will make whiter flour. The main purpose of bleaching flour is to satisfy the housekeeper. When it was known that I would stop bleaching, several persons laid in flour because they preferred the bleached. I did the same myself.

Baking is the only true test of the qualities of the flour; bleaching whitens; the strength has to be in the wheat.

When I first commenced bleaching, I reduced the amount of patent of first grade because we had indifferent wheat, and I did not believe the bleacher could help me out along the line of strength; and now for three years we have had indifferent wheat, and I think the miller who trusted to his bleacher, that is the miller who increased his per cent of patent, and not to his selection of wheat, lost out and went back to first principles.

Dickinson Brothers, Glasgow:

"Patent" flour is a flour made by patented process which whitens flour and takes out of the wheat only the best portions; "straight" flour is a flour made from the entire wheat except the husks. Patent flour should be snow white; straight is creamy colored.

The main purpose in bleaching flour is to whiten it and this makes it more salable for general household cooking. Properly bleached flour will make snow white cakes and pastry, and is in demand by housekeepers. *The discontinuing of the use of bleachers has somewhat enhanced the value of patent flour.* Of course, the trial of the flour is its final test. Color is preferred white, but it must possess other qualities.

It is our opinion that the only result of the use of bleachers by mills is that the users are thus enabled to market a larger per cent of their product at fancy prices. The effect upon the consumer so far as has come within our observation, aside from the changes in prices, has been perfectly harmless.

Burnam & Rucker Milling Company, Paintlick:

"Patent" flour is the very whitest flour the mills can possibly make. There is no special difference between the "patent" and "straight" except in color. This mill puts about 16 per cent in the patent; the rest, in the straight.

This mill operated an Alsop bleacher until advised to stop it. The bleacher was used because it improved both grades of flour very much. The agents for the bleaching process stated that it would make flour very much whiter, which it did. No bad effect whatever has been noticed, and there has been no complaint from any one.

The demand for flour all over our territory is white, a very white flour, and they are going to have it if it is possible to get it. If flour is not beautifully white, you are knocked out in your sales.

If we could have run our bleacher this last year, as we had such a mean crop of wheat, we could have improved its color so much it would have been a great help to the millers, and given the trade a great deal better satisfaction.

We started our Alsop bleacher June, 1908; it would have been a great benefit to us if we could have continued its use; when we had to stop it, it injured our trade.

W. H. Harlan, Manager, Harlan & Lowe Milling Company, Bardwell:

"Patent" flour is understood by the trade to be better than "straight", and is supposed to be from middlings and break flours. "Straight" flour is 100 per cent of the stock; most millers take 60 or 75 per cent out and call it "straight" or "extra fancy." "Clear" flour is the low grade flour, or flour with 85 to 90 per cent of best out of it. The patent is three or four shades lighter in color than the straight, and makes the whitest and best bread. The "clear" is only good to dust with or make gingerbread. This mill puts 50 per cent of the stock into the patent, and 50 per cent into the second grade.

The bleacher enabled us to compete with the best flour made. The process makes the flour whiter and permits an increase of about ten per cent in the patent. The agents for the various bleaching processes claim that it would make the flour work like it had been ground six months, when in fact it was six hours old. The bleaching makes a whiter effect in the flour and in the bread. Our main purpose in bleaching the flour is to be able to compete with our competitors in the milling business, as we were experts in the bleaching.

Color makes flour sell for more as every one, but idiots, wants white flour, for it is an emblem of purity and must be pure to be white. Our opinion is that the flour bleached is better in every particular and that your ruling

has worked great injury to the honest millers, as some rascally millers take advantage of those that want to comply with the law, and never have stopped and never will, no matter what Uncle Sam says. * * * * * Worse than bleaching is millers' short weights from 3 to 6 pounds to the barrel, and bran 95 pounds and branding 100 pounds.

H. C. Smith & Sons, Harrodsburg:

This mill puts 20 per cent into the first grade, 40 per cent into the second grade, and 40 per cent into the third grade.

If we could use a bleacher we would not make any larger per cents of patent. The bleaching process makes the flour whiter and makes lighter bread. The dryer you make flour the better it will rise.

White flour sells better.

Our bleacher has not run since April 3, 1909, and we feel that our Government and State officials have put a handicap upon us by not *promptly* and *vigorously* prosecuting those who have violated their ruling. If this is not done the gate should be opened and all allowed to enter the pasture who will.

The Somerset Milling Company, Somerset:

"Patent" flour is the best grade made by the mill. "Straight" flour means all grades run together into one. "Clear" flour is the grade between the patent or top grade, and the low grade. Patent flour is whiter than straight, and has less of the germ in it. This mill puts about 60 per cent of the stock into the patent, 32 per cent into the clear, and 8 per cent into the low grade.

This mill has a bleacher but does not operate it; would bleach if allowed to as the flour gives better satisfaction.

The agents for this bleaching process claim that the flour would be whiter and would keep better as the flour would be dried out the same as in storing for 60 or 90 days. These claims are fulfilled. The main purpose in bleaching the flour is to make a whiter, and, therefore, a better flour. All other things being equal, color affects the market value of the flour to the extent of "business or no business."

It is our opinion that bleaching affects the flour in no way except to dry out and whiten. If bleaching is universally prohibited, grades and prices will adjust themselves, but never as long as some are allowed to bleach and others not. It is our opinion that bleached flour has never commanded a premium over unbleached, but nine times out of ten the mill that bleaches will carry off the order in competition with the mill that does not bleach, all things else being equal. We made no change in percentages when we stopped bleaching. A low grade flour cannot be bleached and sold for a high grade.

Mr. W. N. Stice, Standard Roller Mill Company, Cerulean:

"Patent" flour is a good, pure, clean, white flour, made from sound wheat, perfectly cleaned and separated from bran. "Straight" flour is the whole run of the mill, naturally containing some powdered bran. "Clear" flour is a per cent, generally 10 to 20 per cent, of the tail of mill. Latter part of process.

The patent is supposed to be whiter, containing less dirt and offal, not so much soft flour, 10 per cent better. The patent is 20 per cent whiter and cleaner than the clear, containing much less soft stock. This mill puts 75 per cent into the patent, 20 per cent into the clear, 5 per cent into the low grade.

This mill operated a bleacher up until a year ago, and found that it enabled a 5 per cent increase in the patent, and that it improves each grade all the way down the mill. The main purpose in bleaching flour is to purify, and as near as possible, to reach perfection in the art of milling. Pure air, oxygen and hydrogen, is certainly nature's remedy. This is applied in a compressed form, and does at once, instantly, exactly what a few months time will do by storing the flour in a clean, dry and airy room.

A good clean, clear, white flour will sell for more money, and do it quicker, in competition with a darker flour.

I think it (the bleacher) the greatest invention of the age, applicable to the manufacture of flour. It does it "good," Dr. Wiley to the contrary, notwithstanding. It has been in use more or less for five or six years. It has raised the grades, and has had a tendency to combine the different grades, made fewer; many big mills make several grades. The tendancy in milling now is to make one and only one grade of flour, by extra cleaning, scouring, washing and brushing the wheat, then to properly mill, and purify during the milling, and afterward to give it a treatment of compressed air, combined with the electric current.

It won't turn dirt, fungus, smut or bran to flour. It only shows these elements up plainer. It is not the purpose of the process to take inferior wheat and make good flour, neither is it the purpose of the process to remedy bad milling, with the preceding machines. Neither is it intended to be used to help deceive the public. These things have all been charged against it, contrary to the truth. The delay and dilatory tactics of those who have the prosecutions in charge, have done and are doing the milling industry a great injustice. Aside from the dead capital tied up in the machinery is the fact that many mills in the State have never quit the use of their machines. Their flour will outclass the fellows' who do not use it. Then the per cent increase to higher grade, etc. Just outside the State, on opposite side of the Ohio river, they make it. We have had to sacrifice all our trade at Tennessee and Cumberland river points, also Paducah, and much of it among the coal mines of Western Kentucky.

It is only one chance in 1000 that the flour will be apprehended in inter-

state commerce. The county authorities would not likely catch one barrel or bag in 10,000, but for us, we desire to obey the law, and even if we did not, if we should have to pay the penalty on 300 or more bags, it would break us up, etc., etc.

You would only have to go through most any of the larger mills to find them (the bleachers) in operation. The product goes *somewhere*.

John W. Fry, Melber Roller Mill, Melber:

"Patent" flour is the highest grade the mill makes, from middlings and part of breaks.

"Straight" flour is all the clear flour contained in the wheat.

"Clear" flour is what remains after the patent is drawn off. The patent is a little whiter than the straight; the clear is a shade browner than the straight. This mill puts 60 per cent into the patent, 40 per cent into the clear, and 100 per cent into the straight.

The bleaching process makes the flour a shade whiter, and bakes up a little more pleasing to the eye. The trade demands white flour, and always has, and the milling trade has endeavored to please its trade.

I don't think it is harmful; it has not disarranged fixed grades; it has had some effect on the flour market, as flour bleached has had a greater demand than flour not bleached, by the retailers and consumers.

There is no deception practiced in the bleaching process, as the final test in flour is in baking, and if flour is not properly milled (and good wheat used in same) all the bleaching would not improve it.

My opinion of bleaching is that it gives the finishing touch to a well milled flour, that time only will accomplish, which takes about 6 months (after being milled).

R. L. Martin, Miller, Cave Milling Co., Bowling Green:

"Patent" flour is white lively flour; best patent.

"Straight" flour is the whole wheat flour, or 100 per cent.

"Clear" flour is the patent flour taken out.

This mill puts 70 to 75 per cent into the best patent, 100 per cent into the straight, 20 to 25 per cent into the clear, 5 per cent into the low grade.

The agents for the bleaching process claimed that it will make white flour, and give better satisfaction to the trade.

The purpose of the bleaching of flour is to make it white and give the customers satisfaction. The public demands a white flour.

We began bleaching April 1, 1908. Our grades are just the same since bleaching as before. We use bleached on our own table, and like it better than unbleached, and we find that we are healthy, and have not had any bad effects from using bleached flour.

James Cate & Son Company, Hopkinsville:

"Patent" flour is a flour sufficiently clear and white to meet the demands of the housewife. If properly milled there is practically no difference between the "patent" and "straight" except in texture or degree of fineness. This mill mills only soft, winter wheat, and knows nothing of flour known as "clear."

The agents for the bleaching process claimed that it ages and whitens the flour. This process improves the color.

The main purpose in bleaching flour is more business and satisfied customers. There is a universal demand for white flour.

It is our opinion that the bleaching process ages and whitens the flour, but we do not know that it has either increased or diminished the consumption of flour.

Secretary Wilson's circular recently issued contains the following statement: "That the flour is colored and stained in a manner whereby damage and inferiority are concealed."

Our bleacher rendered the flour white, and did not color or stain, and this was demanded by our customers. We do not know of any process that will conceal the condition of inferior flour.

J. A. McAlister, Stanley Mills, Stanley:

"Patent" flour is the best grade of flour.

"Straight" flour is a good grade, but not so white.

"Clear" is good but still darker. The "patent" is three or four shades whiter than the "straight."

This mill makes only two grades, 85 per cent patent, and 15 per cent clear. No effect from the bleaching of flour has been noticed except that it makes flour white, and pleases the people better. The bleaching process makes the flour white, and that is what the people want in this section. The mill cannot sell flour if it is not up in color.

I can't see anything unsound with bleached flour. I can't see any evil effect in bleached flour. I don't believe that bleaching has disarranged grades at all. The general effect on the market has been good with me.

Burkholder Brothers, Crofton Mills, Crofton:

We make one grade of flour, middlings and low grade to bran. The bleaching process makes the flour whiter, which gives much better satisfaction with our customers. Ninety-nine out of a hundred prefer bleached flour here. The price is the same.

We think that bleaching is one of the greatest discoveries that has been

made in the manufacturing of good flour. We do not think that it injures the flour in any way to make it unwholesome. It has not disarranged any fixed grades of flour in our locality, but simply raised the quality.

We would be very glad to get to use our bleacher again, and our customers, with but very few exceptions, prefer bleached flour.

C. H. Beshers, Columbus Star Mills, Columbus:

"Patent" flour is the best flour, or the highest grade, made from purified middlings. The word patent was first used to designate flour made from purified middlings, and bolted through the "patented" middlings purifier.

"Straight" flour is 100 per cent, or all the flour together.

"Clear" flour is "family flour" or medium grade. In the North the word "clear" is not just what the South means by clear. "Clear," "family" or "bakers ' grade is most generally used, according to the different localities.

This mill puts 30 per cent into the patent, 50 per cent into the straight, and 20 per cent into the clear.

The agents for the bleaching process made no false claims, and all claims they did make were more than fulfilled. The main purpose in bleaching flour is to whiten it and give it age and to take away from it the yellow cast. No one with any sense would claim for the bleacher that it will make a low grade into a higher grade. It only improves flour by whitening it, and I think aging it and putting it in better condition. Color influences the market value of flour from 20 to 25 cents per barrel.

The bleacher is all right. It helps the miller to honestly better his output, and is, in my opidion, a grand thing all around. It will not do the many things some claim, but on the other hand, is not guilty of any of the base charges laid against it. It is a good thing for the American miller and for all who want nice flour.

J. B. Boyd, Proprietor, New Era Mills, Allensville:

"Patent" flour is the best grade of flour. Usually the amount left after deducting the patent is considered "straight," but a straight run of 100 per cent is strictly "straight."

The amount left after cutting off the patent is really a "clear" flour.

The patent is some whiter and better than the straight, and is considerably whiter and better than the clear.

This mill puts about 60 per cent of the stock into the patent, about 40 per cent into the clear or bakers,' 100 per cent into the straight proper.

The agents for the various bleaching processes claimed that it makes better and whiter flour, and increases the per cents of the better grades or whiter flour. The purpose in using a bleacher is to make whiter and better

flour, and to get more good flour out of a bushel of wheat. The color of the flour increases its market value.

I think the bleaching process a good thing; that it helps the flour both in color and rising; that it enables the miller to get more for his flour, and the farmer more for his wheat.

As explained, the trade usually considers the clear or bakers' as a straight; but a strictly straight flour is a straight run of 100 per cent, all thrown into one grade. I know of no way in which the grades are disarranged or in which one miller has an advantage over another in the use of a bleacher.

R. P. Poynter & Son, Horse Cave Mills, Horse Cave:

The "patent" is whiter than "clear," and contains more strength than the "straight."

This mill puts 60 per cent into the patent, 30 per cent into the straight, and 10 per cent into the clear.

The agents for the Alsop bleacher claimed that this process would age and whiten and improve the quality of the flour. The process improves and whitens, thus giving our trade better satisfaction. We think color alone would not affect the flour to any great extent without quality.

We did not install a bleacher when they were first introduced, and tried very hard to keep from it, but we soon found that our trade was gradually going to the mills that had the bleached flour. Our trade gradually decreased until we were forced to install an Alsop bleacher, immediately after which our trade began increasing until it surpassed anything we had ever had, giving perfect satisfaction to all. Then after Secretary Wilson's decision we stopped the bleacher and our trade again diminished. We drew this trade from mills around us that had no bleacher. While running the Alsop process we did not increase the percentage of patent flour, and the increase in trade was due solely to the improvement in the flour. While this machine was expensive and cost something to operate, we would like very much to again give the trade what they are calling for. We feel safe in saying that 95 per cent of our trade now demands bleached flour.

E. F. Spears & Son, Paris:

The terms "patent," "straight" and "clear" are so variously applied that they designate nothing.

The agents for the bleaching process claim that it neutralizes coloring matter which gives a clearer white. The bleaching process produces better color, and puts it into a better condition for baking and keeping.

Our observation of the effects of the bleaching process on flour is that it imparts a better color and that it ages flour by neutralizing coloring matter

and oils, which otherwise must be neutralized or removed by fermentation in baking, or by some chemical action which takes place if the flour is kept for a period of six or eight months.

Another effect of the bleaching process is the removal of unnecessary moisture, thus rendering it less liable to become musty and lumpy. Flour that has attained the age of six, eight or twelve months and has been properly cared for will bake much whiter than that which is baked within a few hours of its manufacture. Evidently there can be but little difference in the chemical action of bleaching and aging.

T. L. Penn, Bandana Roller Mills, Bandana:

As above mentioned, it causes fresh flour to look as if it had been stored for four or five months, improves the color and gives my customers better satisfaction by the improvements. If grades are disarranged, I don't know about that. Can't tell you the effect on the market, only as to my output. I know that it gives better satisfaction than before I installed the process, and besides, my experience at my table and of my cook. Cook says that it makes up better, and, therefore, is better, and color is improved, so that it is better, and all around suits my customers much better.

R. U. Kevil & Sons, Mayfield, by J. U. Kevil:

The trade considers "patent" flour to be the whitest flour, and from the best portion of the wheat.

"Straight" flour is considered second to the patent and also entire wheat flour. The patent flour is a few shades whiter, and is made mostly from middlings.

"Straight" flour is made from stock not so good.

This mill puts 70 to 75 per cent into patent, and the balance, with the exception of low grade, into the straight.

The agents for the bleaching process claimed that it purifies and ages flour and whitens it. The process seems to take most of the moisture from the flour, and whitens it several shades. The public demands white flour. The uninformed trade or consumer judges flour by the color. The dealer likewise has to consider color. The consumer in this section judges it by color and bread, but no matter how nice the bread, it is unsatisfactory without being white.

From what we have read on this subject and from our experience and knowledge of it, we do not believe it is injurious. We believe it is beneficial to flour, and especially so to flour made from new, soft winter wheat. Do not remember date of introduction. Our firm has used it from 5 to 6 years. Most mills increased percentages of patent on installation of bleachers, and have maintained them since discontinuing their use. Discontinuing their use has

caused mills all kinds of trouble, as our people demand white flour. I have taken the same flour to my home catching part of it just before being bleached, and the other just after, and without their knowledge of the trouble, they always complained of the unbleached. We do not think bleaching wi improve flour made from inferior wheat only in color.

C. W. Terry, Miller, Bowling Green Milling Company, Bowling Green:

"Patent" flour is best patent, made of purified middlings.

"Straight" flour is patent and clear run together, or the mill run, called 100 per cent.

"Clear" flour is that which is not best patent flour, and a percentage of the lower grade; the best patent taken out.

Best patent is made from the middlings, is clearer and practically free from all small particles of bran.

Clear flour is made from the tail of mill, and is finish of all middlings and contains more colored matter than the best patent. This mill puts 80 per cent into the best patent, 100 per cent into the straight, and 20 per cent into the clear.

A bleacher was purchased for uniformity in color. No increase was made in the patent. The bleaching process takes off the creamy color to a softer white one. The main purpose in bleaching flour is to age it at once instead of waiting 90 days or four months for nature to whiten it. We make no difference in price whether bleached or unbleached, and we are fully aware that to make good flour, whether bleaching or not bleaching, good wheat has to be ground, nor do we calculate for it to cover up anything bad, for it has to go in good to come out good.

Our opinion as to bleaching, will say that we do not believe it improves the rising quality of the flour, or improves the taste. Nor do we believe that bleaching is injurious to health. If so, we would not use it on our own tables. We go in the market for the best grades of No. 2 wheat, and this same grade of wheat, raised in different localities, does not make the same color of flour, owing to the soil conditions, etc., and the only reason we ever used the bleacher is to put on a uniform color. We millers as a rule always try our best to make the best patent flour to place on the market under our established brands.

Hustonville Roller Mills, Hustonville:

The people who want the flour to make white bread, and rise well in the baking, believe that the "patent" is purest and best material of the wheat.

"Straight" flour is flour made from whole wheat after taking out a small per cent of low grade.

"Clear" flour is after the first or patent is taken out with a small per cent of low grade.

The patent is about 15 per cent whiter than the straight, and about 20 to 25 per cent whiter than the clear. This mill makes three grades when running, 50 per cent goes into the patent, 45 per cent into the clear, and 5 per cent into the low grade. When we bleach we make from 5 to 10 per cent more patent. The agents for the various bleaching processes claim that the bleacher would enable us to compete with the larger mills by making the flour whiter and more of the patent. The bleaching process makes the flour very much whiter, and nothing else, and we are satisfied that no one will ever be injured by bleached flour. To make the flour whiter is all we care to bleach for, so we can furnish the people what they want, white flour. The trade demands white flour, and without it the trade is continually kicking, very noticeably since we discontinued the bleaching.

Our experience is simply this: Before bleaching, the trade was continually demanding white flour, which was almost impossible to furnish. But after the bleacher was put in, everything ran smoothly, and hardly a kick on color was put in the entire time we used it which was about 2½ years. We felt like we were giving the people what they wanted. After trying the bleacher on the second grade, or clear, we found no improvement, and, consequently, cut it off of all grades but the patent. We are satisfied that flour made from inferior wheat cannot be helped by bleaching.

Dillon E. Mapother, No. 16 Board of Trade, Louisville:

"Patent" flour varies from 30 to 40 per cent of the best of the wheat.

"Straight" flour is 98 or 100 per cent of the wheat—only the mill feed cut out.

"Clear" flour is the residue from the patent, varying in quality as to per cent of patent.

The patent has better color than the straight. The clear still lower color than the straight.

The bleaching process improves the color, and, in my opinion, is of advantage, while I do not think deleterious effects are appreciable. The main purpose in bleaching flour is to improve its appearance. In most cases color is the only guide as to the market value of the flour.

I consider it advantageous, for the consumer desires white flour, and when bleached, the cheaper grade, say 90 per cent, will show as good color as possibly a 70 per cent unbleached.

Under bleaching, the patents were produced at lower cost because satisfactory color was produced with a much larger per cent yield from the grain, and I hardly think this any advantage to the trade or consumer of flour.

JUDGE FOSTER'S FINDINGS AGAINST BLEACHED FLOUR.

UNITED STATES DISTRICT COURT, EASTERN DISTRICT OF LOUISIANA.

UNITED STATES OF AMERICA, Libellant,
vs.
420 Sacks, Et Al. of Flour.

No. 14173.

* * * Now, after due consideration and upon all of the testimony, records, files and proceedings herein—

The Court finds; that there is testimony and evidence tending to prove the allegations of the libel, and accordingly,

That all of the flour described in said libel was and is liable to be proceeded against in this Court and seized, condemned, confiscated and destroyed as adulterated and misbranded and deleterious food within the meaning of the Food and Drugs Act, approved June 30th, 1906, in this, to-wit; that all of said flour was, by the claimant herein, the Aetna Mill and Elevator Company, before shipping the same from Kansas into Louisiana, bleached and whitened by treating all of the same by a process known as the "Alsop Process" whereby and by means and reason thereof

(a) A substance known as "nitrites" has been and is mixed and packed with said flour so as to reduce and lower and injuriously affect its quality and strength;

(b) That said flour was and is mixed, colored and stained in a manner whereby damage and inferiority is concealed;

(c) That said flour contains added poisonous and added deleterious ingredients, to-wit: nitrites, which renders the same injurious to health.

And that said flour was and is misbranded within the meaning of said act, in this, to-wit:

(a) That it was offered for sale under the distinctive name of another article,—that is to say, the said flour was offered for sale as "High Patent Flour," whereas, in truth and in fact, it was inferior to "Patent Flour" and was a mixed flour consisting of "Straight Flour" mixed with "Clear Flour."

(b) That it was labelled and branded so as to deceive and mislead the purchaser, that is to say, each of said sacks and other packages containing said flour was labelled and branded in substance as follows: "Aetna Mills—Aetna Silk—High Patent—Aetna Mills and Elevator Company, Wellington, Kansas," whereas in truth and in fact none of said flour was "Patent Flour," but, on the contrary, all thereof was and is a mixture of straight flour made in July, 1909, out of a mixture of hard and soft new winter wheat, to which "Straight Flour" there was added and mixed a quantity of "Clear" old wheat "Straight Flour" there was added and mixed a quantity of "Clear" old wheat flour, amounting to 15 or 20 per cent of said mixture.

It is therefore, ordered, adjudged and decreed that said flour (except that which has been released by order of Court), be, and all of same is hereby condemned and confiscated to the United States of America, as being a food adulterated, misbranded and of a poisonous and deleterious character, and that all of the same be destroyed by the Marshal, and that the said libellant, the United States of America, have and recover of and from the Aetna Mill and Elevator Company, the owner and claimant herein, the costs and charges allowed by law.

New Orleans, La., March 15th, 1910.

(Signed) RUFUS E. FOSTER,
Judge.

JUDGE McPHERSON'S CHARGE AND THE JURY VERDICT AGAINST BLEACHED FLOUR.

IN THE DISTRICT COURT OF THE UNITED STATES, WESTERN DISTRICT OF MISSOURI, WESTERN DIVISION.

United States of America,
vs.
Six Hundred and Twenty-five (625) Sacks of Flour.
Lexington Mill and Elevator Company, Claimant.

No. 285.

THE CHARGE TO THE JURY BY THE COURT, Smith McPherson, Judge.

(Italics by the Court.)

April 9th, 1910, Arba S. Van Valkenburgh, the then United States Attorney for this Judicial District, in his official capacity as such officer filed with the clerk of this court a pleading designated by law as a libel. Later on, to-wit, May 19th, 1910, Mr. Van Valkenburg as such officer as aforesaid filed an amended libel in the name of the United States of America, which in effect charged that the said claimant, the Lexington Mill and Elevator Company, April 1st, 1910, sold and shipped from Lexington, in the State of Nebraska, to a grocer by the name of B. O. Terry at and of Castle, in Sullivan county, Missouri, a shipment of flour containing six hundred and twenty-five (625) sacks of flour of forty-eight pounds of flour to the sack. The said libel charges the route of shipment, namely, over two or more connecting railroads between the two said points. The said Terry buying said flour and receiving said shipment for the purpose of retailing said flour to consumers at the said town of Castle and to his customers in the vicinity thereof, and for said purposes the said Lexington Mill and Elevator Company made said shipment.

It is further charged in the said libel, that is to say, that the flour in question was treated by a process for bleaching flour known as the Alsop Process, which process consists of the generation, by means of electricity of nitrogen peroxide gas which is mixed with atmospheric air, and the mixture brought into contact with the flour in a state of agitation, and that the flour was thereby caused to be adulterated in certain particulars, namely: —

a. In that substances known as nitrites or nitrite-reacting material have been mixed and packed with the flour so as to reduce and lower and injuriously affect its quality and strength in these respects among others, to-wit: That the capacity of the said flour to change and improve as it would have changed and improved if aged by natural processes has been destroyed; That by direct action the elasticity of the gluten has been lessened and im-

paired so as to injuriously affect the bread-making qualities of the flour; That other constituents of the flour have been injuriously affected so as to reduce, lower and impair its bread-making qualities.

b. In that by the treatment of the flour by the Alsop Process it has been mixed, colored and stained in a manner whereby damage and inferiority is concealed in these respects among others, to-wit: That the inferiority of freshness or newness, an inferiority which is present in flour freshly milled and which manifests itself among other things, in inferiorities of color, of elasticity, of gluten, and of the quality of other ingredients which affect its value for bread-making purposes, is thereby concealed; That said flour has been caused to simulate the appearance of flour which has been properly aged and conditioned by natural processes after being milled; That this treatment by the Alsop Process has concealed the inferiority of said flour and has given it the appearance of a better grade of flour than it really is, and further that the flour was when milled, when bleached, and now is, of a grade of flour inferior to a patent flour and inferior to the flour made from the first quality of hard wheat, and that by the Alsop Bleaching Process it has been caused to have the appearance of a Patent flour and of a flour made from the first quality of hard wheat, and that thereby the inferiority of said flour was and is concealed and that in other respects also the inferiority of said flour was and is concealed.

c. In that by the treatment as aforesaid the said flour has been caused to contain added poisonous or other added deleterious ingredients to-wit, nitrites or nitrite-reacting material, which may render said flour injurious to health.

The amended libel further charges that said flour is misbranded in substance as follows:

a. That the bags and sacks containing such flour were labeled as follows:

"L. 48, Lexington Cream XXXXX Fancy Patent. This flour is made from the first quality hard wheat."

That in truth and in fact a patent flour is, and is known and recognized to be, the best grade of flour, and which consists only of that portion of the flour content of the wheat known as the "middlings." But that the flour contained in said sacks is not patent flour, but is a grade and quality of flour inferior to patent flour being a mixture of middlings together with a commercially inferior grade of flour, and a flour which before bleaching was darker in color than a patent flour and inferior in grade, quality and strength to patent flour, and that this mixture was shipped into Missouri labelled under the distinctive name of another article, and was labelled so as to deceive and mislead the purchaser, in the respect that it purported to be a patent flour whereas in truth and in fact it is not a patent flour.

b. That the label on each sack contained a statement, "This flour is made of first quality hard wheat," whereas in truth and in fact the flour was not made of first quality hard wheat, but was milled in whole or in

part from a grade or grades of wheat inferior to first quality hard wheat, namely, "yellow berry," and other inferior wheat, and was sold under the distinctive name of another article than itself, and that the flour seized purported to be made from the first quality of hard wheat, whereas in truth and in fact it was made in whole or in part of wheat inferior to the first quality hard wheat, namely, "yellow berry" and other inferior wheat and therefore was sold under the distinctive name of another article than itself and was misbranded within the meaning of the Act of Congress.

To this amended libel which contains the government's charge and a statement of its alleged cause of action, the Lexington Mill and Elevator Company, claimant herein, has filed its answer, which in substance and meaning states:

That the Lexington Mill and Elevator Company is interested in the flour seized; that the same was manufactured at its mill in Lexington, Nebraska, and sold to B. O. Terry of Castle, Missouri, and was shipped from Lexington, Nebraska, to Terry at Castle, Missouri, under a guaranty that the same was not adulterated; that the claimant has not been paid for the flour, but that after the seizure, was required to and did furnish Terry other flour in lieu of the flour seized; that if the flour seized be condemned, claimant will suffer loss to the extent of its value, namely, Seven Hundred and Fifty ($750.00) Dollars; it admits the shipment of the flour by the route alleged in the libel, and that the flour was branded as indicated by an amendment to the amended libel.

It admits that the flour was treated by a process known as the Alsop Process, but denies that the same was adulterated within the meaning of the Act of Congress, and denies that any substance known as nitrites or nitrite-reacting material has been mixed or packed with the flour or any part thereof so as to injuriously reduce or lower its quality or strength in any respect whatever, and denies that the flour has been mixed, colored or stained in a manner whereby damage or inferiority is concealed in any respect whatsoever, and denies that the same has been treated in any manner whereby the grade or the quality of the flour has been concealed, and denies that the treatment of the flour has given it the appearance of a better grade of flour than it really is, and denies that any of the flour is inferior to a patent flour, and denies that any of the same was when milled or now is of a grade of flour inferior to a grade of flour made from the first quality of hard wheat, and denies that the quality of said flour or wheat from which it was made was in any manner concealed, and denies that the same or any portion thereof has been caused to contain any added poison or other added deleterious ingredient which may render said article injurious to health.

It admits and alleges that the flour was labeled as the evidence shows it to have been labeled, but denies that so-called patent flour is known or recognized to be a grade of flour consisting only of that portion of the content of the wheat known as "middlings," and says that it is not true that

the flour contained in said sacks is not patent flour, or that it is of a grade or quality inferior to patent flour, or that it is a mixture of middlings together with a commercially inferior grade of flour, or of a flour which was of a darker color than a patent flour, or inferior in grade, quality or strength to a patent flour, and denies that the flour was mixed and shipped into Missouri and sold under the distinctive name of another article than itself, or that the same was labeled in any manner so as to deceive or mislead the purchaser, or that it did deceive or mislead the purchaser in any respect whatever.

It admits that the sacks were labeled as the evidence shows them to have been labeled, but denies that the flour was made in whole or in part from a grade of soft wheat, or that it was sold under the name of an article different from what it really was, or that it was in any respect misbranded.

It admits that the flour was treated by the Alsop Process and in that connection alleges that the process consists of generating, in rapid succession, a flaming electric discharge in a current of air in proximity to such electric discharge, and in conducting the air, as modified by such discharge, into the presence of the flour as it is being continuously passed through a revolving reel or agitator, but denies that the flour was in any way adulterated or that by the process any poisonous or other deleterious ingredient has in any manner been added thereto or imparted thereto, or that the flour is in any way injurious to health or contains any added deleterious ingredient, or that the same is adulterated in any manner, or that by such process any damage or inferiority is in any manner concealed, or that the quality or strength of the flour is in any manner reduced or lowered.

To this answer the government by its counsel has filed a reply.

On the issues thus outlined as contained in the amended libel, and the answer and reply, this case is to be determined.

By reason of the libel heretofore referred to, a writ of seizure was issued by the order of this court commanding the United States Marshal for this District to seize the said shipment of flour and the Marshal still holds the same subject to the further orders of the Court herein.

The statute under which this proceeding was brought and the case now being tried is an enactment of the Congress of the United States approved by the then President June 30th, 1906 (four years ago). This statute as to its validity is challenged by the claimant herein. But with that question you have no concern other than to observe it, because the court holds that the Congress of the United States with the approval of the President had the power under the Constitution of the United States to enact the statute that was enacted and under which we are proceeding, and the Court holds and so directs you that the statute is a valid enactment, and to be enforced in any and all cases where the evidence and the facts come within the wording of the statute.

This statute is named "The Food and Drugs Act," and is an act for

preventing the manufacture, sale or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein, and for other purposes. It will be observed that the statute deals with drugs, medicines, liquors, and foods, a part of the statute is with reference to drugs, medicines and liquors, and likewise confectionery but with which in this case we are not concerned except as the same has a bearing with reference to foods. That part of the statute with reference to foods reads as follows: "That for the purposes of this act an article shall be deemed to be adulterated in the case of food:

"First: If any substance has been mixed and packed with it so as to reduce or lower or injuriously affect its quality or strength * * *

"Fourth: If it be mixed, colored, powdered, coated or stained in a manner whereby damage or inferiority is concealed.

"Fifth: If it contain any added poisonous or other added deleterious ingredient which may render such article injurious to health."

The statute further prohibits the misbranding of articles of food and provides in substance as follows:

"That the term 'misbranded' as used herein shall apply to articles of food or articles which enter into the composition of food, the package or label of which shall bear any statement regarding such article or the ingredient or substances contained therein which shall be false or misleading in any particular."

Any statement or expression of opinion by the court during the trial of this case with reference to any fact or alleged fact or any criticism by the Court of any witness or party or counsel on either side, are each and all withdrawn, and you will treat and consider the case as if such statements or criticisms by the Court were not made. And I charge you to give no consideration to the same or any part thereof.

You are the sole judges of the facts in this case. Much testimony in this case was given by scientists and experts who testified before you. The testimony of the experts as to their opinion is not binding upon the jury and is merely advisory and may be given such weight by the jury as the jury may deem proper in view of all the facts and circumstances in evidence, or such expert testimony may be wholly disregarded by the jury in arriving at their verdict.

While you are the judges of the facts and of the testimony and what weight shall be given thereto regardless of expressions of opinion by me, it is my belief that I can be of substantial aid to you in stating some facts which in my opinion are so well established by the evidence as that you ought to have but little or no argument with reference thereto, and take the same as established facts.

However, notwithstanding my statements or expressions of opinion with reference to any fact in the case, you are to remember that you are the sole judges of the facts in the case, and of all deductions to be made therefrom.

It is an established fact and concerning which there is no conflict in the testimony that the flour in question in this case was transported fr m Lexington, Nebraska, to Castle, Missouri, in interstate commerce and was subject to seizure for confiscation, if it is adulterated or misbranded in any respect or particular alleged in the amended libel.

It is also an established fact in the opinion of the court that the flour seized and in question was made from wheat of a 1909 crop grown in the State of Nebraska and known by the name of No. 2 Turkey Wheat, and that the wheat was ground at the claimant's mill at Lexington, Nebraska, on the night of March 31st, 1910, and shipped the next day to the said Terry at Castle, Missouri, by whom it was received in about seven days.

It is also an established fact in the opinion of the Court that the wheat from which the flour was made contained a percentage of what is called yellow berry wheat. The witness, Mr. Tucker, the head miller of claimant, testified that the yellow berry was about or approximately ten to twenty-five per cent of the entire amount of the entire wheat used to make the flour in question that has been seized in this case, and the testimony of other millers in Nebraska and Kansas shows that the wheat called "yellow berry" is frequently, indeed commonly, found mixed with turkey wheat as it is grown in those states, and that the percentage of such yellow berry varies, frequently running higher than fifty or seventy-five per cent of the turkey wheat produced in various places and communities in said states. And there is evidence to the effect that but a small part, probably about one per cent of the turkey wheat produced in the various places in these states which are referred to in the testimony, that is wholly free from the yellow berry wheat. And it appears that it is the common practice of millers in Kansas and Nebraska to mill turkey wheat mixed with this yellow berry.

It is admitted that the flour seized in this case was treated by the Alsop Process for the purpose of bleaching and whitening the same; that that process employs a gaseous substance referred to in the testimony as nitrogen-peroxide gas—NO_2, or $N_2 O_4$.

It appears that nitrogen-peroxide gas is—in concentration— a brownish or yellowish gas heavier than atmospheric air, of offensive odor, corrosive in character, and a poisonous and deleterious substance, and if taken by a human being in sufficient quantities will produce poisonous action and death.

It appears that when nitrogen-peroxide gas is brought into contact with water or moisture, there is by chemical change produced nitrous acid and nitric acid in equal quantities, and it also appears that each of these acids so produced is a poisonous and deleterious substance which if taken by a human being in sufficient quantities will produce poisonous action and death.

It appears that the water or moisture content of flour is equal to about ten or twelve per cent of the total weight of the flour, amounting to about five pounds of each of the sacks seized or about twenty pounds in a barrel of flour.

It appears that nitrous acid readily combines chemically with other sub-

stances such as are contained in wheat flour and thereby forms nitrites of various kinds, depending upon the character of the substances with which the acid chemically combines.

It appears that such nitrites as may be formed by the introduction of nitrous acid into flour are poisonous and deleterious substances and that if taken by a human being in sufficient quantities will produce poisonous action and death.

It appears that nitric acid readily combines chemically with other substances such as are contained in wheat flour, and thereby forms nitrates of various kinds depending upon the character of the substances with which the acid combines.

To enable the government to obtain a verdict at your hands in its favor, it is required to furnish such a measure of evidence as to sustain the allegations of the amended libel by a fair preponderance of the evidence. By a fair preponderance of the evidence is meant a greater weight of evidence and it is sufficient if it satisfies your mind that the allegations which it supports are true without regard to which side produces the evidence or the witnesses giving the same. It is not incumbent on the government to show that the allegations of the amended libel in a case like this are true beyond a reasonable doubt. Proofs beyond a reasonable doubt are only exacted in a criminal case, and this is not a criminal case within the meaning of that rule, but it is an action in the nature of a civil action. You are the judges of the weight of the evidence, and of the credibility of the witnesses, and it is for you to say what the truth is.

It is incumbent on the government to prove that the flour seized was adulterated and misbranded in *some* repect or particular alleged in the libel. But it need not prove that the flour was adulterated or misbranded in *all* of the respects and particulars alleged. If it appears from the evidence in this case that the flour was adulterated in *any* respect or particular alleged, then you must find for the government that the same was adulterated, and if it appears in the evidence that the same was misbranded in *any* respect or particular alleged, then you must find for the government that the same was misbranded. On the other hand, if you find that it was not adulterated in any respect or particular alleged, then you must find against the government on that issue. And if you find that it was not misbranded in any respect or particular alleged, then you must find against the government on that issue.

One of the issues submitted to you is the alleged violation of the first subdivision relating to food in Section 7 of the Act, which in substance declares an article of food to be adulterated if any substance has been mixed and packed with it so as to reduce or lower or injuriously affect its quality or strength.

Upon this point the substance of the charges made by the Government is, (a), that the capacity of the flour to change and improve as it would have changed and improved if aged by natural processes, has been destroyed by the

treatment of the flour by the Alsop Process whereby substances known as nitrites or nitrite-reacting material have been mixed and packed with the flour, and, (b), that by direct action of such process the elasticity of the gluten has been lessened and impaired so as to injuriously affect the bread-making qualities of the flour. And, (c), that other constituents of the flour have been by such process injuriously affected so as to reduce, lower, and impair its bread making quality.

On the first branch of this particular issue it appears that wheat flour improves by lapse of time and processes of natural aging. I charge you that if the treatment of this flour by the Alsop Process for the purpose of bleaching and whitening resulted in any injury to the capacity of the flour to change and improve as it would have changed and improved if aged by natural processes, that your finding must be for the government that the flour is adulterated.

On the second branch of this particular issue, I charge you that if you find from the evidence that by the direct action and as a result of the treatment of this flour by the Alsop Process the elasticity of the gluten has been lessened or impaired so as to injuriously affect the bread-making qualities of the flour, that your finding must be for the government that this flour is adulterated.

On the third point of this particular issue, the government claims that the treatment of this flour by the Alsop Process caused substances known as nitrites or nitrite-reacting material to be mixed and packed with the flour so as to reduce, lower and impair its bread-making qualities, and so as to render the same injurious to health. If you shall find from the evidence that the flour seized was by such treatment so injured, your finding must be for the government that this flour was adulterated.

The substance of the charges of the government that this flour is adulterated in violation of the fourth subdivision relating to food of Section Seven of the law in question, is that by the treatment of the same by the Alsop Process the flour has been mixed, colored and stained in a manner whereby damage or inferiority is concealed in these respects, namely, (a), that the said flour has been caused to simulate the appearance of flour that has been naturally aged and conditioned by natural processes after milling; (b), that the treatment by the Alsop Process has concealed inferiority in said flour, and has given it the appearance of a better grade of flour than it really is; (c), that the flour is of a grade inferior to patent flour and inferior to flour made from the first quality of hard wheat, and that treatment of the same by the Alsop Process has caused it to have the appearance of a patent flour and of a flour made from the first quality of hard wheat.

It appears from the evidence in this case that wheat flour when freshly made is inferior to what that same flour will become by the lapse of time and the processes of natural aging and conditioning; that the inferiorities of freshness or newness manifest themselves in inferority of color, of elasticity of the gluten, and of the quality of other ingredients which affect its value for bread-making purposes; and it further appears that by the lapse of time and aging and conditioning by natural processes wheat flour will improve for a period of

time, stated to be from two to four months, or thereabouts; and that such improvement increases the value of the flour and makes it lighter in color; and it further appears that this bleaching process makes the freshly milled wheat flour appear to be like and to simulate the appearance which that same flour will assume after natural aging and conditioning. And it further appears that this flour when seized was not naturally aged or conditioned, but was newly milled flour.

On this branch of this particular issue it is for you to say in the light of all these facts and all the evidence whether or not the inferority of freshness or newness was concealed by the bleaching process.

On the second branch of this particular issue, I charge you that if treatment by the Alsop Process has given to this flour the appearance of a better grade or quality of flour than it really is, you should find for the government that it is adulterated. And upon the third branch of this particular issue, I charge you that if you find from the evidence that this flour is of a grade of flour inferior to patent flour or is a flour inferior to flour made from the first quality hard wheat, and that bleaching by the Alsop Process has caused it to have the appearance either of a patent flour—as that term will be explained to you in this charge—or the appearance of a flour made from the first quality of hard wheat, then you must find for the government that this flour is adulterated.

The government charges adulteration of this flour in violation of the fifth subdivision relating to food of the section of the statute under which we are proceeding. The words of that provision are as follows: "If it (in this case meaning flour) contains any added poisonous or other added deleterious ingredient which may render such article (in this case meaning flour) injurious to health."

The substance of the charge found in the amended libel is that by the treatment of the flour by the Alsop Process it has been caused to contain added poisonous and other added deleterious ingredients which may render the same injurious to health, to-wit: Nitrites, nitrite-reactiug material, nitrogen peroxide gas, nitrous acid, nitric acid, and other poisonous and deleterious ingredients and substances.

It is the claim of the government that if the flour contain any added poisonous or other added deleterious ingredient of a kind or *character* which may render (that is, which is capable of rendering) such article injurious to health, it is adulterated, and should be condemned for confiscation.

On the other hand, it is the claim of the claimant that even though the flour contain added poisonous or other added deleterious ingredient, it may not be condemned unless it shall further appear that such added substances are in such quantity that the flour shall be thereby rendered injurious to health.

This statute was enacted for the purpose of benefiting and protecting the consumer, which in this case means those who eat bread and cake and pastry and gravy and other products made from wheat flour. This was the purpose

that Congress had in mind when it enacted this statute. And in enforcing this statute in proper cases the fact that it will subject the millers to some expense, or the fact, if it be a fact, that it will enable the millers to market their flour more readily or at a better price, is entitled to no consideration and will receive no weight at your hands.

It will be noted that the act does not say, "any added poison," but does say "any added poisonous ingredient." The word "poisonous" as an adjective conveys a descriptive meaning and is used in a qualitative sense and not in a quantitative sense. That is, it refers to the kind of substance, and not to the quantity of the substance. This idea or meaning is further emphasized and rendered more certain by the qualifying clause "which *may* render such article injurious to health." It does not say "which *does* render such article injurious to health," but manifestly it was the purpose of congress to include in this distinction all ingredients of a *poisonous character* to which in their essential nature might be ascribed the tendency to affect health injuriously.

This statute is essentially a remedial one, for the correction of known or supposed abuses with respect to the adulteration of food and other articles of human consumption. It is primarily a statute of prevention. Its meaning is made clear when its purpose is known and borne in mind.

It is not conceivable that the Congress of the United States, when it passed this act, intended that producers and vendors might continue to add poisonous and other injurious substances to food so long as the quantity added was not sufficient to produce observable poisonous or injurious effects upon the health of consumers, nor is it conceivable that Congress intended to require that the government before proceeding to condemnation of an article of food as adulterated must prove that it contains added poisonous or other added deleterious ingredient in such a quantity as *would* render such article injurious to health. It is known to everyone that there is no method of ascertaining or measuring the effect of the consumption of such substances in food upon the public health or upon the health of any particular individual.

It is clear that it was intended by Congress to prohibit the adding to food of any quantity of the prohibited substances.

The fact that poisonous substances are to be found in the bodies of human beings, in the air, in potable water, and in articles of food, such as ham, bacon, fruits, certain vegetables, and other articles, does not justify the adding of the same or other poisonous substances to articles of food, such as flour, because the statute condemns the adding of poisonous substances. Therefore the court charges you that the government need not prove that this flour or food stuffs made by the use of it would injure the health of any consumer. It is the *character*—not the *quantity*—of the added substance, if any, which is to determine this case.

The flour seized in this case is an article of food within the meaning of the Act of Congress. And if the treatment of the same by the Alsop Process caused it to contain any added poisonous or other added deleterious ingredient of a kind or character which may render the same injurious to health,

then it is adulterated and must be condemned.

It is admitted that this flour was treated by the Alsop Process for the purpose of bleaching or whitening, and the evidence establishes that nitrogen-peroxide gas was employed for that purpose and further establishes that that gas, nitrous acid, nitric acid and nitrites of the kind which may be produced by such treatment are poisonous and deleterious substances, and that these substances when taken in sufficient quantities will produce poisonous action or death.

It appears from the evidence in this case that the bleaching process imparts and adds to flour substances referred to in the testimony as nitrites or nitrite-reacting material, and such substances were imparted to the flour seized in this case by the bleaching process. It further appears from the evidence that such substances so imparted or added to this flour are qualitatively both poisonous and deleterious, that is to say, that these substances are of a poisonous and deleterious character.

It is well known that wheat flour is not eaten raw. There is evidence in this case that tends to show that during the process of making bread nitrites or nitrite-reacting material contained in the flour is lessened and may be eliminated under some circumstances, but it is also well known that wheat flour is used for the making of other articles of food—biscuits, dumplings, pastry, cake, crackers, gravy, and perhaps other articles of food, which may be consumed by all classes of persons, the young, the old, the sick, the well, the weak, and the strong; and I charge you that it is right for you in reaching your verdict to take these facts into consideration together with all the other proven facts and circumstances in the case.

With reference to the issue as to misbranding, the same divides itself under two heads, one with reference to quality of the flour, and the other with reference to the kind of wheat from which it was made. The flour is branded as a fancy patent flour and it is also represented by label on each sack that the flour is made of first quality hard wheat.

There is much dispute in the evidence as to the meaning of the phrase "patent flour." Some of the witnesses for the government testified in substance that the phrase had a well defined meaning among millers, bakers and in the flour market generally, and that it means that the flour so called patent flour, is less than the total flour content of the wheat, and includes what is known in the milling process as the purified middlings, but it is not claimed by the government nor any of the witnesses that patent flour is or contains any definite or specific percentage of the total flour content of the wheat. On the other hand, some of the witnesses for the claimant testified that the phrase "patent flour" has no definite or recognized meaning among millers, bakers, flour dealers or elsewhere, and that flour containing the total flour content of the wheat excepting low grade, sometimes called "red dog," is labeled and sold in the market as "patent flour."

It is the law that if the phrase "patent flour" has a well known and well understood meaning generally among millers, flour purchasers, bakers, and

in the flour markets of the country, then such meaning as so understood is to be attributed to that phrase. In other words, patent flour is the kind of flour that it is generally understood to be by millers, bakers, flour purchasers and in the markets generally. You are, therefore, to determine, first, Has the phrase "patent flour" any well defined and well known meaning? And, second, Is the flour seized that kind of flour, namely, "patent flour?" If it is, your finding must be against the government on this branch of the case. But if it is not a patent flour, as that phrase is understood as heretofore explained, your finding must be for the government upon this branch of the case.

On the second branch of the charge of misbranding contained in the amended libel, the facts appear to be that the flour seized was manufactured by the claimant at its mill from wheat which was raised in the year 1909 in the general vicinity of Lexington, in the State of Nebraska; that the wheat weighed about fifty-nine pounds to the bushel, and was of a variety known as No. 2 Turkey wheat, in which there was a quantity of wheat known as yellow berry, or, as sometimes called by millers, "yellow belly," amounting to from ten to twenty-five per cent of the total wheat used to make this flour. The wheat known as yellow berry is commonly found in Nebraska and Kansas growing with turkey wheat. It differs in color and quality from pure turkey wheat, and is considered by the millers less desirable and is of less value commercially.

The words upon each sack, "This flour is made of first quality hard wheat," are in effect a representation that the flour was made from first quality hard wheat.

You are to determine whether or not that representation is true. And in so doing you will not be controlled by the fact, if it be a fact, that the wheat used was the best grown in the district where claimant procured his supply for milling, but you have a right to consider the same in comparison with other wheats grown in different places and parts of the country as disclosed by the evidence in the case, and in the light of all of the evidence on this question say whether or not the wheat used was in truth and in fact first quality hard wheat.

I am now about committing this case to you gentlemen for decision. We have been engaged in this trial continuously for five weeks of time, during most of which the weather has been oppressively and well-nigh unbearably hot. Your work, as well as that of all of the counsel in the case and my own work, has been exceedingly laborious and fatiguing. I commend you for the patience you have given to the testimony and to the argument of counsel. I have the right to insist and do insist that you now take this case to your room and give both the facts in the case and that law as I have given you in charge your best and most deliberate judgment. In view of statements that have been made by counsel during the progress of this case, you will not consider and you must put to one side all questions of who the counsel are, or where they are from. This is not a contest between states or sections of the country. Ours is but the country, and this enactment by Congress is

for the entire country. The fact that the Patent Office at Washington issued a patent for the Alsop Process has nothing to do with the question of branding correctly, or misbranding of flour. The fact that the Patent Office issued a patent for the Alsop Process does not warrant nor authorize the adulteration of flour as made by the Alsop Process, if it is adulterated. All these things must be put to one side, and your verdict must be determined in accordance with the law and facts in the case. It is of no importance to you, nor is it of importance to me, who will be pleased or displeased in this case, whether of counsel or of the parties, or of any other persons. The only question is, What is the right and what the wrong of this case?

Your verdict must recite whether this flour was misbranded or not, and your verdict must further recite whether this flour was adulterated or not, within the meaning of what I have heretofore said to you. And that there may be no uncertainty as to your verdicts, I hand you two pairs of verdicts. Your foreman will sign the one of each pair and bring the same into court for record, the other of each pair having been destroyed by you. And you will make no other findings than these two. All matters bearing on these two forms you will give due weight thereto, and all matters not having a bearing thereon you will utterly disregard.

You will observe that one of these pairs of verdicts I now hand you is with reference to misbranding. If the flour seized was misbranded in any particular as alleged in the amended libel, your foreman will sign the one thus reciting, but if not misbranded in any particular as alleged in the amended libel, your foreman will sign the other. You will also observe that I hand you a pair of verdicts with reference to adulteration. If the flour seized was adulterated in any one of the ways or methods as alleged in the amended libel, your foreman will sign the one reciting the adulteration; if you do not so find, your foreman will sign the other. You will now take the case.

VERDICT.

We, the jury, find that the flour seized in this case is adulterated.

July 6, 1910. JOHN W. THOMASON, Foreman.

VERDICT.

We, the jury, find that the flour seized in this case is misbranded.

July 6, 1910. JOHN W. THOMASON, Foreman.

KENTUCKY
AGRICULTURAL EXPERIMENT STATION

OF THE

STATE UNIVERSITY.

BULLETIN NO. 150.

THE PRESERVATION OF DRUGS

LEXINGTON KY,
SEPTEMBER 25, 1910.

Kentucky Agricultural Experiment Station

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Address:
KENTUCKY AGRICULTURAL EXPERIMENT STATION,
Lexington, Ky.

THE PRESERVATION OF DRUGS.

By Linwood A. Brown, Drug Chemist, Food and Drug Division.

One of the most essential branches of Pharmacy is the preservation and keeping of drugs. This has been taught in all our schools and colleges of Pharmacy to a limited extent, but has not received the time, attention and thought that the subject demands.

This subject becomes of vastly greater importance today, because of the unprecedented growth and development in all the contributory sciences to Pharmacy.

Modern organic chemistry is opening a vast field of research, and the thousand and one new synthetic organic compounds and "near" compounds which have flooded the drug market within the last decade, are only a beginning.

Many new drugs, chemicals, preparations, etc., ofttimes of a very unstable nature, are constantly being added to the already long list of such now being used by the physician, in his combat with disease, and it is through the druggist's hands that these, as well as the older and more familiar drugs, must reach the consumer in good, no—in perfect condition.

The point which we wish to emphasize in this bulletin, is this—*no matter what quality of drugs is bought, nor how carefully a preparation may have been made by the druggist, there is always a possibility of deterioration, change of strength, and loss of medicinal properties, unless the drug has been properly kept, stored or handled.*

The Pharmacopoeia in a great many instances, states the proper care that should be given to such, in order to preserve the strength and quality of the preparation. But the druggist himself must make use of his ingenuity and the experience of others, as reported in the different drug journals, in the keeping and handling of a large number of preparations not mentioned in the Pharmacopoeia or National Formulary.

It is the object of this bulletin to suggest and discuss means

of preserving and keeping drugs which are liable to deteriorate or spoil, and to thus aid the druggist in complying with the provisions of the drug law.

The public is gradually awakening to the fact that it can have pure drugs, and has caused to be passed such laws as will secure the needed results.

The passage and subsequent enforcement of the Federal Food and Drugs Act of June 30, 1906, have so plainly shown the need of such control, that almost every state in the Union has either adopted the Federal Act or has passed laws in close agreement with it.

The Kentucky Food and Drugs Act of March 13th, 1908, defines a drug as follows:—

"Sec. 5. That the term drug, as used in this act, shall include all medicines and preparations recognized in the latest revisions of the United States Pharmacopoeia or National Formulary, for internal or external use, and any substance intended to be used for the cure, mitigation or prevention of diseases, either of man or other animal, and shall include paris green and all other insecticides and fungicides."

This clearly defines what is meant by the term drug, and the law states further, in Section 6:

"That for the purpose of this act, an article of drug shall be deemed to be adulterated:

First. If, when a drug is sold under or by the name recognized in the United States Pharmacopoeia or National Formulary, *it differs from the standard of strength, quality or purity,* (italics added) as determined by the tests laid down in the United States Pharmacopoeia or National Formulary official at the time of investigation.

Provided, That no drug defined in the United States Pharmacopoeia or National Formulary shall be deemed to be adulterated under this provision if the standard of strength, quality or purity be plainly stated upon the bottle, box, or other container thereof, although the standard may differ from that made by the test laid down in the United States Pharmacopoeia or National Formulary.

Second. If the strength or purity fall below the professed standard of quality under which it is sold."

This plainly shows that drugs, when sold in Kentucky, must conform to the Pharmacopoeia, or, if not, their strength or

purity must be plainly stated on the label. This point has been explained more fully in regulations gotten out by representatives of the Kentucky Medical Association, Kentucky Pharmaceutical Association, and the Director of the Experiment Station as provided in the law.

In order to present such a diversified subject in as clear and concise a manner as possible, we have divided the subject into four groups which will be taken up for discussion, in the order here given.

First—Crude Drugs.
Second—Chemicals.
Third—Preparations.
Fourth—Miscellaneous Drugs.

PART I—CRUDE DRUGS.

Most crude drugs when received by the druggist in a modern drug store are very seldom in the form in which they are picked or collected, but have passed through the hands of the drug miller and reach the druggist usually in powdered form, ready for percolation or maceration, or other form in which the drug is to be used, although there is a number of crude drugs handled by the druggist, which have not been ground, such as spices, rhubarb, cardamom, compressed herbs, etc.

Many crude drugs when gathered contain a large amount of moisture, varying anywhere from 5 to 80% of the weight, and in order to preserve them and to facilitate comminution, they must be dried, and, owing to their porous nature, are very prone to reabsorb moisture and become mouldy.

The practice of keeping crude vegetable drugs in cardboard or paper containers, or in open drawers, in drug stores, is not good practice, as a great many of them depend for their medicinal properties upon the presence of volatile principles, and when so kept, rapidly lose a considerable portion of such constituents in the hot dry atmosphere of the average drug store. Ofttimes such drugs, when kept in this manner, are stored near a stove or radiator during the winter months, and subjected to its direct heat.

Such drugs should be placed as soon as received, in japanned tin boxes provided with removable labels, and so arranged that odorless drugs will not be kept in close proximity to those

possessing strongly odoriferous principles, thus preventing contamination.

The boxes containing such drugs should be kept in a cool, dry place in the store room, and only sufficient quantity taken from them and kept in the store to supply the immediate counter trade.

Some crude drugs are especially liable to attack from insects, and the insect that is liable to attack some particular drug will depend to a large extent on the nature of the drug, and the physical characteristics of the insect.

The insects most injurious to crude drugs are those provided with strong jaws for biting, and in this class may be cited the mites, many kinds of beetles, and some insects that are injurious in the larva stage.

The mites are small, round, oval insects with eight legs, and the mouth is provided with a beak. There are many species of the mite: some being known as sugar mites, cheese mites, etc.

Cantharides are often attacked by a mite belonging to the genera Glyciphagus. The presence of this pest may be known by the formation of a considerable amount of dust and broken fragments collecting at the bottom of the jar, and by careful examination small whitish objects may be seen moving about in the powder.

Prof. Sayre of the University of Kansas, reports having found a small beetle, Satodrepa panicea, feeding on columbo, aconite, mustard, althea, belladonna, poke root, ginseng, angelica, etc.

Ergot, belladonna root, musk root, powdered senna, powdered jaborandi leaves, sweet almonds, etc., are attacked by species of this same family (Plinidae).

A large number of other drugs is attacked by some form of insects, and large quantities are damaged to such a degree as to prevent their use in pharmaceutical preparations.

Drugs liable to be infected with such insects should be treated with the vapors of carbon bisulphide, chloroform, etc., by placing in tight boxes and placing a wad of cotton, or a sponge, saturated with the remedy to be used, in it, and closing tightly and allowing to stand for about twenty-four hours, until the vapors have had time to thoroughly penetrate the drug, after which expose to air until free from vapors.

Sunlight is also valuable to prevent the growth and destructive action of such insects.

The Pharmacopoeia gives but few specific directions for the keeping of crude drugs, the following being the only instances found.

Ergot.

"Should be moderately dried, and not exposed to a damp atmosphere. After being kept for more than a year, it is unfit for use."—U. S. P.

Chrysarobin.

"Should be preserved in amber colored, glass stoppered vials."—U. S. P.

Conium.

"If kept for more than two years, is unfit for use."—U. S. P.

Camphor.

Owing to its ready volatility, camphor "should be kept in well closed vessels, in a cool place."—U. S. P.

Columbo.

Should be thoroughly dried and kept in a dry place. Should be closely watched for insects, as it is liable to be attacked, if kept for any length of time.

Capsicum.

This drug depends upon its oleoresin for its medicinal properties, and should be kept in well closed containers, in a cool dry place.

Cloves.

Should be kept in well closed containers, in a cool dry place.

Digitalis.

Digitalis should be kept in air tight containers, and in the dark. It has been recommended that it be kept over unslaked lime.

Belladonna Root.

Is very apt to be attacked by insects, unless closely watched.

PART II—CHEMICALS.

Many chemicals contain water of crystallization and are prone to effloresce and give off a part of the water of crystallization, the crystals becoming opaque and unsightly and eventually falling to a powder. Good examples of this are magnesium sulphate, sodium carbonate, Rochelle salts, sodium arsenate, sodium phosphate, zinc sulphate, etc. This is a distinct monetary loss to the druggist, as well as being liable to cause him trouble when such substances are used in preparation of medicines, for the quantities as called for in the Pharmacopoeia are intended to be of U. S. P. composition, which, in the case of crystalline compounds containing water of crystallization, are expected to contain definite amounts of water of crystaliization.

Some, on the other hand, absorb moisture and become entirely liquified, depending upon the nature of the drug, and extent of exposure. Scale pepsin, potassium acetate, sodium and potassium hydroxides, potassium carbonate, granular effervescent powders, etc., while some liquids like glycerin, sulphuric acid, absolute alcohol, and to a lesser extent, alcohol, are hygroscopic, and become reduced in strength or otherwise unfit for pharmaceutical use.

Again, some chemicals are readily affected by the chemical or actinic rays of light, and by exposure to the air are oxidized, or in the case of some very unstable compound, are reduced by contact with organic bodies. Silver, gold, platinum, and mercury salts, are readily reduced or changed by the action of light, or contact with organic substances, also some organic compounds are similarly affected, such as resorcinol, quinine sulphate, santonin, some alkaloids, etc.

Potassium chlorate, nitrate, and permanganate, sulphur, silver oxide, hypophosphites, etc., are so readily affected by contact with organic bodies, that there is always a possibility of an explosion or spontaneous ignition, resulting in disastrous consequences.

Ferrous sulphate, hydriodic acid and its preparations, sulphurous acid, pyrogallic acid, benzaldehyde, oil of bitter almonds, oil of lemon, oil of orange, etc., are apt to absorb oxygen from the air and become deteriorated, while a number of drugs, such as Goulard's extract, lime water, sodium and

potassium hydroxides, ammonia, etc., greedily absorb carbon dioxide on exposure to the air, and are rendered unsightly or unfit for use.

Therefore, in view of the above mentioned facts, the druggist should give particular care to the storing and handling of this class of drugs, if he expects to dispense chemicals of U. S. P. strength and potency.

The following is an itemized list of those drugs liable to be affected as mentioned above, with some suggested means of keeping and storing same.

Benzoic Acid.

Owing to the fact that this acid is distinctly volatile, at ordinary room temperatures, and that it is affected by light, turning darker, the Pharmacopoeia has directed that "it should be kept in dark, amber colored, well stoppered bottles, in a cool place."

Dilute Hydriodic Acid.
Dilute Hydrobromic Acid.

Both of these acids are of a very unstable nature, and when freshly prepared, should be colorless, odorless, liquids, which on exposure to light and air become discolored, liberating iodine or bromine, as the case may be. For this reason, the Pharmacopoeia directs that they shall "be kept in amber colored, glass stoppered bottles, protected from the light."

Dilute Hydrocyanic Acid.

This is another very unstable acid, which is very apt to decompose, forming ammonium formate, carbon dioxide, cyanic acid, and paracyanogen, a polymer of cyanogen, which deposits as a brownish precipitate. It is not known exactly why this change takes place, but the presence of acids or alkali, and the action of light, tend to promote these changes. It should be kept in a cool place, as the acid is quite volatile, and is very apt to fall below the required strength of 2%. "It should be kept in small, dark amber colored, cork stoppered vials, in a cool place." —U. S. P.

Hydrochloric Acid.
Dilute Hydrochloric Acid.

"Should be kept in glass stoppered bottles."—U. S. P.

Nitric Acid—Concentrated and Dilute.

Nitric acid is a powerful oxidizing agent, acting violently on almost all organic compounds. It is decomposed by direct or diffused sunlight, becoming brownish in color, due to liberated oxides of nitrogen. For this reason "it should be kept in glass stoppered bottles."—U. S. P. And as a further precaution, should be kept in dark closets, and in a cool place.

Nitro Hydrochloric Acid.

Owing to the fact that time must be allowed for this reaction to complete itself, this acid should never be made extemporaneously. It should contain in solution, both free chlorine and nitrosyl chloride, and for this reason it should be kept in "dark amber colored, glass stoppered bottles, which should not be more than half filled, and which should be kept in a cool place."—U. S. P. If bottles are filled too full, the gases which are liberated for some time, may produce pressure enough to burst bottles.

Dilute Nitro Hydrochloric Acid.

The nitrosyl chloride found in nitro hydrochloric acid, is decomposed into hydrochloric and nitrous acid by the water used in this preparation. The U. S. P. directs that this "be kept in dark amber colored, glass stoppered bottles, in a cool place. It should not be dispensed unless recently prepared."

Phosphoric Acid, Sulphuric Acid and Aromatic Sulphuric Acid.

"Should be kept in glass stoppered bottles."—U. S. P.

Sulphurous Acid.

Is a solution of sulphur dioxide in water, and when exposed to air, is readily oxidized to sulphuric acid, and loses part of its sulphur dioxide by volatilization. Light also affects it, reducing it to hydrogen sulphide. For this

reason "it should be kept in dark amber colored, glass stoppered bottles, and kept in a cool place, protected from light."—U. S. P. (It should not be dispensed unless full strength.)

Trichloracetic Acid.

This acid is volatile at room temperature, and is very deliquescent. "Should be kept in dark amber colored, well stoppered bottles, in a cool place."—U. S. P.

Ammonium Benzoate.

"Should be kept in well stoppered bottles."—U. S. P.

Ammonium Bromide.

This salt frequently turns dark when exposed to light, which is believed to be due to small amounts of iron present. The Pharmacopoeia directs that "it should be kept in well stoppered bottles," and it no doubt would be better to keep in a dark place.

Ammonium Carbonate.

Ammonium carbonate, when exposed to the air, gives off vapors of ammonia and carbon dioxide, leaving a residue of ammonium bicarbonate, a white powder. "Should be kept in well stoppered bottles, in a cool place. For dispensing purposes, only the translucent portion should be used."—U. S. P.

Ammonium Iodide.

This salt is very deliquescent, and frequently turns yellow, due to liberated iodine, which may be prevented by the careful addition of a few drops of spirit of ammonia. The U. S. P. directs that this salt "should be kept in small, amber colored, well stoppered vials, protected from light."

Ammonium Salicylate.

"Should be kept in well stoppered bottles, protected from heat and light."—U. S. P.

Ammonium Valerate.

Slightly efflorescent in very dry air, such as in drug stores, but deliquescent upon coming in contact with moist air. "Should be kept in well stoppered bottles."—U. S. P.

Silver Cyanide.
Silver Nitrate.
Silver Nitrate moulded.
Silver Nitrate mitigated.
Silver Oxide.

These salts of silver, as is true of practically all silver salts, are quite readily affected by light, turning brown or black, or by coming in contact with organic matter, which reduces them to metallic silver, rendering them unfit for the use to which they are intended. The U S. P. directs in each case that they "should be kept in dark amber colored vials, (glass stoppered is best) protected from light."

Arsenous Iodide.

This salt is quite readily decomposed, and should be carefully protected from heat, light, and air.

The U. S. P. states that "it should be kept in amber colored, glass stoppered vials, in a cool place, carefully protected from light."

Gold and Sodium Chloride.

This mixture is slightly deliquescent, and the gold chloride is reduced by light, hence "should be kept in amber colored, well stoppered vials."—U. S. P.

Bismuth and Ammonium Citrate.

"Keep the product in amber colored, well stoppered bottles, protected from light."—U. S. P.

Benzaldehyde.

This substance greedily absorbs oxygen from the air, forming a precipitate of benzoic acid in the bottle, and unless tightly stoppered, the entire contents of the bottle will soon become solid.

"Should be kept in small amber colored, well stoppered bottles."—U. S. P.

Calcium Bromide and Chloride.

The great difficulty in keeping these two salts, is on account of their extreme deliquescence, soon absorbing

moisture enough from the air to liquify. The bottles should be stoppered with good sound corks, and coated with a layer of paraffin, which should be sealed with a hot spatula each time they are opened. The U. S. P. directs that they "should be kept in well stoppered bottles."

Calcium Hypophosphite.

"Should be kept in well stoppered bottles"—U. S. P. to protect it from moisture, and the air, which causes it to oxidize to the phosphate.

Exsiccated Calcium Sulphate.

Plaster of paris is used almost entirely in medicine as a dressing or plaster casts, and unless well protected from moisture, will not "set." The common practice of keeping it in boxes or drawers, is gross carelessness.

"Should be kept in well closed vessels, carefully protected from moisture."—U. S. P.

Calx or Lime.

As is well known, lime is readily converted into "slaked lime" on exposure to air, forming a mixture of hydrate and carbonate of lime. Only unslaked lime should be used in preparing Liquor Calcis.

"Should be kept in well closed vessels, in a dry place."—U. S. P.

Chlorinated Lime.

This compound is readily decomposed on exposure to air and moisture, giving off an odor of chlorine or hypochlorous acid, and absorbing CO^2 from the air which combines with the base to form calcium carbonate.

Instances have been known of violent explosions taking place even when kept in well stoppered bottles (A. J. P. 1861, p. 72).

The U. S. P. directs that it "should be kept in well closed vessels, in a cool and dry place."

Sulphurated Lime.

This preparation should be kept protected from air

and moisture to prevent oxidation of the sulphide to sulphate, and in order to comply with the Pharmacopoeia, "should contain at least 55% of calcium sulphide."

Should be kept "in small, glass stoppered vials."—U. S. P.

Chloralformamide.

"Should be kept in amber colored, well stoppered vials." U. S. P. Owing to its volatility, it should be kept in a cool place.

Chloral Hydrate.

Is quite readily volatile at ordinary temperature of a drug store, and its aqueous solution rapidly decomposes, which is greatly hastened by the presence of alkaline substances. "It should be kept in glass stoppered bottles, in a cool and dark place."—U. S. P.

Amber colored bottles are preferred.

Chromium Trioxide.

Great care should be used in handling and storing chromium trioxide, as it is *very deliquescent,* and when brought in contact with organic substances, decomposition takes place, often with great violence.

"Should be kept in glass stoppered bottles, and great caution should be observed to avoid bringing it in contact with organic substances, such as cork, tannic acid, sugar, alcohol, collodion, etc., as serious accidents are liable to result."—U. S. P.

Cinnamic Aldehyde.

"Should be kept in small, amber colored, well stoppered bottles."—U. S. P.

Lead Plaster.

"Should be kept wrapped in paraffined paper."—U. S. P.

Ferric Chloride.

Is very deliquescent, and sunlight has the property of reducing it to the ferrous state, therefore the U. S. P.

directs to "keep in glass stoppered bottles, protected from light."

Ferric Citrate.

"Keep in well stoppered bottles, protected from light." U. S. P.

Iron and Ammonium Citrate.
Iron and Ammonium Sulphate.
Iron and Ammonium Tartrate.
Iron and Potassium Tartrate.
Iron and Quinine Citrate.
Soluble Iron and Quinine Citrate.
Iron and Strychnine Citrate.
Soluble Ferric Phosphate.
Soluble Ferric Pyro-Phosphate.

"Should be kept in well stoppered bottles, protected from light."—U. S. P.

Ferrous Sulphate.

This salt crystallizes with seven molecules of water, a portion of which is given up on exposure to the air; it also absorbs oxygen from the air, causing the crystals to become coated with a layer of basic sulphate. The crystals appear to keep better, if crystallized from a slightly acid solution.

The U. S. P. directs that it "should be kept in well stoppered bottles."

Exsiccated and Granulated Ferrous Sulphate.

"Should be kept in perfectly dry, well stoppered bottles."—U. S. P.

Reduced Iron.

Owing to the finely divided state of this substance, it is very prone to oxidation, and hence should be kept in tightly stoppered bottles, in order to preserve the required strength of metallic iron.

Guaiacol.

Guaiacol is discolored when exposed to the light, becoming brownish, therefore the U. S. P. directs that it "should be preserved in amber colored bottles, protected from light."

Hexamethylenamine.
"Should be kept in well stoppered bottles."—U. S. P.

Mercuric Chloride.
"Should be kept in well stoppered bottles."—U. S. P.

Calomel.
This salt is of a white or yellowish white color, depending on the process used in making it. Light has the property of reducing it to Hg, with the formation of mercuric chloride, according to the following reaction:
$2\ Hg\ Cl + light = Hg + Hg\ Cl^2$.
The U. S. P. directs that it "should be kept in dark amber colored bottles."

Yellow Mercurous Iodide.
For the same reason as given under calomel, it "should be kept in dark, amber colored vials, with the least possible exposure to light."

Red Mercuric Iodide.
Yellow Mercuric Oxide.
Red Murcuric Oxide.
Ammoniated Mercury.
Mercury with Chalk.
"Should be kept in well stoppered bottles, protected from light."—U. S. P.

Iodoform.
"Should be kept in amber colored bottles, in a cool and dark place."—U. S. P.

Iodol.
"Should be kept in amber colored bottles, protected from light."—U. S. P.

Iodine.
"Should be kept in glass stoppered bottles, in a cool place."—U. S. P.

Lithium Benzoate.
Lithium Bromide.
Lithium Carbonate.
Lithium Citrate.
Effervescent Lithium Citrate.
Lithium Salicylate.
"Should be kept in well stoppered bottles."—U. S. P.

Magnesium Oxide.
Slowly absorbs moisture and carbon dioxide, on exposure to the air, and hence "should be kept in well closed vessels." —U. S. P.

Magnesium Sulphate.
This salt should contain seven molecules of water of crystallization, in order to meet the requirements of the U. S. P.
As ordinarily kept by druggists in barrels, boxes, etc., without any precaution, it loses one molecule of water, forming a white powder, a loss of about 8% in weight.
"Should be kept in well closed vessels."—U. S. P.

Effervescent Magnesium Sulphate.
"Should be kept in well stoppered bottles."—U. S. P.

Manganese Hypophosphite.
Manganese Sulphate.
"Should be kept in well stoppered bottles."—U. S. P.

Menthol.
Owing to the volatile nature of this substance, it "should be kept in well stoppered bottles, in a cool place."—U. S. P.

Naphthalene.
This substance turns brown on exposure to light, and is volatile at ordinary temperature, hence "should be kept in well stoppered, amber colored bottles."—U. S. P.

Pepsin.
Pancreatin.
Both of these animal ferments are slightly hygroscopic, and should be kept in well closed vessels, and in a cool place. Neither should have a disagreeable ordor.
It has been definitely shown by a number of investi-

gators, that pepsin and pancreatin destroy each other when in solution.

Phenol Salicylate (Salol).

Owing to its low melting point, and ready volatilization, it should be kept in well stoppered bottles, in a cool place.

Lead Acetate.

This salt should contain 99.5% of pure lead acetate [Pb (C^2 H^3 O^2) ^{2} 3 H^2 O] in order to conform to the U. S. P. requirements, and owing to the facility with which it absorbs CO^2 and gives up its water of crystallization, it "should be kept in well stoppered bottles."U. S. P.

Lead Iodide.

"Should be kept in well stoppered bottles, protected from light."—U. S. P.

Lead Nitrate.
Lead Oxide.

"Should be kept in well closed vessels."—U. S. P.

Potassium Acetate.
Potassium Bicarbonate.
Potassium Bitartrate.
Potassium Bromide.
Potassium Carbonate.
Potassium Chlorate.
Potassium Citrate.
Potassium Citrate Effervescent.
Potassium Cyanide.
Potassium Dichromate.
Potassium and Sodium Tartrate.
Potassium Ferro-cyanide.
Potassium Hypophosphite.
Potassium Iodide.
Potassium Nitrate.

"Should be kept in well stoppered bottles."—U. S. P.

Potassium Hydroxide.

This substance is extremely deliquescent and absorbs CO^2 with avidity, and should be kept in bottles made of hard glass, to prevent the action of the alkali on the glass.

The cork should be sealed over with a layer of paraffin,

and each time the bottle is opened, should be resealed by means of a hot spatula.

The U. S. P. directs that it "should be kept in well stoppered bottles, made of hard glass."

Potassium Permanganate.

The unstable nature of this substance is so well known, that a word of caution as to the handling of it should be unnecessary.

The U. S. P. directs that it "should be kept in *glass stoppered* bottles, protected from light. Potassium permanganate when in concentrated solution, or in the dry condition, should not be brought in contact with organic or other readily oxidizable substances."

Pyrogallol.

"Should be kept in dark amber colored bottles."—U. S. P.

Pyroxylin.

Unless well washed, this compound seems to be prone to decomposition, which appears to be accelerated by light.

The U. S. P. directs it to be "kept in cartons protected from light."

Resorcinol.

Acquires a pink to dark reddish color on exposure to light, hence "should be kept in dark amber colored vials."—U. S. P.

Santonin.

When exposed to light for any length of time, it turns yellow, and hence should be kept in a dark place.

"According to Sestini, the santonin is changed into formic acid, and an uncrystallizable substance, much more soluble in alcohol than santonin itself, which he calls photosantonic acid, and a resinous substance."—U. S. Disp.

The yellow crystals may be obtained pure by recrystallization from alcohol.

"Should be kept in dark, amber colored vials, and in a dark place."—U. S. P.

Salicin.

"Should be kept in well stoppered bottles."—U. S. P.

Sodium Acetate.
Sodium Arsenate.
Sodium Benzoate.
Sodium Borate.
Sodium Bromide.
Sodium Chlorate.
Sodium Citrate.
Sodium Hypophosphite.
Sodium Iodide.
Sodium Nitrate.
Sodium Nitrite.
Sodium Phenol Sulphonate.
Sodium Phosphate Effervescent.
Sodium Phosphate-Exsiccated.
Sodium Pyrophosphate.
Sodium Thiosulphate.

"Should be kept in well stoppered bottles."—U. S. P.

Sodium Arsenate-Exsiccated.

"Should be kept in dry, well stoppered bottles."—U. S. P.

Sodium Bicarbonate.

This salt begins to lose carbon dioxide, and is converted into the normal carbonate, if exposed to air, or stored in a warm place.

"Should be kept in well closed vessels, in a cool place."—U. S. P.

Sodium Bisulphite.

When exposed to air, it loses sulphur dioxide and is oxidized to the sulphate, hence "should be kept in a cool place, in small, completely filled, well stoppered bottles."—U. S. P.

Sodium Carbonate—Monohydrated.

This is the only official sodium carbonate and is the one that should be used in all pharmaceutical work. The com-

mercial sodium carbonate contains ten molecules of water, a portion of which it rapidly loses on exposure to air.

The official salt should be kept in well stoppered bottles.

Sodium Hydroxide.

"Should be kept in well stoppered bottles, made of hard glass."—U. S. P.

See comment on Potassium Hydroxide.

Sodium Phosphate.

This should contain twelve molecules of water of crystallization, in order to conform to the U. S. P. It loses five molecules on exposure to air, forming a white powder.

"Should be kept in well stoppered bottles, in a cool place."—U. S. P.

Sodium Salicylate.

"Should be kept in well stoppered bottles, protected from heat and light."—U. S. P.

Sodium Sulphate.

"Should be kept in well closed vessels, in a cool place."—U. S. P.

Sodium Sulphite.

"Should be kept in well stoppered bottles, in a cool place."—U. S. P.

Strontium Bromide.

Very deliquescent in moist air, becoming liquified and unfit for use.

"Should be kept in glass stoppered bottles."—U. S. P.

Strontium Iodide.

"Should be kept in small, glass stoppered vials, carefully protected from light."—U. S. P.

Light and air cause this chemical to become yellow.

Strontium Salicylate.

"Should be kept in well stoppered bottles, protected from heat and light."—U. S. P.

Sulphonal.
Trional.
"Should be preserved in well stoppered vials."—U. S. P.

Washed Sulphur.
Precipitated Sulphur.
"Should be kept in well stoppered bottles."—U. S. P.

Sulphur Iodide.
On exposure to the air, this salt loses iodine, hence "should be kept in glass stoppered bottles, in a cool place." —U. S. P.

Terpin Hydrate.
"Should be kept in well stoppered bottles."—U. S. P.

Terebene.
"Should be kept in well stoppered bottles, in a cool place, protected from light."—U. S. P.

Thymol Iodide (Aristol).
"Should be kept in amber colored vials, protected from light."—U. S. P.

Zinc Acetate.
Zinc Sulphate.
"Should be kept in well stoppered bottles."—U. S. P.

Zinc Bromide.
Zinc Chloride.
"Should be kept in small, glass stoppered bottles."— U. S. P.

Zinc Phenol Sulphonate.
Zinc Valerate.
"Should be kept in small, well stoppered bottles."— U. S. P.

Zinc Iodide.
"Should be kept in small, glass stoppered bottles, protected from light."—U. S. P.

INFLAMMABLE AND EXPLOSIVE BODIES.

In the storage of liquids of an inflammable nature, great care should be taken to prevent loss by evaporation, which if near a fire, may give rise to an explosion.

Acetone.

"Should be kept in well closed vessels, in a cool place, remote from lights or fire."—U. S. P.

Ether.

"Should be kept in partially filled (to relieve pressure), well stoppered containers, preferably tin cans, in a cool place, remote from lights or fire."—U. S. P.

Acetic Ether.

"It should be kept in well stoppered bottles, in a cool and dark place, remote from lights or fire."—U. S. P.

Ethyl Chloride.

"On account of its extreme volatility, it should be preserved in hermetically sealed glass tubes, and kept in a cool place, remote from lights or fire."—U. S. P.

Alcohol.

"Should be kept in well closed vessels, in a *cool* place, remote from lights or fire."—U. S. P.

Commercial alcohol is seldom of the purity and strength necessary for pharmaceutical use, averaging as a rule, from 88% to 92%, and containing large amounts of aldehydes, fusel oil constituents, coloring matter, and tannin.

Even the best of alcohol, as has been found in this laboratory, will soon become contaminated with coloring matter and tannin, if stored in barrels. It is much better to keep alcohol in glass or tin, as it keeps its strength better, does not absorb coloring matter, etc., and does not so readily develop an acid reaction, due to the oxidation of the aldehydes present.

The varieties of alcohol known as "silent spirits," "cologne spirits," or "velvet spirits," are usually very pure and conform to the requirements of the Pharmacopoeia for strength as well as absence of impurities.

Absolute Alcohol.

"It should be kept in well stoppered bottles, or tin cans, in a cool place, remote from lights or fire."—U. S. P.

Dilute Alcohol.

"Should be kept in well closed vessels, in a cool place, remote from lights or fire."—U. S. P.

Petroleum Benzin.

"Should be carefully kept in well stoppered bottles, or tin cans, in a cool place, remote from lights or fire."—U. S. P.

Collodion.
Styptic Collodion.
Flexible Collodion.
Cantharidal Collodion.

"Keep in well corked and sealed bottles, in a cool place, remote from lights or fire."—U. S. P.

Spirit Nitro Glycerin.

"Should be kept and transported in well stoppered tin cans, and should be stored in a cool place, remote from lights or fire."—U. S. P.

Spirit Nitrous Ether.

"Keep in small, well stoppered, dark amber colored vials, in a cool place, remote from lights or fire."—U. S. P.

Spirit Ether and Compound Spirit Ether.

No directions are given by the Pharmacopoeia, but owing to the volatile and inflammable nature of these preparations, they should be kept in medium sized, well stoppered bottles, and in a cool place.

Amyl Nitrite.

"Should be kept in hermetically sealed glass bulbs, or in dark amber colored, glass stoppered vials, in a cool and dark place."—U. S. P.

Carbon Bisulphide.

"Should be kept in partially filled, well stoppered bottles, or in tin cans, in a cool place, remote from lights or fire."—U. S. P.

Phosphorous.

"Should be carefully kept under water, in strong, well closed vessels, in a secure and moderately cool place, protected from light."—U. S. P.

MISCELLANEOUS LIQUIDS.

Chloroform.

When used for anaesthetic purposes, it should be perfectly free from chlorinated and other decomposition products, as such impurities increase its toxicity when used to produce anaesthesia.

Light rapidly decomposes chloroform.

"Should be kept in dark amber colored, glass stoppered bottles, in a cool and dark place."—U. S. P.

Bromoform.

"Should be kept in dark amber colored, glass stoppered bottles, in a cool place, protected from light."—U. S. P.

Bromine.

"It should be kept in protected glass stoppered bottles, in a cool place."—U. S. P.

Phenol.

Crystallized phenol absorbs moisture if exposed to a damp atmosphere, and liquifies, is readily volatile, and both the crystallized and liquified become red on exposure to light.

"Should be kept in dark, amber colored, well stoppered bottles."—U. S. P.

Paraldehyde.

"Should be kept in well stoppered, dark amber colored bottles, in a cool place."—U. S. P.

Cresol.

"Should be preserved in amber colored bottles, protected from the light."—U. S. P.

Methyl Salicylate.

"Should be kept in well stoppered bottles, protected from light."—U. S. P.

Etherial Oil.

"Keep in small glass stoppered vials, in a cool place."—U. S. P.

Turpentine.

When freshly distilled, it is free from offensive odor, but on exposure to air, and to a greater extent if exposed to light, it becomes yellowish and develops a strong odor, with the formation of a resinous substance.

"Should be kept in well stoppered bottles."—U. S. P.

Rectified Oil Turpentine.

"Should be kept in well stoppered, amber colored bottles, in a cool place."—U. S. P.

ALKALOIDS, ALKALOIDAL SALTS, GLUCOSIDES, Etc.

Alkaloids as a rule, are very stable bodies, though some are readily affected by light, alkalies, etc. None such should be dispensed if discolored to any extent.

Aconitine.

"Should be kept in amber colored, well stoppered vials."—U. S. P.

Atropine.

"Should be kept in amber colored, well stoppered vials."—U. S. P.

Codeine.
Codeine Phosphate.
Codeine Sulphate.
Colchicine.
"Should be kept in well stoppered, amber colored vials." U. S. P.

Homatropine Hydrobromide.
"Should be kept in well stoppered vials, protected from light."—U. S. P.

Hydrastine.
Hydrastinine Hydrochloride.
"Should be kept in well stoppered bottles."—U. S. P.

Hyoscine Hydrobromide.
Hyoscyamine Hydrobromide.
Hyoscyamine Sulphate.
"Should be kept in well stoppered, amber colored vials." U. S. P.

Morphine Acetate.
This salt gives off acetic acid, and is converted into the insoluble alkaloid, especially if the bottle contains alkali, as some cheap glassware is liable to do.
"Should be kept in well stoppered, dark amber colored vials. A minute quanity of free acetic acid should be present to prevent decomposition."—U. S. P.

Morphine Hydrochloride.
Morphine Sulphate.
"Should be kept in well stoppered, amber colored vials." —U. S. P.

Quinine.
Quinine Bisulphate.
Quinine Hydrobromide.
Quinine Hydrochloride.
Quinine Salicylate.
"Should be kept in well stoppered, (dark) amber colored vials."—U. S. P.

Quinine Sulphate.

Should contain seven molecules of water of crystallization, which it rapidly loses on exposure to air. It also turns brown if unduly exposed to light.

"Should be kept in well stoppered bottles, preferably of an amber color, and in dark place."—U. S. P.

Tin cans with tightly fitting covers, serve the purpose admirably.

Apo-Morphine Hydrochloride.

Is easily affected by light, acquiring a greenish color, forming an emerald green colored solution. It should never be used in this condition.

Alkalies promote this change, and for this reason the bottles should be rinsed out with dilute hydrochloric acid before filling.

"Should be kept in small, dark amber colored vials, which have been previously rinsed with dilute hydrochloric acid, and dried."—U. S. P.

Strychnine Nitrate.
Strychnine Sulphate.

"Should be kept in well stoppered vials."—U. S. P.

Pelletierine Tannate.
Physostigmine Salicylate.
Physostigmine Sulphate.
Pilocarpine Hydrochloride.
Pilocarpine Nitrate.

"Should be kept in small, dark amber colored, well stoppered vials."—U. S. P.

Veratrine.

"Should be kept in well stoppered, amber colored vials."—U. S. P.

PART III—PREPARATIONS, ETC.

The storing and preservation of galenical preparations require greater care and judgment than almost anything else that comes under the purvey of this bulletin. In the case of chemicals, etc., we are dealing with substances of a definite composition usually, but in the case of preparations of the U. S. P., N. F., and unofficial preparations, we have a more complex proposition to deal with, inasmuch as they may contain anywhere from two to ten or fifteen ingredients to be taken into consideration.

Ammonia Water.

This is a solution of ammonia gas in water, and at ordinary temperature rapidly loses ammonia gas. If the temperature is allowed to rise too high, enough pressure may be generated in the container to cause it to burst.

Cork stoppers discolor ammoniacal liquids, causing them to become brownish.

"It must not be dispensed for medicinal purposes if it contains less than 10% by weight, of the gas. Should be kept in glass stoppered bottles, in a cool place."—U. S. P.

Stronger Ammonia Water.

"Should be kept in partly filled, strong, glass stoppered bottles, in a cool place. Great caution should be used in handling this liquid."—U. S. P.

Stronger Orange Flower Water.
Stronger Rose Water.

"Should be kept in bottles loosely stoppered with a pledget of purified cotton, and in a dark place."—U. S. P.

It is a peculiar fact that preparations of this kind rapidly lose their fragrance, and become musty and stale, if kept in tightly stoppered bottles: however, on removing the stopper, and covering with cloth or cotton, to keep out dust, they soon regain their former fragrance.

These two preparations, as well as others of this nature, sometimes develop fungus growth, or become thick and mucilaginous. It is possible that this could be prevented

to a large extent, by a process of pasturization, by heating to a temperature of 75 to 80°C, for one hour, for three consecutive days, and then stoppering with a plug of cotton.

Distilled Water.

This is the only water that should be used in the manufacture of preparations, or in prescription practice.

"Keep in glass stoppered bottles, which have been rinsed with hot distilled water immediately before being filled."—U. S. P.

Hydrogen Peroxide.

This is a notoriously unstable preparation and even when kept under the most favorable conditions, is liable to deteriorate. Sometimes the pressure in bottle becomes great enough to cause it to explode with great violence.

Many things have been tried to preserve it, some with considerable success; among these are acids, acetanilid, and other amido compounds, benzoic acid, urea, etc.

There is no doubt, as has been shown by many analyses, that acetanilid does help to preserve hydrogen peroxide solutions, though after a certain lapse of time, the odor of nitrobenzole becomes distinctly noticeable.

"Should be kept in a cool place."—U. S. P.

We would suggest that it, as well as Hydrozone, Pyrozone (5%) Glycozone, Conc. Ethyl Nit., and other preparations of this nature, be kept in a dark closet, so that in case of an explosion taking place, there will be no danger from flying pieces of glass.

Fowler's Solution.

The arsenic in this solution should be in the arsenous condition, but if unduly exposed to the air, it absorbs oxygen and is converted into the arsenate.

It would be well to keep this preparation in small, well filled, well stoppered bottles.

Donovan's Solution.

This is another arsenic preparation, containing the iodide of both mercury and arsenic.

This preparation sometimes turns yellow or even deep

red, due to the liberation of free iodine. This can be prevented by the addition of a small globule of mercury, to the bottle, and shaking until the color of the iodine disappears.

Solution Ammonium Acetate.

This preparation is intended to be a carbonated solution, and if left exposed for some time, it loses carbon dioxide and becomes stale, and flat to taste.

"Should be freshly made when wanted."—U. S. P.

Lime Water.

Owing to the fact that this preparation absorbs carbon dioxide from the air, precipitating the calcium as carbonate, it soon loses its strength.

Lime water should not be kept in too warm a place, as calcium hydroxide is more soluble in cold than in warm water; for example—a saturated solution of calcium hydroxide at 25°C, contains about .14%, while at 15°C it will contain about .17%.

In the keeping of lime water, we would suggest that druggists make up quantities of ten gallon lots, or more.

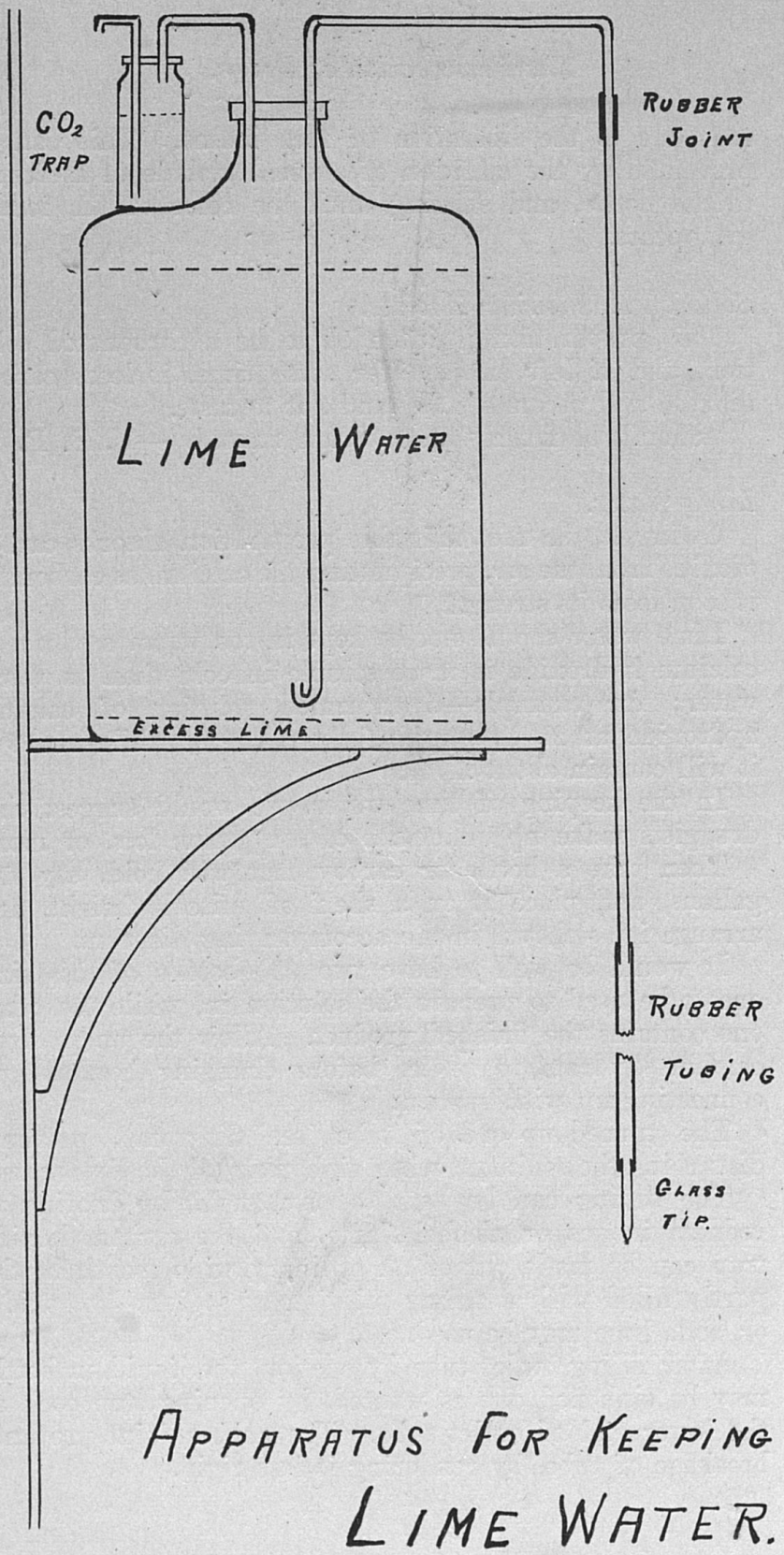
Then take a bottle or carboy that will hold, say five gallons, and place it on a shelf of suitable height, and arrange it as shown in the accompanying diagram.

It would be well to have two (2) bottles of this size, one to be used to prepare the solution in, while the other one contains the finished product. Allow the undissolved calcium hydrate to settle, before changing bottles, and connecting up with syphon.

The turned up end of tube (see diagram), prevents disturbing the sediment when siphoning off the lime water.

The tubing can be bent to any angle, by heating to redness in gas or alcohol flame, and the carbon dioxide trap can be made out of an ordinary wide mouth bottle, partly filled with a strong solution of sodium hydroxide, or, soda lime may be used.

After filling outlet tube by suction, the liquid in bottle may be siphoned out as wanted, by opening stop cock at the lower end of outlet tube. The rubber joint prevents breakage of tube, by rendering it less rigid.



APPARATUS FOR KEEPING
LIME WATER.

Lime water may be kept for months in this way, without change, if kept in a cool place.

Chlorine Water.

"Should be freshly made when wanted."—U. S. P.

However, by keeping in partially filled, glass stoppered, amber colored bottles, in a dark cool place, it may be preserved for some time unaltered. The glass stoppers should be coated with paraffin.

Solution Chlorinated Soda.

"Should be kept in well stoppered bottles, protected from light, and in a cool place."—U. S. P.

Solution Formaldehyde.

The greatest trouble in keeping formaldehyde solution, is its tendency to be converted into a polymer, known as paraformaldehyde, causing the solution to become turbid.

When not intended for medicinal use, methyl alcohol is sometimes added to the extent of 20% in formaldehyde solutions to prevent polymerization, when intended for use as a disinfectant, or to kill smut in grain, such as wheat.

"Should be kept in well stoppered bottles, in a cool place, protected from light."—U. S. P.

Solution Mercuric Nitrate.

"Keep in glass stoppered bottles."—U. S. P.

Compound Solution of Iodine. (*Lugol's Solution*).

"Keep in glass stoppered bottles."—U. S. P.

Solution of Magnesium Citrate.

The solution as prepared by the present Pharmacopoeia. contains the tribasic magnesium citrate, and is much more stable than the former preparation.

Only enough should be prepared to last a short time, as it is liable to precipitate a white sediment and become unfit for use.

"Should be freshly prepared when wanted."—U. S. P.

Solution Lead Sub Acetate. (*Goulard's Extract.*)

Should be carefully protected from exposure to air, as it readily absorbs CO^2 and becomes turbid, due to the formation of lead carbonate.

"Keep in well stoppered bottles."—U. S. P.

Diluted Lead Sub Acetate Solution.

The *distilled* water that is used in making this preparation, should be boiled and then cooled before adding to lead solution. This is necessary to drive off absorbed CO^2, and prevent precipitation of lead carbonate.

"Keep in well stoppered bottles."—U. S. P.

Solution Potassium Citrate.

It is advisable to keep the solution of the ingredients separate, and mix them as required, if the trade warrants keeping stock solutions.

"Should be freshly made when wanted."—U. S. P.

Solution of Potassium Hydroxide.
Solution of Sodium Hydroxide.

"Should be kept in bottles made of green glass, and provided with glass stoppers, coated with paraffin or petrolatum."—U. S. P.

Compound Solution of Sodium Phosphate.

"Keep the solution in well stoppered bottles, in a moderately warm place."—U. S. P.

Chalk Mixture.

This preparation is very apt to spoil by fermentation during warm weather, and the introduction of compound chalk powder into the U. S. P. makes the extemporaneous preparation of chalk mixtures very easy. There is no excuse for not dispensing a *fresh preparation.*

"Should be freshly made when wanted."—U. S. P.

Compound Iron Mixture (Griffith's Mixture).

The iron in this preparation should be in the ferrous condition, but on exposure to air, it is oxidized to the ferric state, the preparation becoming brownish instead of the greenish color as seen in a well made, freshly prepared preparation.

"Should be freshly made when wanted."—U. S. P.

Mucilage of Acacia.

"Should be kept in well stoppered, completely filled bottles, in a cool place."—U. S. P.

Mucilage Elm.
Mucilage of Sassafras Pith.
"Should be freshly made when wanted."—U. S. P.

Oleate of Mercury.
This preparation has a tendency to reduce to metallic mercury, which is partially due to the impurities in the oleic acid used.
"Preserve in tightly stoppered bottles."—U. S. P.

Oleo-resin of Aspidium.
Oleo-resin of Capsicum.
Oleo-resin of Cubebs.
Oleo-resin of Lupulin.
Oleo-resin of Pepper.
Oleo-resin of Ginger.
"Keep in well stoppered bottles."—U. S. P.

Seidlitz Powders.
Should not be stored in a damp place, as the tartaric acid is very liable to deliquesce sufficiently to be absorbed by the paper, nor should they be stored in too warm a place, as the sodium bicarbonate loses CO^2 and is converted into the normal carbonate.
A very good plan is to store the white and blue powders separately in empty 25-ounce quinine sulphate cans.
"Keep the powders in well closed containers, in a dry place."—U. S. P.

Compound Licorice Powder.
This preparation is sometimes attacked by insects, in which case there is only one thing to do—throw it away.
This may be *prevented* by adding a few drops of chloroform to the container, thus saturating the air in the bottle with chloroform vapors.
"Keep in well closed vessels."—U. S. P.

Compound Morphine Powder.
Owing to the volatile nature of the camphor, this powder should be kept in tightly stoppered bottles, and in a cool place.
"Transfer it to well stoppered bottles."—U. S. P.

Spirits.

On account of the volatile nature of this class of preparations, it is well to store them in a cool place, and out of direct sunlight.

The following preparations have special directions for keeping:—

Spirit of Nitrous Ether.

It is advisable to put up spirit of nitrous ether in one, two, three or four ounce bottles, and seal by dipping neck of bottle in melted paraffin. Then keep in a dark cool place.

Keep in "small, well stoppered, dark amber colored vials, in a cool place, remote from light or fire."—U. S. P.

Spirit Ammonia.
Spirit Ammonia, Aromatic.

"Should be kept in glass stoppered bottles, in a cool place."—U. S. P.

Compound Spirit of Orange.

"Keep in completely filled, well stoppered bottles, in a cool and dark place."—U. S. P.

Suppositories.

There is only one official suppository, but the druggist is often called upon for extemporaneous, or manufactured suppositories, and he should not only endeavor to send them out in good condition, but so that they will remain so until used. This rule should hold good with all other preparations that he dispenses.

Cocoa Butter suppositories are very apt to melt or get soft if handled too much, or kept in too warm a place.

Glycerinated Gelatin suppositories should be kept and dispensed in wide mouthed bottles, or other tightly closed containers, and kept in a cool place, in order to protect them from the effect of heat, dry air, or moisture.

Glycerin Suppositories.

"Should be preserved in tightly stoppered, glass vessels."—U. S. P.

Syrups.

This is one of the most troublesome classes of preparations that the druggist is afflicted with, on account of many of the official syrups seldom being called for, and the druggist usually finds that the stock on hand has spoiled, by becoming sour, or mould has formed in the bottle, etc., this usually occurring just when a "hurry up" prescription is received.

Consequently the making of syrups should receive the druggist's most careful attention, for while careful attention to details will not always prevent the spoiling of his syrups, yet it will prevent it to a great extent.

Syrups deteriorate for several reasons.

First—Impure sugar used.

Second—Invertion of sugar to fermentable sugar, by (a) acids, being present in solvent; (b), heating too long.

Third—Excess sugar used which subsequently crystallizes out, leaving weak syrup.

Fourth—Insufficient amount of sugar used.

Fifth—Contamination with moulds, yeast "germs," and other fermentative bacteria.

Sixth—Loss of active ingredients by (a) volatilization by heat, e. g. syrup of wild cherry, etc., (b), oxidation, e. g. Fe I^2.

Seventh—Discoloration caused by caramelization of sugar by acids.

These changes may be prevented to a large extent by—

First—Use pure sugar and carefully adjust the proportion of sugar to solvent.

Second—Filling small bottles completely full with the hot syrup and stoppering *tightly*, and keeping in cool place.

Third—By use of preservative, as specified in Pharmacopoeia, as in syrup Hydriodic acid, etc.

Fourth—By use of "Cold process," which prevents the formation of fermentable sugars.

Fifth—By preparing only enough syrup that can be used up quickly.

Tinctures.

The Pharmacopoeia gives no general directions for the

preservation of tinctures, but with a few exceptions, they are as a class quite stable. They contain less extractive matter than the fluid extracts, and hence are less liable to precipitate and become unsightly.

Tinctures of Aconite, Belladonna, Hyoscyamus, Stramonium, etc., are claimed to lose part of their alkaloidal strength after being kept for some time, but this has been shown fairly conclusively, not to be the case. However, it is best not to keep in stock more of this kind of tincture than can be used up within a reasonable length of time.

As a rule, this class of preparations is quite stable, under ordinary care.

Tr. Aloes.

The aloin frequently crystallizes out on the side of the container, and in this way reduces the strength.

Tincture Cinchona.

Deposits cinchona red, holding a portion of the alkaloids, the strength being slightly reduced.

Tincture of Digitalis.

Should be protected from strong light.

Tincture of Nux Vomica.

Owing to the slight solubility of sugar of milk in strong alcohol, this preparation sometimes becomes turbid, caused by the sugar of milk used as a diluent in the extract of Nux Vomica. The tincture should be dispensed perfectly clear.

Care should also be used to prevent loss of alcohol from this strongly alcoholic preparation, as any great loss of alcohol might dangerously increase the strength of the tincture.

Tincture of Opium (Laudanum).

Should be kept in well stoppered bottles; when long kept and frequently exposed, Laudanum becomes thick, and acts with unexpected energy.

Tincture Krameria.

This preparation sometimes deposits krameria red, and gelatinizes; is best kept in small well stoppered bottles.

Tincture Ferric Chloride.

According to the Pharmacopoeia, this preparation should be made and allowed to stand for at least three months, protected from light.

The object of this is to allow the formation of a small amount of esters, which give it a more agreeable odor, and doubtless modify the astringency.

The tincture is affected by light, with the formation of ferrous iron.

"Let the tincture stand, in a closely covered vessel, protected from light, at least three months; then transfer it to glass stoppered bottles, and keep it protected from light."—U. S. P.

Tincture of Iodine.

There is hardly a preparation in the Pharmacopoeia which varies so much as this one, which is due to two causes—

First—Carelessness in preparing.

Second—Carelessness in storing and keeping.

The first cause needs no comment, it speaks for itself; the second cause has certain extenuating circumstances which may relieve the druggist of a certain portion of the responsibility.

Tincture of Iodine, when prepared without Potassium Iodide, rapidly forms ethyl iodide, and hydriodic acid, with corresponding loss of free iodine, which is entirely prevented by the use of the quantity of potassium iodide directed by the U. S. P.

If exposed, it loses alcohol faster than it does iodine, becoming rapidly stronger, sometimes reaching a concentration of 200%, or more, of the U. S. P. strength.

Should be kept in tightly stoppered bottles, in a cool place, and never be dispensed with cork stoppers, as iodine rapidly attacks cork.

Tincture of Kino.

The great trouble with tincture of kino, is its tendency to gelatinize. This can be prevented if the directions of the U. S. P. as to heating, be carefully carried out, and then keeping in small, well stoppered bottles.

Ointments.

Any ointments, unless protected by some preservative, like benzoin, poplar buds, etc., are very apt to spoil and become rancid in a short time unless carefully prepared and kept.

Stock ointments should be kept in non-permeable containers, such as glass or glazed porcelain jars, free from cracks and other flaws.

In making up a new batch of any ointment, great care should be taken that the containers are perfectly clean, not apparently so, for the slightest trace of rancid fat remaining will greatly accelerate the change.

If too high a heat be used in making an ointment, it is very liable to dissipate some of the volatile ingredients, and also cause the fatty base to become rancid.

Ointments should be dispensed in glass or porcelain jars, or in collapsable tubes, which effectively protect them from air. Some ointments are readily affected by contact with metallic substances, and care should be used in preparing and dispensing same.

Ointment of Tannic Acid.

"Avoid the use of iron utensils."—U. S. P.

Diachylon Ointment.

This ointment very quickly becomes rancid and hence "should be prepared extemporaneously."—U. S. P.

Nut Gall Ointment.

"Avoid the use of metallic utensils."—U. S. P.

Ointment of Yellow Mercuric Oxide.
Ointment of Red Mercuric Oxide.
Citrine Ointment.

"Contact with metallic utensils should be avoided."—U. S. P.

Iodine Ointment.

"Avoid the use of metallic spatula; should be freshly made when required."—U. S. P.

Ointment of Potassium Iodide.

"Should be prepared extemporaneously."—U. S. P.

Fixed Oils.

Very little trouble should be experienced with this class of oils, as they are quite stable, the main points to be observed are their protection from air and moisture.

Some of the fixed oils such as the drying (e. g. linseed oil) and semi-drying oils (e.g. castor oil), have unsaturated bonds or linkings in the molecule, and will absorb oxygen from the air, becoming oxidized and much thicker, and if in thin layers forming a film or varnish. The non-drying oils, such as olive or cotton seed oil, lard oil, etc., become rancid, due to the liberation of the fatty acid.

The druggist should make it a point to dispense only bland, non-rancid oils, fats, etc., and should keep his stock of oils, etc., in a cool place, in well closed containers, free from water.

Castor Oil.

"Should be kept in well stoppered containers."—U. S. P.

Cotton Seed Oil.

"Should be kept in well closed containers."—U. S. P.

Croton Oil.

"Should be kept in small, well stoppered bottles."—U. S. P.

Cod Liver Oil.

"Should be kept in cool place, well stoppered bottles, which have been thoroughly dried before filling."—U. S. P.

Olive Oil.

"Should be kept in well stoppered bottles, in a cool place."—U. S. P.

Expressed Oil Almonds.

"Keep in well stoppered containers in a cool place."—U. S. P.

Linseed Oil.

"Should be kept in well stoppered containers."—U. S. P.

Volatile Oils.

As a general rule, the largest constituent of volatile

oils consists of hydrocarbons, which are quite easily affected by oxidation; the really valuable parts of volatile oils are present in small amounts, and have a delicate odor, characteristic of that particular oil. This portion of the oil is very easily affected by changes that may take place in itself or in some other constituent of the oil, producing a marked deterioration in the delicate odor or flavor of the oil.

It is best to keep the oil in the bottle that it comes in, rather than to transfer it to more showy glass labeled, glass stoppered shelf bottles. Very few, if any, of the so-called ground glass stoppered shelf bottles found in drug stores, are fit for anything but the ash barrel. We believe that there are more good drugs sacrificed on the altar of showy shelf bottles than one realizes, for the average shelf bottles leave the drug or preparation at the mercy of the chemical rays of light, the ground (?) glass stoppers allow air to get in and exert its oxidizing effect, and they allow volatile substances to evaporate almost without let or hindrance.

The amber colored cork stoppered bottles are much superior in this respect, if not quite so pretty and elegant looking.

There is one point that should be closely looked after—and that is to keep the mouth of the bottle clean, otherwise the resinous matter that forms by oxidation of the small amount of oil adhering there each time the bottle is used, will contaminate the contents, giving it an unpleasant odor.

Oil of Bitter Almonds.

"Keep in small, well stoppered, completely filled, amber colored bottles, protected from light and air."—U. S. P.

Benzaldehyde.

"Should be kept in small, amber colored, well stoppered bottles."—U. S. P.

Oil of Anise.

"Should be kept in well stoppered, amber colored bottles, protected from light."—U. S. P.

Oil of Orange Peel.

"Should be kept in small, well stoppered, amber colored bottles, in a cool place, so as to avoid as far as possible, the development of a terebinthinate odor. Oils that have developed such an odor should not be dispensed."—U. S. P.

Oil Cajeput.

"Should be kept in well stoppered amber colored bottles, in a cool place."—U. S. P.

Oil of Betula.
Oil of Caraway.
Oil of Cloves.
Oil of Chenopodium.
Oil of Cinnamon.
Oil of Copaiba.
Oil of Coriander.
Oil of Cubeb.
Oil of Erigeron.
Oil of Eucalyptus.
Oil of Fennel.
Oil of Gaultheria.
Oil of Hedeoma.
Oil of Juniper.
Oil of Lavender Flowers.
Oil of Lemon.
Oil of Peppermint.
Oil of Spearmint.
Oil of Myristica.
Oil of Rose.
Oil of Rosemary.
Oil of Savin.
Oil of Santal.
Oil of Sassafras.
Oil of Thyme.
Volatile Oil of Mustard.

"Should be kept in well stoppered, amber colored bottles, in a cool place, protected from light."—U. S. P.

Oil Turpentine.

"Should be kept in well stoppered bottles."—U. S. P.

Rectified Oil Turpentine.

"Keep in well stoppered, amber colored bottles, in a cool place."—U. S. P.

Fluid Extracts.

Should be kept in dark colored bottles, securely corked, and in a place not exposed to marked changes in temperature.

Many fluid extracts, unless properly kept, will lose alcohol by evaporation, causing a marked precipitation, which may carry down with it a considerable portion of the active ingredients, though in a great many instances the precipitates have been found to be physiologically inactive.

Direct or strongly diffused sunlight also has the property of causing precipitation in fluid extracts, hence they should be kept in a cool, dark place, and in dark bottles.

Extracts.

The main thing about keeping extracts is to keep them in the condition they are expected to be used in; solid extracts should not be allowed to dry out, and powdered extracts should be kept perfectly dry.

Extract of Colocynth.
Comp. Extract of Colocynth.

"Should be kept in well stoppered bottles."—U. S. P.

Extract of Nux Vomica.
Extract of Opium.

"Should be kept in well stoppered, amber colored vials."—U. S. P.

MISCELLANEOUS DRUGS.

STERILIZATION.

There is a number of drugs, preparations, etc., with which the modern druggist has to contend, which must be kept or dispensed in a sterile condition, hence a few words here concerning sterilization and disinfection will not be out of place.

A substance is said to be *aseptic* when entirely free from living germs.

This condition may be brought about in one of two ways (1) by sterilization; (2) by disinfection.

Sterilization means the destruction of germ life on or within a body, by means of heat. This may be done either by dry or moist heat, and can only be applied to such substances as will not be injuriously affected by the temperature required to destroy germ life.

Disinfection means rendering a substance *free* from living germs by use of chemicals, agents, etc.

Partial disinfection consists in the use of such substances as will inhibit or prevent the growth of germs, without entirely destroying them; such substances are called *antiseptics.*

Sterilization by heat is preferable wherever it can be applied as it is complete and does not introduce any foreign substances. Dry heat is more effective than moist heat, but of course can only be applied to dry bodies, such as bottles, ointment jars, flasks, funnels, spatulas, stirring rods, and some times surgical instruments, etc.

The temperature necessary is 150° to 200° Centigrade, (300° to 392°F) or about the temperature at which cotton begins to turn brown. An ordinary stove oven will answer the purpose admirably. Time necessary is about 1 to 1½ hours.

Moist heat is used on all liquid substances, and some solids. For the average drug store operations, this may be performed by suspending the bottle of solution, stoppered with cotton, in boiling water. It should be subjected to the boiling temperature of the water not less than twenty minutes.

This means of sterilization is applicable to all solutions that are not decomposed at the boiling temperature of water.

Pasteurizing is heating to 60°C which should be repeated

twice, on successive days, in order to kill the spores which may develop in the mean time.

Among the substances that the pharmacist may be required to sterilize, are the different preparations that are apt to decompose through bacterial action, such as syrups, infusions, decoctions, ointments, injections, etc.

Dusting powders are sometimes required to be dispensed in a sterile condition, which if not volatile at the temperature of 150-170°C. may be sterilized by dry heat.

Zinc oxide, talc, boric acid, calomel, etc., may be rendered sterile in this manner.

Hypodermic injections are very difficult to sterilize on account of the easy manner in which the potent substances are decomposed. For this reason it is sometimes necessary to use some chemical agent to destroy the germs; carbolic acid, salicylic acid, corrosive sublimate, thymol, hydrogen peroxide, formaldehyde, etc., have been used, but a 3% solution of carbolic acid has proven less objectionable than any other germicide for this purpose.

Antiseptic Gauzes, bandages, etc.

The pharmacist is seldom called on to prepare this class of preparations, but he should use care and have a knowledge of bacterial contamination in order to keep them properly.

They should be kept away from dust, and be handled as little as possible, otherwise they are liable to become contaminated.

Medicated and Toilet Soaps.

Milled or toilet soaps are usually perfumed or scented in order to cover up any disagreeable odor from the soap stock, and to give a pleasant odor to the soap. They usually contain from 10 to 30% water, and should not be exposed to an excessively hot atmosphere, as that causes the soap to dry out and become hard, and if much alkali be present, it seems to accumulate near the surface, especially if the soap contains glycerin.

They also discolor more rapidly if exposed to too much heat.

Castile Soap.

The U. S. P. states that this soap "contains about 30%

water," and is usually bought by the druggist by weight, so unless kept properly will lose considerable of its weight. Should be kept in a closely covered container, or wrapped in waxed paper.

Bichloride Soap.

This medicated soap is very prone to decomposition and is usually colored to conceal such change.

If the soap base contains any free alkali, it will react with the mercury salt, causing the soap to take on a greenish tinge. A good sublimate soap should be perfectly white or cream colored, and not develop a greenish tinge.

Phenol Soap.

This is liable to lose phenol if kept too long and unduly exposed.

Granular Effervescent Powders.

This class of preparations is very unstable, as it is a mechanical mixture of an acid body with a carbonate and the medicinal agent, and needs only the presence of moisture to set up the chemical reaction between the acid and alkali.

Therefore it is very necessary that this class of preparations be kept in a perfectly dry condition, and in a cool place.

In conclusion we would like to add that while we are aware that this bulletin does not cover the entire field of drugs handled by the pharmacist, there being many lines not touched upon in the preceding pages, still we hope that what we have given will be of some assistance to the druggist who is honestly trying to dispense drugs of prime quality and strength.

It might be well to call attention of those who have a copy of the Pharmacopoeia, to study it well, for there is a world of information contained within its pages, and those druggists who haven't a copy of it will do well to secure one and *use it.*

The United States Pharmacopoeia is the legal standard for drugs within the state of Kentucky, and no druggist will be exempt from its requirements.

The author hereby wishes to express his thanks and appreciation for the many helpful suggestions and criticisms during the preparation of this bulletin, to Mr. James H. Martin, former drug inspector for this Station.

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KENTUCKY

AGRICULTURAL EXPERIMENT STATION

OF THE

STATE UNIVERSITY

BULLETIN No. 151.

An Outbreak of Gadflies in Kentucky.

LEXINGTON, KENTUCKY,
October 1, 1910.
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Kentucky Agricultural Experiment Station.

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KENTUCKY AGRICULTURAL EXPERIMENT STATION,

LEXINGTON, KY.

BULLETIN NO. 151.

AN OUTBREAK OF GADFLIES IN KENTUCKY.

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

My attention was called in August to an injury to beef and dairy cattle in Henry and adjoining counties, resulting from the attacks of a large brown gadfly (*Tabanus exul*), resembling in shape and manner of attack the black ox fly, sometimes seen on the backs of grazing cattle in summer. The statements made to me by Mr. Thomas Goff, of Lexington, to the effect that he had seen on his farm in Henry County fifteen or twenty of these flies at work on the back of a single animal, and that his beef cattle had lost an average of 100 pounds each as a result of the constant annoyance from them, led me to stop at Tarascon on the 25th of the month, while on my way to Hardin County, to investigate the outbreak.

It was found that the flies were extremely common in the neighborhood. They were noticed in some numbers even about a dwelling, and were constantly encountered in the pastures along small streams. On cattle I counted from ten to nineteen. On mules and horses in harness they were a constant annoyance, and even hogs were not exempt. Seven of the flies were counted on the exposed side of one of these animals lying in a puddle.

The persecuted stock appeared to have given up fighting their enemies and allowed them to have their way. The switch of a cow's tail was observed to pass over the backs of clinging flies without causing them to move. Occasionally when an animal passed under branches of trees one or two would be dislodged, but they at once dropped down again and went to work as before.

During the middle of the day animals suffered so much that they refrained from grazing at all, either standing close together about the barn or else lurking singly in thickets or standing in pools formed by small streams. One cow I disturbed frequently standing in the water or lying down among the thick herbage as if trying first one and then another expedient to get rid of the pests, yet always with her back, between the thighs and shoulders, dotted with flies. I tried several times to get near her with my net to capture and remove some of them, but she was suspicious and always decamped with her whole collection. In the pastures away from the stock, the flies were observed flying very swiftly with a humming noise. Individuals sometimes came down to the water, and, still on the wing, dipped into it a couple of times, then flew away. One was observed to alight on a sedge in the edge of a stream, and deliberately walking down to the water, thrust in its beak to drink, remaining for a minute, then coming up and flying away. Individuals could be captured occasionally on leaves of oak and other trees over the water.

It was desired if possible to learn where the flies placed their eggs, but not a single individual observed showed the slightest disposition to perform this function, and I was compelled to believe that the period for egg laying had not arrived.

The big black gadfly (*Tabanus atratus*) was occasionally seen, and one was finally found placing its eggs in a mass attached to a leaf of a small dogwood overhanging a stream.

About 3 o'clock in the afternoon I came across a recently "deadened" willow tree on the banks of a stream, and on its trunk from the girdled bark at the base, extending well up among the branches, were numerous individuals of the brown gadfly, engaged with other insects in sucking a fermented sap that exuded from the bark. Several species of wasps and butterflies were noted among them, and also that inveterate lover of sweets of all sorts, the green June bug. In a few minutes it was possible to capture all the flies I

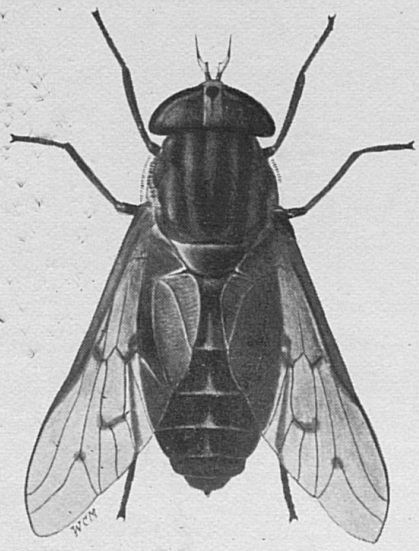


FIG. 1.—The Brown Gadfly (*Tabanus exul*). Female. X2. Original.

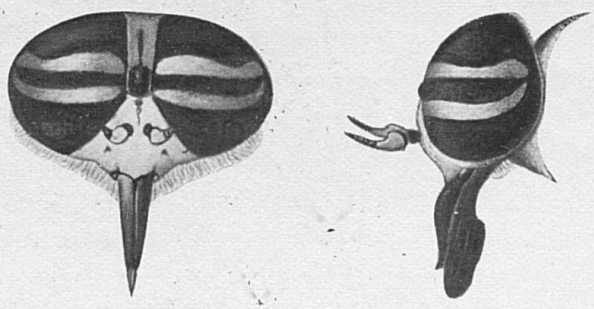


FIG. 2.—Front and side views of the head of the Brown Gadfly, showing the brilliant green stripes on the eyes. On the death of the flies these stripes gradually disappear. Female. X3½. Original.

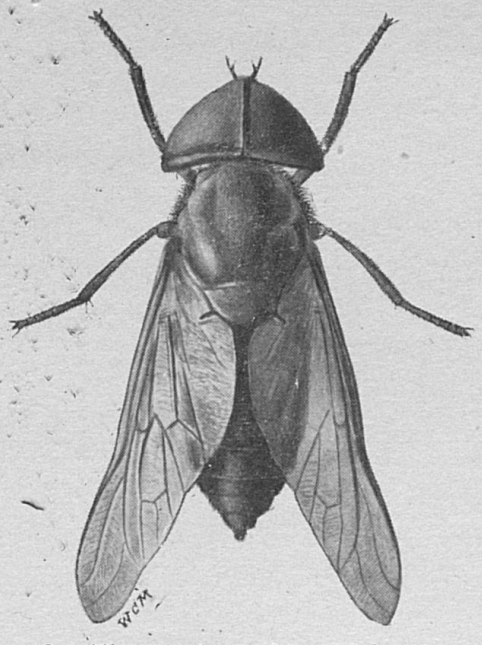


FIG. 3.—The Black Gadfly (*Tabanas atratus*). Male. X2. Original.

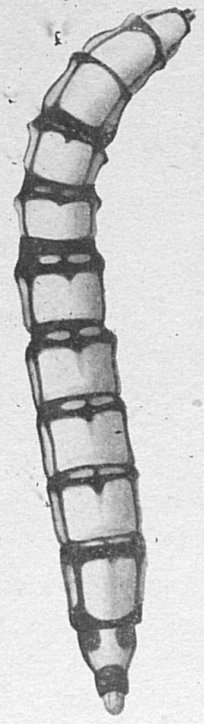


FIG. 4.—The larva or grub of the Black Gadfly. Taken from running water at Lexington. X2. Original.

wanted, among them several males, though these had in every case frayed wings. It was evident that the flies, both male and female, are very fond of sweets; a fact which may prove of importance when we come to look for remedies.

My visit to Tarascon was made primarily to learn what peculiar features of the locality encourage the breeding of the flies in such great numbers. The Tabanidæ are known to live in the grub state in water, or wet soil. The eggs of those that have been studied are placed on marsh plants growing in the water, such as sedges and cat-tail flags, or else on other plants overhanging water. Some species prefer particular plants, while others have no apparent choice. The big black fly is one of the latter, and will put its mass of eggs on any plant, or even a stick, if only it is so situated that the young on hatching will drop into the water.

THE LOCALITY EXCEPTIONAL, BUT SUITED TO THE BREEDING OF GADFLIES.

Marshes are known to be good places for the breeding of a number of the gadflies. But the country about Tarascon is high and not marshy as a whole. Yet the conditions were found very favorable for gadflies from the presence of strong-flowing springs, each of which sends away a small stream of pure cold water. Those I examined run in and out among the herbage, sometimes entirely concealed by a rank growth of sedges and grasses, again entering an open space and forming a pool, everywhere full of flat rocks, bits of wood and other materials, sometimes with growths of algæ, and swarming with snails and aquatic insects.

The grubs of Tabanidæ must have moisture, and thrive best in water of good quality. They are not likely to be common in transient streams, because they require a long period (about a year) to complete their growth, and a protracted drought might utterly destroy them. In marshes they are able to persist in wet soil. They feed upon snails and other aquatic animals. The spring-fed streams on the

high lands about Tarascon, with their overhanging sedges, shrubs and trees thus afford exactly the conditions most favorable to the constant presence of gadflies in the neighborhood, and not only the brown fly, but, as already noted, the big black species occurs there. I am informed by Mr. Goff that the green-head gadfly is also present in some numbers, though I did not encounter it in my rather brief stay.

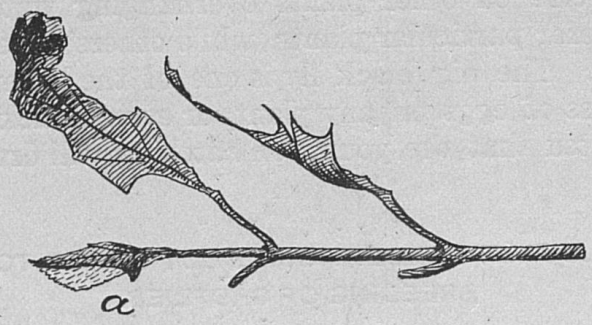


FIG. 5.—The egg-mass (*a*) of *Tabanus atratus*, shown attached to the under side of a leaf. Natural size. The leaves of the shrub were badly gnawed by caterpillars.

The brown gadfly appears to be somewhat closely restricted to these upland streams of rather cool water, and is not at present found in large numbers elsewhere. I have in a good many years' collecting at Lexington secured only two or three specimens. We have spring-fed streams here, but our county is so close grazed, and the native growth so completely removed from the edges of the streams, that less opportunity to breed undisturbed is afforded the flies. At the present time our Fayette County stockmen, of whom I have inquired, know little or nothing of the brown gadfly so troublesome in Henry County.

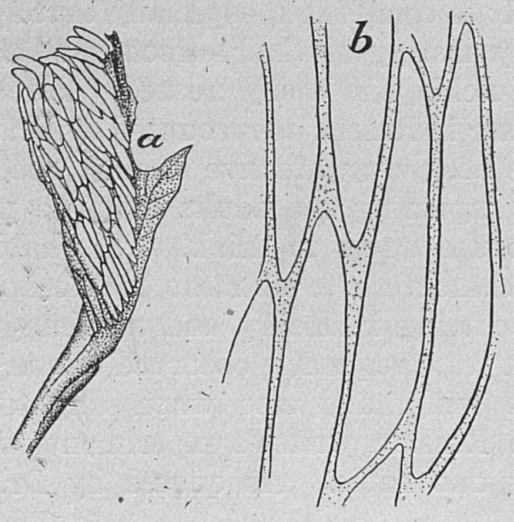


FIG. 6.—The egg-mass (*a*) of *Tabanus atratus* greatly magnified; *b*, a few of the eggs more highly magnified. Original.

The presence of native shrubbery and other wild growths of vegetation has been supposed by stockmen to be in some way responsible for the numbers of flies present in Henry County, but it is evident that the primary cause is the presence of small permanent runlets of good water in which is an abundance of suitable food for the grubs. The shrubbery and trees only afford lurking places for the flies after they emerge from the mud and water. The disposition of the flies to lurk about certain trees, such as black walnut and red bud, does not, therefore, imply that the insect is to any great extent dependent on these plants, or that they have any influence at all on its abundance.

The adult fly is abroad, according to Mr. Goff, for about five weeks, appearing in the latter part of July. It has been observed by him before this year, but not in such large numbers.

SUGGESTIONS FOR TREATMENT.

Many oils and mixtures have been suggested and used on the backs of cattle to drive away the flies, but the success has not always been entirely satisfactory to those who have

tried them. It is complained especially that applications are not sufficiently lasting in their effects, and a large herd of cattle is not quickly and easily treated. Porchinski's use of coal oil on water in Russia, as recounted by Dr. L. O. Howard, seems to have been very effective against species inhabiting pools, the oil capturing the adults in large numbers when they came to the water to drink. This habit of drinking seems to be characteristic of most of the species, and the brown one occurring in Henry and adjoining counties is no exception. It was frequently observed dipping in the water while on the wing, and also when alighted on floating objects. The Russian writer's experiments were suggested by observing this habit. As quoted by Dr. Howard, he writes:

"The insects, in attempting to take in water by the proboscis, were at once wetted by the kerosene and became stuck, as it were, to the surface of the pool. In their efforts to tear themselves away from the oily surface by the aid of their wings, they circled with great velocity on the surface and soon perished. In some cases, not at all infrequently, they succeeded in flying away, but in all such cases they either let themselves down near by on the leaves of some bushes or they flew farther with a peculiar unusual buzz. Their fate, however, was only postponed a few hours. They soon perished (sometimes in five or six hours) from suffocation and poisoning, so that at different distances from the 'pool of death' could be found dead or dying Tabanidæ whose bodies were more or less covered with kerosene. The 'pool of death' not only attracts the Tabanidæ from the immediate neighborhood, but from remote places, especially when there are no other 'pools of death' near by. Moreover, further experiments and observations showed that the presence of other pools, brooks and creeks does not detract from the importance of the 'pools of death' for this reason, that a Tabanus has only to attempt once to take water from the 'pool of death' to find certain death, and the insect will certainly make this attempt, owing to the very active life of the Tabanidæ, which fly with great power and for long stretches of time. Lastly, it must be mentioned that the most of the Tabanidæ very unwillingly fly to open places much removed from the woods. For instance, I rarely saw

Tabanidæ taking water from a river flowing less than half a mile from the nearest parts of the woods where these insects swarmed in great numbers; they always took water from a stagnant pool near by."

Porchinski applied a "half pound" of coal oil to an area amounting to about two-thirds of a square yard (one square arshin), and found it necessary to renew the oil every morning.

The conditions at Tarascon are not such as to make the use of oil on the surface of water quite so satisfactory as was the case with Porchinski's experiments. The little streams flow rapidly over much of their courses, and it is only in the pools formed here and there that the flies can be reached. These open places in the sun are, however, just the spots chosen by the flies for dipping, and very likely some good could be done in pastures by treating these pools, possibly helping the good work by enlarging them or producing others in convenient places by damming the streams temporarily.

A serious objection to the use of oils and other materials on cattle for the prevention of fly injury is the difficulty of treating large numbers quickly and thoroughly. Animals do not submit patiently to being sprayed, and where many are to be treated it seems advisable to construct a chamber or chute through which they may be driven from a yard, the spray being applied from all directions as they pass through. Such an apparatus, styled the Seabury machine, has been used with some success to relieve cattle of ticks and mange in the West, and could readily be constructed and conveniently used to dose a herd of cattle with coal oil or crude oil emulsion, so as to save the animals much of the annoyance to which they are now subject. A single strong force pump with one man to operate it, and provided with several delivery nozzles placed in the walls of such a chute, some overhead, others at the sides and still others beneath, all kept playing while cattle were driven through would do the work effectively. Either the prepared crude oil emulsions or the

standard home-made coal oil emulsion may be used, diluted one part to ten of water. For the preparation of such emulsions the reader is referred to pages 14 and 15 of our Bulletin No. 147. In the West a spraying machine of the sort suggested is set up on ranges wherever convenient, and from 800 to 1,000 cattle per hour are sometimes sprayed. A 25 per cent. mixture of crude oil and water is in common use.

The South Africans* have in use a somewhat simpler device consisting of two parallel rows of fence posts placed close together and supplied with wire fencing. Stock to be sprayed is driven between the two fences and sprayed from each side as it passes through. The alley formed by the fences is made to widen out at one end into a stock paddock or yard, so as to render less difficult the task of driving stock into the alley. At the end from which the animals escape may be placed a gate to prevent the too rapid movement of cattle under treatment. With a sprayer on each side, sixty animals can be sprayed in such an alley in an hour.

The spraying machine used in the Western States, with its enclosed space filled with spray driven with some force from different directions, seems calculated to dose animals more thoroughly and quickly.

One other suggestion may be ventured as to possible means of destroying the flies, basing it on my observation as to their fondness for sweets. A poisoned sirup, consisting of molasses and black cobalt, brushed high up on the trunks of trees where stock cannot reach it, seems calculated to kill many of the adult flies, as it does the tobacco fly. It is worth trying at any rate.

DESCRIPTION OF THE FLY.

General color, including wings, dark gray. Length of body, male, 0.75 inch; to tips of wings, about 1 inch. Length of body, female, 0.81 to 1.00 inch: to tips of wings, about 1.13 inch.

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*See an article by C. P. Lounsbury, Journal Department of Agriculture, Cape of Good Hope, South Africa, October, 1902.

Eyes reddish brown, with two parallel bright metallic green stripes across each, beginning on each side of a small shining black frontal prominence and extending outward nearly to the external margins. In the female these bands are nearly equal in width, the upper one expanding finally at the margin. Both green bands complete in male, and the eyes viewed from the front, noticeably round, as compared with those of *T. sulcifrons.*

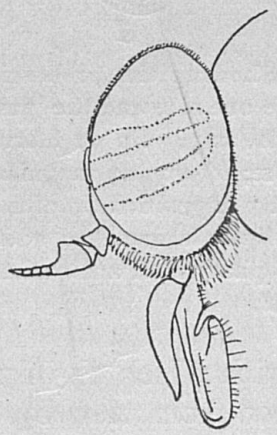


FIG. 7.—A side view of the head of the Brown Gadfly (*Tabanus exul*), showing the mouth parts in position, the puncturing parts concealed in a groove along the front (dorsal) side of the proboscis. X 3½. Original.

The thorax is gray, with obscurely indicated lengthwise black markings. The abdomen is of a deep orange shade above, marked with a median series of rather acute gray triangles; tip black. Beneath, the abdomen is largely brownish orange. Antennæ, black at base, then orange, the curved tip black. Legs largely black, the tibiæ reddish brown at bases. Wings smoky gray, each with four rather obscurely defined black marks, a small round one nearest the tip being especially noticeable.

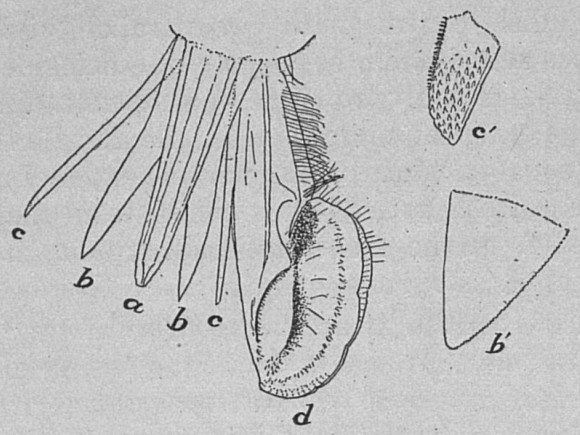


FIG. 8.—Showing the proboscis of *Tabanus exul* pressed to one side and the puncturing parts exposed. *a*, the upper lip or labrum; *b*, mandibles; *c*, maxillæ; *b'*, greatly magnified tip of mandible; *c'*, greatly magnified tip of maxilla; *d*, proboscis, lower lip or labium; an additional slender piece, the hypopharynx of anatomists, is concealed by *a*. Original.

The mouth parts with which the fly stings or punctures are ordinarily concealed from view by other more conspicuous parts. They consist of six lance-shaped pieces closely applied to each other, and in turn held close against the upper (dorsal) side of the conspicuous proboscis.

Professor Hine, of the Ohio University, in his account of *Tabanus sulcifrons*, which he finds common in Northern Ohio, and with habits like those of the Kentucky fly, represents the Ohio species as having a well-marked black W near the middle of the wing. In Kentucky flies only the outer portions of the W are represented. The triangles on the abdomen are here narrow, and the space between the eyes of the females contracts downward. The green stripes of the eye in the Kentucky flies are of equal length in both male and female.*

*It seems to me very doubtful if this species is distinct from *Tabanus abdominalis*, Fabr. The first posterier cell is generally open in Kentucky examples, but is sometimes closed on one side and open on the other.

GADFLIES DO NOT PRODUCE BOTS OR WARBLES.

It is a common notion among farmers that the gadflies are in some way related with the grubs found in the stomachs and in tumors on the backs of animals. The large black fly (*Tabanus atratus*) is quite generally believed to be the adult of the ox warble. It seems necessary to insist, therefore, that the gadflies have no relation with the thick bodied grubs found in horses' stomachs and under the skins of cattle. The warbles and bots are the young of flies that do not sting and which always place their eggs on the bodies of animals, sometimes on the legs and "heels", to be taken into the mouth, whence they find their way to the parts in which we commonly find them.

The egg-laying habits of the gadflies are as given in the preceding paragraphs. I saw the big black ox fly actually placing its eggs on a young dogwood at Tarascon, August 25, and have collected the eggs at other times along streams. Such egg-masses have been kept by entomologists until the eggs hatched and the young dropped into water, and the long cylindrical tapering grubs have been reared to maturity, so that stockmen need not hesitate to accept as truth the assertion that the gadflies never injure stock excepting as the adults do it by stinging and sucking the blood.

In addition to the two large gadflies figured in this bulletin, at least a dozen other species occur in Kentucky. Several of them are constantly annoying to horses on hot days in wooded sections, though not commonly occurring in very large numbers. The Greenhead (*Tabanus lineola*) occurs everywhere in the State. Members of a group of rather small gadflies with black-blotched wings are especially annoying to horses in mountainous regions from their habit of gathering in some numbers on the bases of the ears, where their punctures sometimes cause the blood to flow down over the faces of animals. These so-called ear-flies belong to the genus Chrysops. The following have been noted in Kentucky:

Chrysops æstuans.
C. univittatus.
C. obsoletus.
C. vittatus.

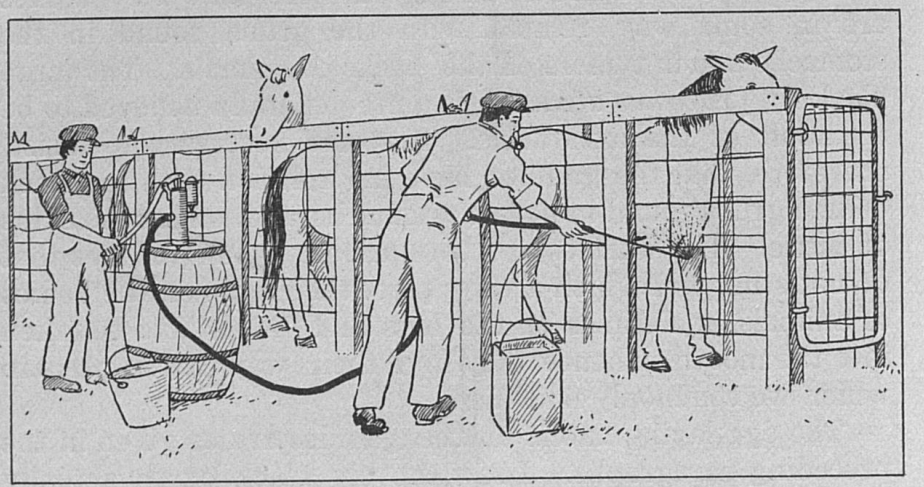


FIG. 9.—An alley or race for confining stock to be sprayed (after Lounsbury). The fences are two feet apart and twenty-five feet in length, accommodating three animals at one time. The floor should be of cement, so sloped as to drain away the surplus spray. An earth floor soon becomes miry and renders the work disagreeable.

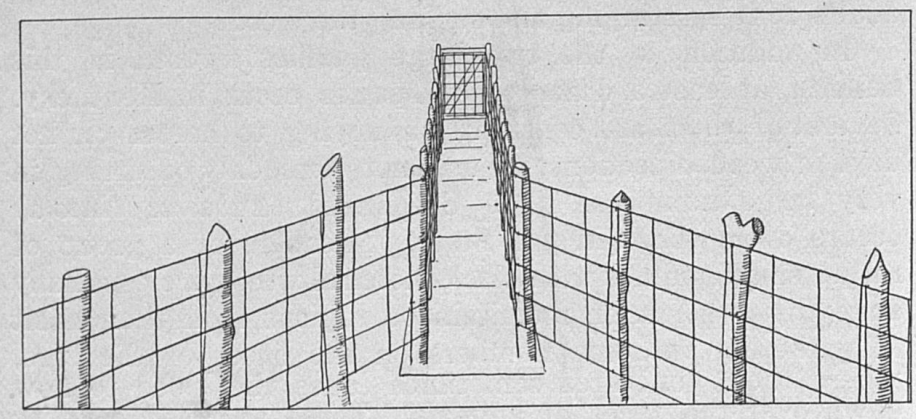


FIG. 10.—The entrance to a spraying alley. (Adapted from Lounsbury's half-tone illustration.)

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Kentucky Agricultural Experiment Station

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

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

Address:
KENTUCKY AGRICULTURAL EXPERIMENT STATION,
Lexington, Ky.

BULLETIN No. 152

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 555 different brands of commercial fertilizers registered during the year 1910. Of these different brands, 325 were complete fertilizers, or fertilizers containing all three of the essential ingredients, namely: phosphoric acid, nitrogen and potash (non acidulated bone and potash mixtures are not counted in this item); 67 acid phosphates or superphosphates, 7 nitrogenous superphosphates, 72 acid phosphates and potash mixtures, 81 bones, tankage and non-acidulated bones and potash mixtures; and 3 contained potash only. Samples of these various brands sent by manufacturers have been analyzed, as well as samples collected by deputy inspectors and those sent by farmers, and the results are given in the tables which follow.

Results of Analyses. The results of these analyses show that in most cases the samples analyzed have come fully up to the guarantee, or, where there is a slight deficiency in one ingredient, it has been made up by an excess in one or both of the other ingredients. But in a few instances, the deficiency in one ingredient, while fully made up by an excess of the other ingredients, is still too low to be considered acceptable, this being due to bad mixing at the factory. In a few instances, there seems to be an inclination on the part of the manufacturer to guarantee higher percentages than their goods contain. Some manufacturers also have used muriate of potash in making fertilizers in which the potash was guaranteed from sulphate.

Changes in Table of Results. The following changes have been made in this report in the method of reporting results. First: Nitrogen is separated into the various forms in which it occurs, namely, nitrogen in nitrates, nitrogen in ammonia salts and organic nitrogen. Second: In case of bones, the bone phosphate of lime equivalent is given and the percentage of fineness is shown also, fine bone being that which passes through a sieve with meshes one-twenty-fifth inch square, and medium bone that which passes through a sieve with meshes one-sixth inch square, but not including the fine bone. Third: The analy-

ses are grouped under tables, the classification being based upon the nature of the fertilizer, as follows:

Table 1. Complete fertilizers.
Table 2. Bones, tankage and mixtures of bone and
Table 3. Acid phosphates. [potash.
Table 4. Acid phosphate and potash mixtures.
Table 5. Nitrogenous superphosphates.
Table 6. Potash salts.

Free Analysis of Fertilizers. It is hoped that farmers who purchase fertilizers in quantity, at least, will take advantage of Section 8 of the fertilizer law, and send a sample to the Station for free analysis.

Essentials in Taking 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 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.

Blank certificates will be furnished free upon application to the Station. The section of the fertilizer law describing the manner in which samples are to be taken for free analysis is also printed on the certificate.

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

Soluble and reverted phosphoric acid in mixed fertilizers	6 c lb.
Soluble and reverted phosphoric acd in plain acid phosphates	5 c lb.
Insoluble phosphoric acid in mixed fertilizer	2 c lb.
Phosphoric acid in fine bone	4 c lb.
Phosphoric acid in medium bone	3 c lb.
Nitrogen in all fertilizers	17½c lb.
Potash in all fertilizers, from sulphate	6 c lb.
Potash in all fertilizers, from muriate	5 c lb.

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

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

The figures in the table which are set in bold face type

are those results which, in the judgment of the Director, were too low to be acceptable.

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

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	A. D. Adair & McCarty Bros., Chattanooga, Tenn.	
30446	Adair's Soluble Pacific Guano.	Manufacturer
30447	Adair's Ammoniated Dissolved Bone	Manufacturer
30451	Furman High Grade Fertilizer	Manufacturer
30452	Adair's Standard Tobacco Grower	Manufacturer
35015		W. T. Kirkman, Elkton
30453	Adair's High Grade Special Tobacco Grower	Manufacturer
30984	David Harum Extra High Grade Guano	Manufacturer
	The American Agr'l Chemical Co., Cin. Sales Dept., Cincinnati, Ohio.	
30622	Special Potato & Vegetable Manure	Manufacturer
30623	High Grade Tobacco & Truck Fertilizer	Manufacturer
35016		Jas. H. Dodson & Son, Maysville
30624	K. & T. Special Manure	Manufacturer
35017		Roy and Jasper, Science Hill
35277		S. McKinley, Columbia

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
11.34	0.24	11.58				1.51	1.83	2.09		$21.09	30446
10.00						*1.65*	*2.00*	*2.00*		*19.78*	
8.53	0.50	9.03				1.65	2.00	2.17		18.39	30447
8.00						*1.65*	*2.00*	*2.00*		*17.38*	
9.90	0.34	10.24				1.78	2.16	2.26		20.51	30451
10.00						*1.65*	*2.00*	*2.00*		*19.78*	
7.94	0.29	8.23				1.62	1.97	2.44		17.76	30452
8.64	1.05	9.69				1.82	2.21	1.80		18.96	35015
8.00						*1.65*	*2.00*	*2.00*		*17.38*	
8.27	0.41	8.68				1.64	1.99	6.52		22.34	30453
8.00						*1.65*	*2.00*	*6.00*		*21.38*	
10.62	0.80	11.42	0.99		2.31	3.30	4.01	4.60		29.21	30984
10.00						*3.29*	*4.00*	*4.00*		*27.52*	
5.46	1.30	6.76		0.27	0.84	1.11	1.35	10.54		21.50	30622
5.00	*2.00*	*7.00*				*0.82*	*1.00*	*10.00*		*19.67*	
9.13	1.89	11.02		0.39	1.50	1.89	2.29	5.57		23.91	30623
9.42	1.66	11.08		1.50	0.37	1.87	2.27	3.14	2.25	24.35	35016
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*5.00*		*21.18*	
8.34	1.77	10.11		1.83	1.00	2.83	3.44	6.48		27.11	30624
8 68	1.73	10.41		2.02	0.45	2.47	3.00	6 60		26.36	35017
9.67	1.52	11.19		1.95	0.74	2.69	3.27	1.62	4.89	29.12	35277
8.00	*2.00*	*10.00*				*2.47*	*3.00*	*6.00*		*25.05*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The American Agr'l Chemical Co., Cin. Sales Dept., Cincinnati, Ohio.	
30629	Bradley Fert. Works B. D. Sea Fowl Guano	Manufacturer
35019		Richeson & Turner, Campbellsville
35279		J. A. Rain, Vine Grove
30630	Bradley Fert. Works Potato and Root Fertilizer	Manufacturer
30631	Bradley Fert. Works Corn and Wheat Phosphate	Manufacturer
30632	Bradley Fert. Works Dissolved Bone with Potash	Manufacturer
35020		Hoskins and Dyche, London
35280		W. M. Murphy, Waynesburg
30633	Bradley Fert. Works Niagara Phosphate	Manufacturer
35281		J. A. Rain, Vine Grove
30636	Cleveland Dryer Works Ohio Seed Maker with Potash	Manufacturer
30637	Cleveland Dryer Works Potato & Tobacco Fertilizer	Manufacturer
35023		Hines and Gardner, Vanceburg
30638	Cleveland Dryer Works Phospho Bone	Manufacturer

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
8.15	2.24	10.39		1.74	0.70	2.44	2.96	1.88		$21.10	30629
9.33	2.05	11.38		1.31	0.90	2.21	2.68	1.98		21.74	35019
9.33	1.91	11.24		0.94	1.07	2.01	2.44	1.84		20.84	35279
8.00	*2.00*	*10.00*				*2.06*	*2.50*	*1.50*		*19.11*	
8.38	2.38	10.76		0.36	0.59	0.95	1.15	3.30		17.64	30630
8.00	*2.00*	*10.00*				*0.82*	*1.00*	*3.00*		*16.27*	
10.37	2.52	12.89		0.49	0.52	1.01	1.23	1.28		18.27	30631
10.00	*2.00*	*12.00*				*0.82*	*1.00*	*1.00*		*16.67*	
8.35	2.13	10.48				1.18	1.43	2.42		17.42	30632
8.79	1.98	10.77		0.53	0.70	1.23	1.49	2.30		17.95	35020
8.63	1.21	9.84				0.96	1.17	2.23		16.43	35280
8.00	*2.00*	*10.00*				*1.03*	*1.25*	*2.00*		*16.01*	
7.21	3.58	10.79				1.10	1.34	1.30		15.23	30633
7.80	3.15	10.95				1.00	1.21	1.07		15.19	35281
7.00	*1.00*	*8.00*				*0.82*	*1.00*	*1.00*		*12.67*	
8.50	2.80	11.30		0.60	1.23	1.83	2.22	2.33		20.06	30636
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	
8.07	2.52	10.59		0.37	0.61	0.98	1.19	3.39		17.51	30637
9.19	1.90	11.09				1.02	1.24	3.21		18.57	35023
8.00	*2.00*	*10.00*				*0.82*	*1.00*	*3.00*		*16.27*	
10.59	2.42	13.01		0.56	0.47	1.03	1.25	1.21		18.50	30638
10.00	*2.00*	*12.00*				*0.82*	*1.00*	*1.00*		*16.67*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The American Agr'l Chemical Co., Bowker Fert. Works, Cincinnati, Ohio.	
30645	Bowker's Harvest Bone	Manufacturer .....
35029		Dunagan & Kirtley, Horse Cave.
35287		Browning, McReynolds & Co., Lewisburg .....
30646	Bowker's Fish Guano	Manufacturer .....
35030		C. P. Clark, Owensboro.....
35288		Browning, McReynolds & Co., Lewisburg .....
30647	Bowker's Kentucky Special...	Manufacturer .....
35031		Fischer Bros., Newport.....
35289		S. McKinley, Columbia.....
30648	Bowker's Tobacco Grower...	Manufacturer .....
35032		Dunagan & Kirtley, Horse Cave.
35290		Richeson & Turner, Campbellsville .....
30649	Bowker's High Grade Fertilizer	Manufacturer .....
35033		Browning, McReynolds & Co., Lewisburg .....
35291		Richeson & Turner, Campbellsville .....
30650	Bowker's 10% Manure.....	Manufacturer .....
35034		S. Y. Cutshaw, Bedford.....
30654	Bowker's Grain & Grass Grower	Manufacturer .....
35037		W. H. Murray, London.....

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
8.02	3.06	11.08				0.96	1.17	1.22		$15.42	30645
8.88	2.24	11.12		0.49	0.50	0.99	1.20	1.37		16.40	35029
8.06	2.35	10.41				0.81	0.98	1.39		14.84	35287
8.00	*1.50*	*9.50*				*0.82*	*1.00*	*1.00*		*14.07*	
8.10	2.74	10.84		0.37	0.63	1.00	1.21	3.14		17.46	30646
8.75	1.98	10.73		0.44	0.59	1.03	1.25	3.07		17.97	35030
8.08	1.75	9.83				0.92	1.12	2.54		16.16	35288
8.00	*1.50*	*9.50*				*0.82*	*1.00*	*3.00*		*16.07*	
8.10	2.09	10.19				1.34	1.63	4.24		19.49	30647
7.87	3.15	11.02		0.94	0.56	1.50	1.82	4.94		20.89	35031
8.27	3.20	11.47				1.49	1.81	3.83		20.25	35289
8.00	*1.50*	*9.50*				*1.23*	*1.50*	*4.00*		*18.51*	
9.64	1.87	11.51		0.88	0.83	1.71	2.08	1.98	2.91	23.78	30648
7.79	1.44	9.23		1.17	0.59	1.76	2.14	2.60	2.51	21.70	35032
8.26	2.68	10.94				1.81	2.20	0.78	4.72	23.76	35290
8.00	*1.50*	*9.50*				*1.65*	*2.00*		*5.00*	*21.98*	
8.62	1.95	10.57		1.98	0.84	2.82	3.42	0.74	5.48	28.31	30649
9.18	1.82	11.00		1.95	0.66	2.61	3.17	4.24	1.68	27.15	35033
9.70	2.00	11.70		0.56	2.15	2.71	3.29	1.12	4.99	29.04	35291
8.00	*1.50*	*9.50*				*2.47*	*3.00*		*6.00*	*26.05*	
5.54	1.17	6.71		0.25	0.81	1.06	1.29	10.60		21.43	30650
5.40	1.36	6.76		0.53	0.35	0.88	1.07	11.36		21.46	35034
5.00	*1.50*	*6.50*				*0.82*	*1.00*	*10.00*		*19.47*	
8.86	2.35	11.21		0.48	1.35	1.83	2.22	2.79		20.77	30654
7.86	2.59	10.45		0.67	1.01	1.68	2.04	2.28		18.63	35037
8.00	*1.50*	*9.50*				*1.65*	*2.00*	*2.00*		*17.98*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The American Agr'l Chemical Co., Michigan Carbon Works, Cincinnati, Ohio.	
30655	Homestead Tobacco Grower..	Manufacturer .....
35038		J. H. Thurman, Somerset.....
35293		Walton, Reynolds, Handy & Co., Cave City .....
30656	Homestead 10% Potash Manure	Manufacturer .....
35039		F. C. Parrish, Horse Cave.....
35294		Walton, Reynolds, Handy & Co., Cave City .....
30657	Homestead Potato & Tobacco Special	Manufacturer .....
35040		S. McKinley, Columbia.....
30658	Homestead High Grade Garden & Vegetable Fertilizer...	Manufacturer .....
30659	Homestead Bone Black Fertilizer	Manufacturer .....
35041		Cyrus Campbell, Burnside.....
35295		W. T. Shaw, Hodgenville.....
30660	Red Line Crop Grower.....	Manufacturer .....
35042		N. F. Hill, Bowling Green.....
35296		D. M. Brakefield, Adairville....
30661	A-1 Potash Fertilizer.....	Manufacturer .....
35043		Cyrus Campbell, Burnside.....
30662	Red Line Tobacco Manure...	Manufacturer .....
35044		Walton, Reynolds, Handy & Co., Cave City .....

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
10.74	1.45	12.19		2.12	1.10	3.22	3.91	3.82		$28.56	30655
10.43	2.28	12.71		2.68	0.45	3.13	3.80	4.17		28.56	35038
10.39	2.17	12.56				3.05	3.70	3.66		27.68	35293
10.00	*1.00*	*11.00*				*2.88*	*3.50*	*3.50*		*25.98*	
5.62	1.25	6.87		0.25	0.82	1.07	1.30	10.62		21.61	30656
5.84	2.14	7.98		0.60	0.47	1.07	1.30	10.94		22.56	35039
5.57	1.93	7.50				1.12	1.36	9.82		21.19	35294
5.00	*2.00*	*7.00*				*0.82*	*1.00*	*10.00*		*19.67*	
9.17	1.68	10.85		0.35	1.52	1.87	2.27	5.48		23.70	30657
8.25	2.54	10.79		1.17	0.67	1.84	2.23	5.22		22.58	35040
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*5.00*		*21.18*	
9.36	1.71	11.07		0.38	1.54	1.92	2.33	5.56		24.19	30658
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*5.00*		*21.18*	
8.23	2.18	10.41		1.68	0.80	2.48	3.01	1.79		21.22	30659
8.14	2.42	10.56		1.31	0.99	2.30	2.79	1.81		20.60	35041
8.86	2.87	11.73				2.30	2.79	1.72		21.55	35295
8.00	*2.00*	*10.00*				*2.06*	*2.50*	*1.50*		*19.11*	
9.03	2.28	11.31		0.48	1.41	1.89	2.29	2.23		20.60	30660
8.74	2.61	11.35		0.90	0.90	1.80	2.19	2.39		20.22	35042
7.95	3.82	11.77				1.76	2.14	2.20		19.43	35296
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	
8.20	2.33	10.53		0.39	0.62	1.01	1.23	3.35		17.66	30661
8.47	1.81	10.28		0.37	0.68	1.05	1.27	3.18		17.74	35043
8.00	*2.00*	*10.00*				*0.82*	*1.00*	*3.00*		*16.27*	
8.12	2.41	10.53		0.39	0.61	1.00	1.21	3.26		17.46	30662
9.06	1.52	10.58		0.48	0.58	1.06	1.29	2.81		18.00	35044
8.00	*2.00*	*10.00*				*0.82*	*1.00*	*3.00*		*16.27*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The American Agr'l Chemical Michigan Carbon Works.	
30663	Red Line Complete Manure..	Manufacturer .....
35045		P. K. Hubbard, Munfordville ...
35297		Woodson Lewis, Greensburg...
	The American Agr'l Chemical Co., Cincinnati Sales Dept., Cincinnati, Ohio.	
30669	N-W Horse Shoe Brand 3-8-6 Fertilizer	Manufacturer .....
30670	N-W Horse Shoe Brand Tobacco Grower	Manufacturer .....
35050		Eskew Bros., Marion.....
30671	N-W Horse Shoe Brand High Grade Vegetable Fertilizer...	Manufacturer .....
30672	N-W Horse Shoe Brand Special Onion & Vegetable Manure	Manufacturer .....
30673	N-W Horse Shoe Brand National Bone Dust.....	Manufacturer .....
35301		Ed Frost, Central City.....
30674	N-W Horse Shoe Brand Challenge Corn Grower.....	Manufacturer .....
35051		E. P. Barnes & Bro., Beaver Dam
35302		Grayson Co. Supply Co. Leitchfield .....
30675	N-W Horse Shoe Brand Kentucky Tobacco Grower.....	Manufacturer .....
35052		Forbes Mfg. Co., Hopkinsville..

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
7.08	3.49	10.57				1.09	1.32	1.26		$14.98	30663
7.08	2.44	9.52		0.27	0.69	0.96	1.17	1.21		14.05	35045
7.95	3.52	11.47				0.97	1.18	1.11		15.46	35297
7.00	*1.00*	*8.00*				*0.82*	*1.00*	*1.00*		*12.67*	
8.87	1.39	10.26		1.83	0.97	2.80	3.40	6.60		27.60	30669
8.00	*2.00*	*10.00*				*2.47*	*3.00*	*6.00*		*25.05*	
8.84	1.93	10.77		0.41	1.51	1.92	2.33	5.39		23.49	30670
8.48	2.36	10.84		1.28	0.49	1.77	2.15	5.08		22.40	35050
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*5.00*		*21.18*	
9.06	1.94	11.00		0.38	1.56	1.94	2.36	5.47		23.91	30671
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*5.00*		*21.18*	
5.34	1.62	6.96		0.27	0.81	1.08	1.31	10.60		21.44	30672
5.00	*2.00*	*7.00*				*0.82*	*1.00*	*10.00*		*19.67*	
8.03	1.95	9.98		1.66	0.73	2.39	2.90	1.92		20.71	30673
8.59	2.94	11.53		1.01	1.20	2.21	2.68	1.88		21.11	35301
8.00	*2.00*	*10.00*				*2.06*	*2.50*	*1.50*		*19.11*	
7.97	2.23	10.20		1.71	0.87	2.58	3.13	1.59		21.07	30674
8.36	2.17	10.53		1.07	1.14	2.21	2.68	1.70		20.34	35051
9.33	2.40	11.73		1.15	1.20	2.35	2.85	1.79		22.18	35302
8.00	*2.00*	*10.00*				*2.06*	*2.50*	*1.50*		*19.11*	
8.82	2.41	11.23		0.51	1.36	1.87	2.27	2.28		20.37	30675
8.65	0.94	9.59		0.83	0.74	1.57	1.91	2.15		18.41	35052
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The American Agr'l Chemical Co.	
30676	N-W Horse Shoe Brand Corn & Wheat Grower.....	Manufacturer .....
35053		Dickey & Co., Glasgow.....
35303		Watkins & Co., Elizabethtown..
30677	N-W Horse Shoe Brand Acidulated Bone & Potash.....	Manufacturer .....
30678	N-W Horse Shoe Brand Potash Manure	Manufacturer .....
30679	N-W Horse Shoe Brand Dark Tobacco Grower	Manufacturer .....
30680	N-W Horse Shoe Brand Animal Bone Manure.....	Manufacturer .....
35304		Ed Frost, Central City.....
	The American Agr'l Chemical Co., Cincinnati Sales Dept., Cincinnati, Ohio.	
30687	Packer's Boar's Head Brand High Grade Vegetable Fertilizer	Manufacturer .....
30688	Packer's Boars Head Brand World of Good Super Phosphate	Manufacturer .....
35058		J. F. Vigle, Burnside.....
30689	Packer's Boars Head Brand Corn and Wheat Grower.....	Manufacturer .....

Complete Fertilizers.

Phosphoric Acid.			Nitrogen.				Equivalent to Ammonia.	Potash.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
8.86	2.46	11.32		0.49	1.34	1.83	2.22	2.43		$20.45	30676
8.83	2.41	11.24		1.01	0.82	1.83	2.22	2.34		20.31	35053
8.98	3.11	12.09		0.74	1.01	1.75	2.12	2.37		20.52	35303
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	
10.36	2.33	12.69		0.55	0.47	1.02	1.24	1.21		18.14	30677
10.00	*2.00*	*12.00*				*0.82*	*1.00*	*1.00*		*16.67*	
8.55	2.36	10.91		0.41	0.56	0.97	1.18	3.04		17.64	30678
8.00	*2.00*	*10.00*				*0.82*	*1 00*	*3.00*		*16.27*	
7.05	3.66	10.71				1.09	1.32	1.25		14.99	30679
7.00	*1.00*	*8.00*				*0.82*	*1.00*	*1.00*		*12.67*	
7.37	3.45	10.82				1.11	1.35	1.28		15.39	30680
7.97	3.31	11.28				1.09	1.32	1.12		15.82	35304
7.00	*1.00*	*8.00*				*0.82*	*1.00*	*1.00*		*12.67*	
8.89	1.76	10.65		0.37	1.61	1.98	2.40	5.50		23.80	30687
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*5.00*		*21.18*	
7.93	2.35	10.28		1.77	0.68	2.45	2.97	1.82		20.86	30688
8.58	2.55	11.13		1.50	0.82	2.32	2.82	2.00		21.44	35058
8.00	*2.00*	*10.00*				*2.06*	*2.50*	*1.50*		*19.11*	
8.70	2.35	11.05		0.46	1.38	1.84	2.23	2.41		20.23	30689
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The American Agr'l Chemical Co., Cincinnati Sales Dept.	
30690	Packer's Boars Head Brand Special Tobacco Grower.....	Manufacturer .....
35059		I. K. Miller & Sons, Campbellsville .....
30691	Packer's Boars Head Brand Ammoniated Bone & Potash..	Manufacturer .....
35060		J. F. Vigle, Burnside.....
30692	Packer's Boars Head Brand Sure Growth Potash Manure..	Manufacturer .....
35061		I. K. Miller & Sons, Campbellsville .....
30694	Packer's Boars Head Brand Faultless Grain Grower.....	Manufacturer .....
	The Armour Fertilizer Works, Chicago, Ill.	
30587	Corn and Wheat Grower.....	Manufacturer .....
35063		J. M. Reynolds, Waynesburg....
35308		C. R. Barnes, Bardstown.....
30588	Grain Grower	Manufacturer .....
35064		Dickey & Martin, Munfordville.
35309		C. R. Barnes, Bardstown.....
30589	Bone, Blood and Potash.....	Manufacturer .....
30590	White Burley & Black Tobacco	Manufacturer .....
35065		Lambert, Walker Hardware Co., Henderson .....

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
8.87	2.35	11.22		0.51	1.35	1.86	2.26	2.40		$20.49	30690
8.80	2.15	10.95		0.52	1.29	1.81	2.20	2.17		19.93	35059
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	
10.40	2.29	12.69		0.51	0.54	1.05	1.27	1.28		18.36	30691
9.82	2.50	12.32		0.39	0.64	1.03	1.25	1.43		17.82	35060
10.00	*2.00*	*12.00*				*0.82*	*1.00*	*1.00*		*16.67*	
7.99	2.46	10.45		0.44	0.56	1.00	1.21	3.61		17.68	30692
8.66	2.04	10.70		0.37	0.65	1.02	1.24	3.21		17.99	35061
8.00	*2.00*	*10.00*				*0.82*	*1.00*	*3.00*		*16.27*	
7.40	3.31	10.71				1.13	1.37	1.38		15.54	30694
7.00	*1.00*	*8.00*				*0.82*	*1.00*	*1.00*		*12.67*	
8.23	1.89	10.12				1.02	1.24	4.57		18.78	30587
9.63	1.02	10.65				1.10	1.34	1.14	2.29	19.71	35063
9.58	0.85	10.43				0.94	1.14	3.45		18.58	35308
8.00	*0.50*	*8.50*				*0.82*	*1.00*	*4.00*		*16.67*	
8.41	2.36	10.77				1.80	2.19	2.62		19.95	30588
7.65	1.63	9.28		1.45	1.27	2.72	3.30	1.94	1.20	22.73	35064
9.83	1.19	11.02				0.98	1.19	2.44		18.15	35309
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	
10.38	1.64	12.02				4.29	5.21	7.84		35.98	30589
8.00	*2.00*	*10.00*				*4.12*	*5.00*		*7.00*	*33.22*	
9.58	0.71	10.29	1.16		1.90	3.06	3.71	4.67		27.16	30590
9.15	1.16	10.31	0.39	0.66	1.34	2.39	2.90	1.74	4.39	26.82	35065
8.00	*2.00*	*10.00*				*2.88*	*3.50*		*4.00*	*25.28*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Armour Fertilizer Works.	
30591	Wheat, Corn & Oats Special..	Manufacturer .....
35066		Barren Co. Grocery & Hardware Co., Glasgow .....
35310		E. S. Ferriell & Sons, Buffalo..
30592	Ammoniated Bone with Potash	Manufacturer .....
35067		Ohio Valley Mill & Supply Co., Ashland .....
30593	Tobacco Grower	Manufacturer .....
35068		Dickey & Martin, Munfordville..
30594	Dark Tobacco Special.....	Manufacturer .....
35069		Kirkpatrick & Brown, Penrod..
30595	Armour's Champion	Manufacturer .....
35311		Simpson Co. Hardware Co., Franklin .....
30596	High Grade Potato.....	Manufacturer .....
35070		Finley Hardware Co., Madisonville .....
30597	Record Brand	Manufacturer .....
30605	Wheat Special No. 2.....	Manufacturer .....
	C. S. Brent, Lexington, Ky.	
30943	Brent's Tobacco & Hemp Special	Manufacturer .....
30944	Brent's Grain Grower.....	Manufacturer .....

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
8.92	1 57	10.49				1.04	1.26	1.57		$16.54	30591
7.28	1.57	8.85	0.33		1.08	1.41	1.71	1.04	2.03	17.79	35066
7.96	0.85	8.81				1.05	1.27	1.07		14.64	35310
7.00	*2.00*	*9.00*				*0.82*	*1.00*	*1.00*		*13.07*	
6.05	1.80	7.85	0.71		1.96	2.67	3.24	2.76		20.09	30592
5.58	4.98	10.56	-			3.13	3.80	2.63		22.28	35067
6.00	*2.00*	*8.00*				*2.47*	*3.00*	*2.00*		*18.65*	
8.70	1.28	9.98	0.33		1.73	2.06	2.50	2.18	3.52	24.56	30593
8.38	1.16	9.54				2.14	2.60	2.06	2.86	23.50	35068
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*5.00*	*22.18*	
7.43	1.63	9.06				2.04	2.48	4.46		21.17	30594
7.95	1.24	9.19				1.81	2.20		4.49	21.77	35069
7.00	*2.00*	*9.00*				*1.65*	*2.00*		*4.00*	*19.78*	
9.54	2.01	11.55				2.10	2.55	2.78		22.38	30595
11.36	0.91	12.27				1.81	2.20	2.06		22.39	35311
10.00	*2.00*	*12.00*				*1.65*	*2.00*	*2.00*		*20.58*	
8.06	1.95	10.01				1.89	2.29	2.02	8.76	29.60	30596
8.96	0.73	9.69				1.76	2.14	10.47		27.67	35070
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*10.00*		*26.18*	
10.15	1.66	11.81				1.09	1.32	1.57		18.23	30597
10.00	*2.00*	*12.00*				*0.82*	*1.00*	*1.00*		*16.67*	
10.24	1.64	11.88				1.00	1.21	2.77		19.22	30605
10.00	*2.00*	*12.00*				*0.82*	*1.00*	*2.00*		*17.67*	
5.66	0.97	6.63		3.34	0.38	3.72	4.52	2.34	8.50	32.74	30943
5.00						*4.00*	*4.86*		*10.00*	*32.00*	
9.44	1.73	11.17		1.19	0.61	1.80	2.19	2.06		20.38	30944
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Canton Lime and Fertilizer Co., Canton, Ohio.	
30950	Clover Leaf Lawn Dressing..	*Manufacturer .....
30951	Celery & Onion Grower.....	*Manufacturer .....
30952	High Grade Wheat, Oats & Corn	*Manufacturer .....
	The Cincinnati Phosphate Co., Cincinnati, Ohio.	
30901	Capitol High Grade Guano....	Manufacturer .....
30902	Capitol Grain & Grass Grower	Manufacturer .....
30906	Capitol Tobacco, Potato & Beet Grower	Manufacturer .....
35078		G. S. Hiatt, Mt. Vernon.....
30909	Capitol Bone & Phosphate Mixture Wheat Special.....	Manufacturer .....
30910	Capitol Truck & Tobacco Fertilizer	Manufacturer .....
	Continental Fertilizer Co., Nashville, Tenn.	
30753	Bear Special Corn Grower....	Manufacturer .....
35081		J. L. Durham, Greensburg.....

*The manufacturer failed to furnish sample as required by law.

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
											30950
3.00						*1.65*	*2.00*	*6.00*		*15.38*	
											30951
5.00						*1.65*	*2.00*	*8.00*		*19.78*	
											30952
8.00						*0.82*	*1.00*	*2.00*		*14.47*	
7.83	0.80	8.63		0.48	0.83	1.31	1.59	3.23		17.54	30901
8.00	*1.00*	*9.00*				*1.23*	*1.50*	*2.50*		*16.81*	
8.81	2.12	10.93				1.00	1.21	2.14		17.06	30902
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*2.00*		*14.87*	
8.86	2.04	10.90				0.91	1.10	4.39		19.03	3090
8.34	1.76	10.10				0.95	1.15	4.72		18.76	35078
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*2.00*	*2.00*	*17.27*	
10.94	10.35	21.29		0.45	1.51	1.96	2.38	1.15		25.28	30909
11.00	*5.00*	*16.00*				*1.65*	*2.00*	*1.00*		*21.98*	
6.89	1.06	7.95				1.70	2.06	1.34	5.69	22.81	30910
6.00	*1.00*	*7.00*				*1.65*	*2.00*		*6.00*	*20.58*	
7.19	2.14	9.33				1.01	1.23	1.20		14.23	30753
6.74	2.18	8.92				0.86	1.04	0.52	0.57	13.17	35081
7.00	*1.00*	*8.00*				*0.82*	*1.00*		*1.00*	*12.87*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Continental Fertilizer Co.	
30754 35321	Bear Special Wheat Grower..	Manufacturer ..... Chas. Ratliff, Princeton.....
30755 35322	Bear Grain Grower.....	Manufacturer ..... Chas. Ratliff, Princeton.....
30756 35082	Bear Slaughter House Bone..	Manufacturer ..... H. A. McElroy, Bowling Green.
30757 35083	Bear Beef, Blood & Bone.....	Manufacturer ..... J. T. Parsons, Leitchfield.....
30758 35084	Bear Special Tobacco Grower	Manufacturer ..... W. F. Grainger, Franklin.....
30759 35085	Bear High Grade Tobacco & Potato Grower	Manufacturer ..... Yerkes & Kenney, Paris.....
30760 35086	Bear Tobacco Grower.....	Manufacturer ..... W. F. Grainger, Franklin.....
30761	Bear Potato Grower.....	Manufacturer .....
30762 35087	Bear Truck Grower.....	Manufacturer ..... W. F. Grainger, Franklin.....
	Duncan & Bro., LaGrange, Ky.	
30873	Tiger Brand Potato Grower..	*Manufacturer .....
30874 35088	Tiger Brand Grain Grower...	*Manufacturer ..... Mfrs. Warehouse .....

*The manufacturer failed to furnish sample as required by law.

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
7.09	1.86	8.95				1.08	1.31	1.23		$14.26	30754
6.92	1.91	8.83				1.05	1.27	1.45		14.19	35321
7.00	*1.00*	*8.00*				*0.82*	*1.00*		*1.00*	*12.87*	
9.21	1.10	10.31	0.29		0.28	0.57	0.69	1.14	2.96	18.18	30755
9.52	2.17	11.69	0.22		0.50	0.72	0.87		3.26	18.72	35322
8.00	*1.00*	*9.00*				*0.41*	*0.50*		*4.00*	*16.24*	
9.73	1.26	10.99				1.75	2.12	0.76	1.37	20.72	30756
8.37	1.25	9.62	0.66		1.11	1.77	2.15	0.76	1.94	19.83	35082
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*2.00*	*18.18*	
11.24	0.96	12.20	0.45		1.12	1.57	1.91	1.68	0.76	21.96	30757
10.88	1.07	11.95	0.32		1.26	1.58	1.92	2.39		21.41	35083
10.00	*2.00*	*12.00*				*1.65*	*2.00*		*2.00*	*20.98*	
7.52	1.40	8.92	0.23		0 72	0.95	1.15	1 00	1.24	15.40	30758
9.91	1.35	11.26	0.35		0.87	1.22	1.48	0.88	1.68	19.60	35084
8.00	*1.00*	*9.00*				*0.82*	*1.00*		*1.50*	*14.67*	
8.40	1.49	9.89	0.37		1.50	1.87	2.27	1.44	2.88	22.13	30759
9.22	0.38	9.60	0.53		0.85	1.38	1.68	3.57		19.61	35085
7.00	*1.00*	*8.00*				*1.65*	*2.00*		*4.00*	*19.38*	
8.68	1.10	9.78	0.22		2.05	2.27	2.76	6.25		25.06	30760
9.17	0.99	10.16	0.29	0.91	1.57	2.77	3.36	2.06	4.17	28.16	35086
8.00	*1.00*	*9.00*				*2.47*	*3.00*		*6.00*	*25.85*	
8.75	0.94	9.69	0.42		1 79	2.21	2.68	6.09		24.71	30761
8.00	*1.00*	*9.00*				*2.47*	*3.00*		*6.00*	*25.85*	
8.34	1.31	9.65	0.36		0.79	1.15	1.40	9.97		24.53	30762
9.19	1.21	10 40		0.79	1.22	2.01	2.44	2.08	3.58	24.93	35087
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*10.00*	*27.78*	
											30873
8.00	*2 00*	*10.00*				*2.47*	*3 00*		*6.00*	*26.25*	
											30874
13.48	0.92	14.40				1.02	1.24	0.88	0.81	21.97	35088
12.00	*2.00*	*14.00*				*0 82*	*1.00*		*1.00*	*19.27*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Duncan & Bro.	
30928	Tiger Brand Tobacco Grower.	*Manufacturer
35089		Mfrs. Warehouse
	The Empire Guano Co., Nashville, Tenn.	
30720	Climax Wheat Grower	Manufacturer
30721	Favorite Manure	Manufacturer
30722	Wheat & Corn Grower	Manufacturer
30723	Blood, Bone & Potash	Manufacturer
35090		Sloss & Grover, Franklin
30727	Red Banner Special	Manufacturer
30729	Special Corn Grower	Manufacturer
30730	High Grade Tobacco Grower	Manufacturer
30731	High Grade Tobacco Special	Manufacturer
35092		Sloss & Grover, Franklin
	The Evansville Packing Co., Evansville, Ind.	
30866	Half & Half	Manufacturer
35324		Eldred Hardware Co., Princeton.
30867	Potato & Tobacco Grower	Manufacturer
35094		Eldred Hardware Co., Princeton.

*The manufacturer failed to furnish sample as required by law.

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
											30928
10.73	0.87	11.60	0.77		0.77	1.54	1.87	7.80		$26.42	35089
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*6.00*	*23.38*	
10.38	2.56	12.94	0.49	0.83	0.92	2.24	2.72	2.64	1.23	25.44	30720
10.00	*2.00*	*12.00*				*1.65*	*2.00*	*4.00*		*22.58*	
10.69	2.51	13.20				1.14	1.38	1.34	2.33	21.96	30721
10.00	*2.00*	*12.00*				*0.82*	*1.00*	*3.00*		*18.67*	
13.46	2.55	16.01				0.54	0.66		1.58	20.96	30722
10.00	*2.00*	*12.00*				*0.82*	*1.00*	*1.00*		*16.67*	
9.25	1.10	10.35		1.01	0.63	1.64	1.99	0.74	2.36	20.85	30723
9.14	1.62	10.76		0.82	0.97	1.79	2.17	2.05		19.94	35090
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	
11.68	0.74	12.42		1.88	0.80	2.68	3.25	0.51		24.21	30727
10.00	*2.00*	*12.00*				*1.65*	*2.00*		*2.00*	*20.98*	
9.25	1.52	10.77				1.20	1.46	0.78	2.94	19.62	30729
8.00	*2.00*	*10.00*				*0.82*	*1.00*	*3.00*		*16.27*	
9.65	1.11	10.76		1.01	0.65	1.66	2.02	2.40	2.07	22.71	30730
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*4.00*	*20.98*	
9.43	1.29	10.72		0.87	0.66	1.53	1.86	1.66	7.55	27.92	30731
9.89	1.07	10.96		0.61	0.99	1.60	1.94	2.64	4.16	25.53	35092
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*8.00*	*25.78*	
7.23	3.85	11.08				2.99	3.63	2.34		23.03	30866
6.12	2.93	9.05		0.22	2.37	2.59	3.14	2.41		19.99	35324
6.00	*5.00*	*11.00*				*2.50*	*3.04*	*2.00*		*19.95*	
8.53	2.05	10.58				2 03	2.46	2.12	3.17	24.09	30867
8.52	1.16	9.68				1.50	1.82	1.34	6.05	24.53	35094
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*5.00*	*21.78*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Evansville Packing Co.	
30868	Beef, Blood & Bone.....	Manufacturer .....
35095		Rector & Co., Lewisburg.....
35325		W. I. Smith, Sebree.....
30869	Wheat & Corn Grower.....	Manufacturer .....
35096		Ed Frost, Central City.....
30870	Bone & Potash.....	Manufacturer .....
35097		Eldred Hdw. Co., Princeton....
35326		Rector & Co., Lewisburg.....
30871	Tobacco Special	Manufacturer .....
35098		Henderson Feed & Commission Co., Henderson .....
30872	Special 10% Potash.....	Manufacturer .....
35099		Eldred Hdw. Co., Princeton....
	Federal Chemical Co., Louisville, Ky.	
30492	Daybreak Standard Corn & Wheat Grower	Manufacturer .....
35327		Mardis & Wray, Campbellsville
30493	Daybreak Beef, Blood & Bone.	Manufacturer .....
35100		Grayson Co. Supply Co., Leitchfield .....
35328		Grayson Co. Supply Co., Leitchfield .....
30494	Daybreak Favorite	Manufacturer .....
35101		J. H. Pelly, Columbia.....

COMPLETE FERTILIZERS.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
8.40	2.50	10.90				1.92	2.33	2.31		$20.11	30868
7.94	3.85	11.79				1.75	2.12	1.30	1.69	20.53	35095
9.60	1.45	11.05				1.45	1.76		2.05	19.64	35325
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*2.00*	*18.18*	
9.77	2.01	11.78				1.46	1.77	2.00		19.63	30869
9.10	0.84	9.94				0.98	1.19	2.09		16.78	35096
8.00	*1.00*	*9.00*				*1.00*	*1.21*	*2.00*		*15.50*	
7.51	1.89	9.40				1.18	1.43	1.23		15.13	30870
7.41	1.39	8.80				0.77	0.93	1.12		13.27	35097
8.03	1.53	9.56				0.89	1.08	1.52		14.89	35326
7.00	*1.00*	*8.00*				*0.82*	*1.00*	*1.30*		*12.67*	
12.00	0.79	12.79				3.42	4.15	1.30	3.47	32.15	30871
12.24	1.12	13.36				2.60	3.16	0.76	4.16	29.99	35098
10.00	*1.00*	*11.00*				*3.29*	*4.00*		*4.00*	*28.72*	
6.48	0.33	6.81				0.95	1.15	1.34	11.06	25.85	30872
5.99	0.78	6.77				0.92	1.12	1.64	9.29	23.51	35099
5.00	*1.00*	*6.00*				*0.82*	*1.00*		*10.00*	*21.27*	
9.25	0.66	9.91				1.89	2.29	1.24	0.96	20.37	30492
10.02	1.56	11.58				1.48	1.80	1.54		19.36	35327
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*2.00*	*19.38*	
10.90	0.51	11.41				1.69	2.05	1.58	3.34	24.79	30493
11.27	1.40	12.67		0.57	0.86	1.43	1.74	1.30	0.52	21.01	35100
10.64	1.22	11.86		0.80	1.15	1.95	2.37	2.19		22.28	35328
10.00	*4.00*	*14.00*				*1.65*	*2.00*		*2.00*	*21.78*	
12.53	0.78	13.31				1.13	1.37	1.34	1.73	22.73	30494
11.84	1.73	13.57				0.95	1.15	1.68		19.91	35101
11.00	*4.00*	*15.00*				*0.82*	*1.00*		*3.00*	*21.27*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Federal Chemical Co.	
30495	Daybreak Special Tobacco Grower	Manufacturer
35102		Grayson Co. Supply Co., Leitchfield
30496	Daybreak Vegetable Grower	Manufacturer
35103		J. D. Shelby, Junction City
30497	Daybreak Standard Crop & Tobacco Grower	Manufacturer
35104		Grigsby & Co., Bardstown
30498	Daybreak Potato & Tobacco Grower	Manufacturer
35105		Mardis & Wray, Campbellsville
30500	Daybreak Special Manure	Manufacturer
35107		Mardis & Wray, Campbellsville
30501	Daybreak Wheat & Corn Special	Manufacturer
35108		Warren-Miller Implement Co., Elizabethtown
35330		Warren-Miller Implement Co., Elizabethtown
30502	Daybreak Corn & Clover Grower	Manufacturer
30503	Daybreak Grain Grower	Manufacturer
35109		A. B. McKinney, Morehead

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
9.35	0.57	9.92				2.14	2.60	1.96	5.03	$26.94	30495
8.32	0.80	9.12	0.23		1.09	1.32	1.60	3.90	0.89	19.89	35102
8.00	*4.00*	*12.00*				*1.23*	*1.50*		*6.00*	*22.71*	
8.86	0.69	9.55				1.78	2.16	1.18	3.72	22.78	30496
8.12	1.53	9.65		0.76	0.95	1.71	2.08	0.72	4.38	22.32	35103
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*5.00*	*22.98*	
9.49	0.56	10.05				1 14	1.38	1.50	2.87	20.54	30497
5.78	0.79	6.57				1.16	1.41	0.92	6.21	19.69	35104
8.00	*4.00*	*12.00*				*0.82*	*1.00*		*4.00*	*18.87*	
9.46	0.33	9.79				1.90	2.31	1.94	5.94	27.20	30498
10.07	1.02	11.09		0.95	0.61	1.56	1.89	0.90	3.89	23.52	35105
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*7.50*	*25.98*	
11.04	0.84	11.88				1.03	1.25	1.44	0.56	19.31	30500
11.16	1.81	12.97				0.65	0.79	1.40		17.79	35107
10.00	*4.00*	*14.00*				*0.82*	*1.00*		*2.00*	*18.87*	
12.14	0.89	13.03				0.82	1.00	0.66	0.62	19.20	30501
12.51	1.21	13.72				0.78	0.95	0.94		19.16	35108
12.29	1.99	14.28				0.42	0.51	0.90		17.92	35330
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.44*	
10.16	0.74	10.90				0.91	1.10	1.27		19.61	30502
9.00	*4.00*	*13.00*				*0.82*	*1.00*		*1.00*	*16.47*	
10.12	0.92	11.04				0.69	0.84	0.56	1.01	16.70	30503
9.11	1.08	10.19				0.36	0.44		0.90	13.70	35109
9.00	*4.00*	*13.00*				*0.41*	*0.50*		*1.50*	*15.64*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Federal Chemical Co.	
30513	Grigsby's Special Wheat Grower	Manufacturer .....
35112		Grigsby & Co., Bardstown.....
35334		Grigsby & Co., Bardstown.....
	Fox Chemical Co., Branch Federal Chemical Co., Louisville, Ky.	
30514	Fox Wheat & Corn Grower...	Manufacturer .....
35113		T. M. Shearer, Burnside.....
35335		H. Austin, Beaver Dam.....
30515	Fox Wheat & Corn Manure..	Manufacturer .....
35114		H. Austin, Beaver Dam.....
30516	Fox Tobacco Grower.....	Manufacturer .....
35115		H. Austin, Beaver Dam.....
30517	Fox Formula	Manufacturer .....
35116		Mitchell & Co., Greensburg....
35336		W. W. Mitchell Co., Greensburg
30518	Fox Special Tobacco Grower..	Manufacturer .....
35117		Mitchell & Co., Greensburg....
30519	Fox Vegetable Grower.....	Manufacturer .....
30520	Fox Crop & Tobacco Grower..	Manufacturer .....
30521	Fox Early Harvest.....	Manufacturer .....
30522	Fox Wheat & Grain Special..	Manufacturer .....

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
11.00	0.88	11.88				1.07	1 30	0.72	1.22	$19.48	30513
10.51	1 59	12.10	0.24		0.77	1.01	1.23	0.54	1.02	18.55	35112
10.81	1.85	12.66				0.79	0 96		1.59	18.39	35334
10.00	*2.00*	*12.00*				*0.82*	*1.00*		*2.00*	*18.07*	
10.14	0.99	11.13				1.71	2.08	1.72	3 40	24.36	30514
11.42	1.39	12.81		1.02	0.74	1.76	2.14	1.16	1.28	23.12	35113
11.88	1.01	12.89				2.14	2.60	1.73		23.88	35335
10.00	*4.00*	*14.00*				*1.65*	*2.00*		*2.00*	*21.78*	
8.76	0.80	9.56				1.80	2.19	2.20		19.33	30515
7.47	0.64	8.11		0.54	1.36	1.90	2.31	1.67		17.54	35114
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*2.00*	*19.38*	
9.24	0.51	9.75				1.78	2.16	0.86	1.27	19.90	30516
8.29	1.02	9.31		0.55	0.76	1 31	1.59	1.73		16.68	35115
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*2.00*	*19.38*	
12.34	0.84	13.18				1.13	1.37	0.94	1.96	22.40	30517
11.68	0 66	12.34				1.12	1.36	1.14	0.90	20.42	35116
12.76	5.78	18.54	0.20		0.72	0.92	1.12	1.84		22.68	35336
11.00	*4.00*	*15.00*				*0.82*	*1.00*		*3.00*	*21.27*	
9.08	0.66	9.74				1.93	2.34	1.24	3.66	23.55	30518
9.66	0.41	10.07		1.01	0.56	1.57	1.91	1.30	3.44	22.68	35117
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*5.00*	*22.98*	
8.82	0.75	9.57				2.05	2.49	1.22	3.67	23.68	30519
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*5.00*	*22.98*	
9.33	0.54	9.87				1.13	1.37	1.40	2.83	20.18	30520
8.00	*4.00*	*12.00*				*0.82*	*1.00*		*4.00*	*18.87*	
11.44	0.66	12.10				0.99	1.20	1.12	0.62	19.32	30521
10.00	*4.00*	*14.00*				*0.82*	*1.00*		*2.00*	*18.87*	
13.18	0.85	14.03				1.05	1.27	0.68	0.45	21.06	30522
12.00	*4.00*	*16.00*				*0.82*	*1.00*		*1.00*	*20.07*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Fox Chemical Co., Branch Federal Chemical Co.	
30523	Fox Potato & Tobacco Grower	Manufacturer
35118		Mitchell & Co., Greensburg
30525	Fox Bone, Blood & Potash	Manufacturer
35119		H. Austin, Beaver Dam
35337		W. W. Mitchell Co., Greensburg
30526	Fox Grain Grower	Manufacturer
30527	Fox Grain Special	Manufacturer
	Globe Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.	
30537	Globe Wheat Grower	Manufacturer
30538	Eagle Corn & Wheat Grower.	Manufacturer
35123		Planters Hdw. Co., Hopkinsville
35342		Planters Hdw. Co., Hopkinsville
30539	Big Four Tobacco Grower	Manufacturer
35124		Planters Hdw. Co., Hopkinsville
30540	Braden Formula	Manufacturer
35125		Masengah & Wallen, Burnside.
35343		Planters Hdw. Co., Hopkinsville
30541	Kentucky Standard Tobacco Grower	Manufacturer
35126		Planters Hdw. Co., Hopkinsville

Complete Fertilizers.

Phosphoric Acid.			Nitrogen.				Equivalent to Ammonia.	Potash.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
9.63	0.47	10.10				1.81	2.20	1.38	6.38	$27.13	30523
9.97	0.60	10.57		0.49	0.54	1.03	1.25	1.00	4.01	21.62	35118
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*7.50*	*25.98*	
12.27	0.91	13.18				0.83	1.01		1.11	19.32	30525
12.27	1.78	14.05				0.44	0.53		1.18	18.39	35119
10.96	4.54	15.50	0.23		0.63	0.86	1.04		1.31	19.55	35337
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.44*	
10.29	0.73	11.02				0.91	1.10	1.04		16.87	30526
9.00	*4.00*	*13.00*				*0.82*	*1.00*		*1.00*	*16.47*	
10.35	0.80	11.15				0.76	0.92	0.56	1.06	17.23	30527
9.00	*4.00*	*13.00*				*0.41*	*0.50*		*1.50*	*15.64*	
10.58	0.79	11.37				1.65	2.00	1.92	3.16	24.51	30537
10.00	*4.00*	*14.00*				*1.65*	*2.00*		*2.00*	*21.78*	
8.66	0.91	9.57				1.78	2.16	1.50	0.72	19.34	30538
8.73	1.19	9.92		0.87	0.69	1.56	1.89	1.63		18.05	35123
10.16	1.16	11.32				1.51	1.83	1.87		19.81	35342
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*2.00*	*19.38*	
8.67	0.89	9.56				1.88	2.28	1.68	0.45	19.56	30539
9.79	0.73	10.52		0.95	0.63	1.58	1.92	0.62	0.59	18.90	35124
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*2.00*	*19.38*	
12.11	0.79	12.90				1.15	1.40	1.54	1.42	22.12	30540
12.93	1.15	14.08				0.83	1.01	1.30	1.25	21.69	35125
11.84	4.07	15.91				1.18	1.43	1.66	1.37	23.27	35343
11.00	*4.00*	*15.00*				*0.82*	*1.00*		*3.00*	*21.27*	
9.44	6.92	16.36				1.90	2.31		6.53	28.59	30541
7.97	0.32	8.29		0.60	0.47	1.07	1.30		4.66	19.03	35126
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*5.00*	*22.98*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Globe Fertilizer Co., Branch Federal Chemical Co.	
30542 35127	Globe Soluble Vegetable Manure	Manufacturer ..... E. J. Tanner, McKinney.....
30543 35128	Universal Crop & Tobacco Grower	Manufacturer ..... F. W. Wilson & Son, Lewisburg
30544 35129 35344	Progress Corn & Wheat Grower	Manufacturer ..... J. B. Benjamin, Providence.... J. W. Cloyd, Campbellsville....
30545	Globe Potato Grower.....	Manufacturer .....
30546 35130	Globe Wheat & Grain Special.	Manufacturer ..... S. V. & D. F. Fry, Covedale....
30547 35131	Globe Potato & Tobacco Grower	Manufacturer ..... S. V. & D. F. Fry, Covedale....
30548 35132	Globe Special Tobacco Grower	Manufacturer ..... Planters Hdw. Co., Hopkinsville
30550 35133 35346	Globe Bone & Potash.....	Manufacturer ..... J. B. Benjamin, Providence.... Jno. W. Allen, Burnside.....
30551 35134	Globe Grain & Grass Grower..	Manufacturer ..... J. M. Langdon, Science Hill...

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
8.94	0.60	9.54				1.87	2.27	1.16	3.59	$22.99	30542
10.02	1.53	11.55		0.72	0.64	1.36	1.65		4.34	22.60	35127
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*5.00*	*22.98*	
8.91	0.68	9.59				1.07	1.30	1.36	2 99	19.66	30543
8.37	1.20	9.57		0.66	0.46	1.12	1.36	0.84	1.30	16.84	35128
8.00	*4.00*	*12.00*				*0.82*	*1.00*		*4.00*	*18.87*	
11.15	0.84	11.99				1.08	1.31	1 44	0.48	19.52	30544
11.16	0.54	11.70				0.88	1.07	1.50	0.46	18.74	35129
11.87	0.77	12.64				1.50	1.82	0.74		20.54	35344
10.00	*4.00*	*14.00*				*0.82*	*1.00*		*2.00*	*18.87*	
9.53	5.44	14.97				2.65	3.22		7.16	31.49	30545
8.00	*4.00*	*12.00*				*2.47*	*3.00*		*6.00*	*27.05*	
12.76	0.88	13.64				1.14	1.38	1.10		20.75	30546
13.73	1.24	14.97	0.22		0.61	0.83	1.01	0.74	0.58	21.33	35130
12.00	*4.00*	*16.00*				*0.82*	*1.00*		*1.00*	*20.07*	
9.06	0.64	9.70				1.85	2.25	1.38	6.42	26.69	30547
10.80	0.73	11.53		0.48	0.93	1.41	1.71	0.98	4.26	24 28	35131
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*7.50*	*25.98*	
9.13	0.41	9.54		1.02	1.49	2.51	3.05	3.96	6.17	31.27	30548
9.16	0.60	9.76		0.96	0.99	1.95	2.37	1.32	9.02	30.20	35132
8.00	*4.00*	*12.00*				*2.47*	*3.00*		*10.00*	*31.85*	
12.24	0.77	13.01				0.80	0.97		1.16	18.99	30550
11.80	1.64	13.44				0.57	0 69		1.42	18.52	35133
10.16	0.75	10.91				0.66	0.80		0.84	15.81	35346
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.44*	
11.86	1.10	12 96				0.82	1.00		1.17	18.94	30551
12.51	1.54	14.05				0.57	0.69	0.56	0.28	18.53	35134
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.44*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Globe Fertilizer Co., Branch Federal Chemical Co.	
30552	Globe Bone Dust	Manufacturer
35135		W. H. Murray, London
30553	Globe Grain Grower	Manufacturer
35136		Hubbard & Mitchell, Greensburg
35347		Finley Hdw. Co., Madisonville
30554	Globe High Grade Tobacco Grower	Manufacturer
	Grayson Co. Fertilizer Co., Leitchfield, Ky.	
30940	Grain Grower	Manufacturer
35141		Mfrs. Warehouse
30941	Tobacco Grower	Manufacturer
	Great Southern Phosphate Co., Mt. Pleasant, Tenn.	
30454	Great Southern Tobacco Grower	Manufacturer
30455	Farmers Champion	Manufacturer
30457	Universal Tobacco Grower	Manufacturer
30460	Great Southern Potato Special	Manufacturer
30461	Great Southern Tobacco Special	Manufacturer

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
10.34	0.70	11.04				0.96	1.17	1.04		$17.09	30552
10.65	0.70	11.35	0.24		0.44	0.68	0.83	0.74	0.65	16.96	35135
9.00	*4.00*	*13.00*				*0.82*	*1.00*		*1.00*	*16.47*	
10.07	0.89	10.96				0.69	0.84	0.58	0.94	16.57	30553
8 88	0.55	9.43				0.42	0.51	1.83		14.18	35136
10.57	0.94	11.51				0.18	0.22	2.20		15.89	35347
9.00	*4.00*	*13.00*				*0.41*	*0.50*		*1.50*	*15.64*	
8.86	0.70	9.56				3.01	3.65		6.14	28.82	30554
8.00	*4.00*	*12.00*				*3.29*	*4.00*		*4.00*	*27.52*	
3.20	0.79	3.99	1.26			1.26	1.53	7.85		16.42	30940
3.15	0.33	3.48	0.63		0.20	0.83	1.01	3.20		10.02	35141
3.00						*1.00*	*1.21*		*4.00*	*11.90*	
4.60	1.07	5.67	2.22			2.22	2.70	7.00		20.72	30941
5.00						*2.00*	*2.43*	*5.00*		*18.00*	
9.92	5.89	15.81	0.48		0.63	1.11	1.35		2.09	20.66	30454
8.00	*2.00*	*10.00*				*0.82*	*1.00*		*4.00*	*18.07*	
11.27	3.66	14.93	0.58		1.31	1.89	2.29	2.04		23.64	30455
10.00	*2.00*	*12.00*				*1.65*	*2.00*	*2.00*		*20.58*	
9.60	1.44	11.04	1.57		0.58	2.15	2.61	0.96	5 96	27.74	30457
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*6.00*	*23.38*	
7.99	4.56	12.55	1.74		0.88	2.62	3.18	1.08	6 71	29.71	30460
7.00	*2.00*	*9.00*				*2.47*	*3.00*		*6.00*	*25.05*	
9.45	2.01	11 46		0.95	1.01	1.96	2.38	1.20	11.17	33.60	30461
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*10.00*	*28.18*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Great Southern Phosphate Co.	
30462	Great Southern Corn Special..	Manufacturer .....
30463	Great Southern Superior Tobacco Grower	Manufacturer .....
	The Groves Co., Cincinnati, Ohio.	
30827	Complete Grain Grower.....	Manufacturer .....
35145		C. E. Young, Burnside.....
35353		Hart and Johnson, Kings Mountain .....
30828	Corn & Tobacco Grower.....	Manufacturer .....
35146		I. K. Miller & Sons, Campbellsville .....
35354		A. F. Vertrees, Vine Grove.....
30829	Favorite Fertilizer	Manufacturer .....
35355		E. E. Perkins, Greensburg.....
30830	10% Potash Fertilizer.....	Manufacturer .....
35356		Hart & Johnson, Kings Mountain
30831	Special Truck Manure.....	Manufacturer .....
35357		A. F. Vertrees, Vine Grove.....
	Hirsh, Stein & Co., Chicago, Ill.	
30798	Calumet Brand Bone Phosphate and Potash.....	Manufacturer .....
35149		Grayson Co. Farmers Union Exchange, Leitchfield .....
35359		Jas. Pearson & Co., Hickory Flat

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
10.80	6.95	17.75		0.20	1.72	1.92	2.33	0.70	1.37	$24.80	30462
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	
8.48	7.20	15.68		0.20	1.51	1.71	2.08	0.68	3.05	23.39	30463
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*4.00*	*20.98*	
8.04	0.78	8.82		0.26	0.79	1.05	1.27	2 37		16.01	30827
9.21	1.28	10.49				0.87	1.06	2.26		16.87	35145
8.66	0.48	9.14		0.35	0.55	0.90	1.09	2.24		15.97	35353
8.00	*2.00*	*10.00*				*0.82*	*1.00*	*2.00*		*15.27*	
8.31	2.12	10.43				1.08	1.31	4.32		18.92	30828
8.70	1.86	10.56				1.01	1.23	4.00		18.72	35146
8.21	0.70	8.91		0.36	0.49	0.85	1.03	4.69		17.80	35354
8.00	*2.00*	*10.00*				*0.82*	*1.00*	*4.00*		*17.27*	
8.30	3.42	11.72		0.39	1.60	1.99	2.42	2.37		20.67	30829
8.48	0.64	9.12		0.67	0.92	1.59	1.93	2.14		18.15	35355
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	
5.50	0.56	6 06				1.05	1.27	10.89		21.39	30830
5.27	0.48	5.75		0.39	0.43	0.82	1.00	9.05		18 43	35356
5.00	*2.00*	*7.00*				*0.82*	*1.00*	*10.00*		*19.67*	
8.66	0.89	9.55		0.52	1.47	1.99	2.42	4.02	4.38	27.00	30831
9.15	0.92	10.07	0.73		1.06	1.79	2.17	1.58	6.17	26.60	35357
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*8.00*	*25.78*	
11.01	1.47	12.48				0.50	0.61	2.32		17.87	30798
10.59	1.38	11.97				0.69	0.84	2.24		17.92	35149
10.70	1.34	12.04				0.62	0.75	2.04		17.59	35359
10.00	*1.00*	*11.00*				*0.41*	*0.50*	*2.00*		*15.84*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Hirsh, Stein & Co.	
30799	Calumet Brand High Grade Bone Phosphate & Potash....	Manufacturer .....
35150		Grayson Co. Farmers Union Exchange, Leitchfield .....
35360		Jas. Pearson & Co., Hickory Flat
30800	Calumet Brand Universal Crop Grower	Manufacturer .....
30801	Calumet Brand Tobacco Fertilizer	Manufacturer .....
35151		Grayson Co. Farmers Union Exchange, Leitchfield .....
35361		I. K. Miller & Sons, Campbellsville .....
30802	Calumet Brand Wheat, Corn & Oats Special.....	Manufacturer .....
35152		Salsman & New, Clarkson.....
35362		Grayson Co. Farmers Union Exchange, Leitchfield .....
30803	Calumet Brand Grain Grower.	Manufacturer .....
35153		Salsman & New, Clarkson.....
35363		Grayson Co. Farmers Union Exchange, Leitchfield .....
30804	Calumet Brand Kentucky Tobacco Grower	Manufacturer .....
35154		Grayson Co. Farmers Union Exchange, Leitchfield .....
30805	Calumet Brand High Grade Garden & Vegetable Grower..	Manufacturer .....
35155		Grayson Co. Farmers Union Exchange, Leitchfield .....

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
11.25	1.45	12.70				0.50	0.61	5.53		$21.36	30799
10.62	1.34	11.96				0.56	0.68	1.02	3.84	20.87	35150
11.11	0.80	11.91				0.42	0.51	5.34		20.46	35360
10.00	*1.00*	*11.00*				*0.41*	*0.50*	*5.00*		*18.84*	
7.69	1.48	9.17				1.04	1.26	1.53		14.99	30800
7.00	*1.00*	*8.00*				*0.82*	*1.00*	*1.00*		*12.67*	
8.77	2.17	10.94				1.00	1.21	3.05		17.94	30801
9.06	1.45	10.51				0.66	0.80	2.87		16.63	35151
8.36	0.69	9.05		0.31	0.51	0.82	1.00	4.01		17.19	35361
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*2.00*		*14.87*	
8.07	1.63	9.70				1.19	1.44	4.76		19.26	30802
9.01	1.67	10.68				0.94	1.14	4.09		18.86	35152
8.71	1.50	10.21				0.89	1.08	4.10		18.27	35362
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*4.00*		*16.87*	
7.63	1.99	9.62	0.25		1.64	1.89	2.29	2.55		19.13	30803
8.28	2.24	10.52				1.79	2.17	2.25		19.36	35153
9.28	2.33	11.61		0.39	1.35	1.74	2.11	2.25		20.41	35363
8.00	*1.00*	*9.00*				*1.65*	*2.00*	*2.00*		*17.78*	
8.86	1.38	10.24		0.97	0.85	1.82	2.21	0.64	4.58	23.69	30804
8.96	1.94	10.90		0.58	1.18	1.76	2.14	0.68	4.66	23.96	35154
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*5.00*	*21.78*	
8.45	1.57	10.02				2.64	3.20	6.86		26.87	30805
8.52	0.70	9.22				2.17	2.63	6.51		24.61	35155
8.00	*1.00*	*9.00*				*2.06*	*2.50*	*6.00*		*23.21*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Hirsh, Stein & Co.	
30806	Calumet Brand Special Potato, Tobacco & Onion Grower	Manufacturer
35156		Grayson Co. Farmers Union Exchange, Leitchfield
30807	Calumet Brand Bone Black Grain Grower	Manufacturer
35157		Grayson Co. Farmers Union Exchange, Leitchfield
30808	Calumet Brand Special 10% Potash Manure	Manufacturer
30932	Calumet Brand Ammoniated Dissolved Pure Bone & Potash	Manufacturer
35161		Grayson Co. Farmers Union Exchange, Leitchfield
	Hopkins Fertilizer Co., New Albany, Ind.	
30485	"Old Times" Tobacco Grower.	Manufacturer
35163		H. D. Loyd, Fordsville
30486	"Old Times" Potato & Tobacco Grower	Manufacturer
35164		J. T. Harmon, Lebanon Jct.
30487	"Old Times" Bone & Potash	Manufacturer
35165		H. D. Loyd, Fordsville
30488	"Old Times" Wheat & Corn Grower	Manufacturer
35166		H. D. Loyd, Fordsville
35367		W. L. Farris, Cane Valley

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
10.23	0.73	10.96		1.08	0.68	1.76	2.14	1.08	9.53	$31.25	30806
9.32	1.40	10.72		0.83	0.96	1.79	2.17	1.20	8.90	29.89	35156
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*10.00*	*27.78*	
8.69	0.93	9.62	0.22		2.40	2.62	3.18	2.49		22.46	30807
8.20	3.21	11.41				1.99	2.42	1.74		19.83	35157
8.00	*1.00*	*9 00*				*2.06*	*2.50*	*1.50*		*18.71*	
5.30	1.16	6.46				0.98	1.19	12.04		22.29	30808
5.00	*1.00*	*6.00*				*0.82*	*1.00*	*10.00*		*19.27*	
10.56	2.89	13.45				1.63	1.98	2.90		22.44	30932
11.45	2.19	13.64		0.95	0.91	1.86	2.26	1.42	1.28	24.09	35161
10.00	*1.00*	*11.00*				*1.65*	*2.00*	*2.00*		*20.18*	
8.21	2.03	10.24	0.32		1.27	1.59	1.93	0.94	2.67	20.37	30485
7.85	0.87	8.72	0.80		0.39	1.19	1.44	2.00	0 60	16.66	35163
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*4.00*	*20.58*	
7.97	1.81	9.78		1.59	1.25	2.84	3.45	7.08		27.30	30486
9.42	1.76	11.18	0.32	1.19	1.12	2.63	3.19	1.18	3.11	26.12	35164
8.00	*1.00*	*9.00*				*2.47*	*3.00*		*6.00*	*25.85*	
6.10	0.75	6.85				0.83	1.01	1.04		11.57	30487
7.43	0.82	8.25				0.59	0.72		1.14	12.69	35165
7.00	*1.00*	*8.00*				*0.82*	*1.00*	*1.00*		*12.67*	
7.88	2.08	9.96	0.23		1.31	1.54	1.87	2.94		18.62	30488
8.58	1.16	9.74	0.42		0.55	0 97	1.18	2.11		16.27	35166
8.24	1.58	9.82	0.49		1.22	1.71	2.08	2.15		18.66	35367
8.00	*1.00*	*9.00*				*1.65*	*2.00*	*2.00*		*17.78*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Hopkins Fertilizer Co.	
30489	"Old Times" Truck Grower...	Manufacturer .....
30957	"Old Times" Half & Half.....	Manufacturer .....
35368		I. K. Miller & Sons, Campbellsville .....
30958	"Old Times" Complete Fertilizer	Manufacturer .....
35369		W. L. Farris, Cane Valley.....
	The Jarecki Chemical Co., Sandusky & Cincinnati, Ohio.	
30888	Lake Erie Guano with Phosphate & Potash.....	Manufacturer .....
35167		M. B. Hines, Science Hill.....
30889	No. 1 Guano with Phosphate & Potash	Manufacturer .....
35168		Rector & Co., Lewisburg.....
35370		Rector & Co., Lewisburg.....
30893	Raw Bone & Guano Mixture..	Manufacturer .....
35373		M. B. Hines, Science Hill.....
30894	Fish, Phosphate & Potash Tobacco & Potato Food.....	Manufacturer .....
35171		Daniel & Myers, Shepherdsville
30896	Tobacco & Truck Grower.....	Manufacturer .....
35173		Daniel & Myers, Shepherdsville
30898	Little Giant Guano.....	Manufacturer .....
35174		Rector & Co., Lewisburg.....

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
7.15	1.95	9.10		1.09	1.33	2.42	2.94	1.54	6.19	$26.80	30489
6.00	*1.00*	*7.00*				*1.65*	*2.00*		*8.00*	*22.98*	
6.26	4.73	10.99				2.11	2.56	2.20		18.99	30957
8.25	4.03	12.28				2.33	2 83	1.96		21.63	35368
6.00	*6.00*	*12.00*				*2.00*	*2.43*	*2.00*		*18.60*	
10.47	1.26	11.73	0.91		1.02	1.93	2.34	2.95		22.77	30958
9.58	1.42	11.00	0.29		0.77	1.06	1.29	2.26		18.04	35369
10.00	*1.00*	*11.00*				*1.00*	*1.21*	*2.00*		*17.90*	
7.72	0.92	8.64		0.55	0.73	1.28	1.55	3.11		17.22	30888
8.67	2.04	10.71		0.24	1.15	1 39	1.69	2.10	0.84	19.20	35167
8.00	*1.00*	*9.00*				*1.23*	*1.50*	*2.50*		*16.81*	
8.99	1.89	10.88				0.98	1.19	2.26		17.24	30889
8.32	1.80	10.12				0 91	1.10	1 94		15.83	35168
9.31	1.34	10.65				0.98	1.19	2.23		17.37	35370
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*2.00*		*14.87*	
10.79	10.89	21.68		0.55	1.34	1.89	2.29	1.31		25.24	30893
11.54	5.32	16.86		0.41	1.41	1 82	2.21	1.41		23.76	35373
11.00	*5.00*	*16.00*				*1.65*	*2.00*	*1.00*		*21.98*	
8.80	2.04	10.84				1.00	1.21	4.06		18.94	30894
8.58	2.27	10.85				0.93	1.13	4.37		18.84	35171
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*2.00*	*2.00*	*17.27*	
7.27	0.83	8.10				1.60	1.94	1.18	5.94	22.96	30896
7.64	0.70	8.34		0.66	1.11	1.77	2.15	0.84	5.86	23.52	35173
6.00	*1.00*	*7.00*				*1.65*	*2.00*		*6.00*	*20.58*	
8.32	0.74	9.06				0.96	1.17	1.17		14.81	30898
7.92	1.72	9.64				0.83	1.01	1.82		14.92	35174
7.00	*1.00*	*8.00*				*0.82*	*1.00*	*1.00*		*12.67*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Jarecki Chemical Co.	
30899	Indian Brand Tobacco & Potato Fertilizer	Manufacturer
35175		W. H. Fremd Grocery Co., Eminence
30900	Indian Brand Gilead Phosphate	Manufacturer
30929	O. K. Fertilizer	Manufacturer
	Jones Fertilizer Co. Louisville, Ky.	
30787	Jones Corn & Wheat Grower.	Manufacturer
35178		Rogers-Harlow & Co., Glasgow.
35377		I. K. Miller & Sons, Campbellsville
30788	Jones Reliable	Manufacturer
35378		T. J. Taylor Co., Burnside
30789	Jones Grain Grower	Manufacturer
35179		Rogers-Harlow & Co., Glasgow.
35379		I. K. Miller & Sons, Campbellsville
30790	Jones Slaughter House Bone	Manufacturer
35180		Hoskins & Dyche, London
35380		D. H. Hatter & Son, Franklin
30791	Jones Miami Valley Phosphate.	Manufacturer
30792	Jones Special Tobacco Grower	Manufacturer
30793	Jones Tobacco & Potato Grower	Manufacturer

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
10.50	0.96	11.46		2.11	0.72	2.83	3.44	1.80	4.04	$29.54	30899
10.46	1.21	11 67		1.49	1.06	2.55	3.10	4.71		26.67	35175
9.00	*1.00*	*10.00*				*2.47*	*3.00*		*5.00*	*25.85*	
9.42	1.95	11.37		0.29	0.72	1.01	1.23	3.54		19.16	30900
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*3.00*		*15.87*	
7.72	1.08	8.80				0.57	0.69	0.76		12.45	30929
6.00	*1.00*	*7.00*				*0.41*	*0.50*	*0.50*		*9.54*	
7.28	1.86	9.14				1.10	1.34	1.28		14.61	30787
8.49	1.06	9.55	0.67		0.35	1.02	1.24	0.48	0.30	15.02	35178
7.89	1.39	9.28				0.83	1.01		1.00	14.14	35377
7.00	*1.00*	*8.00*				*0.82*	*1.00*		*1.00*	*12.87*	
7.68	1.44	9.12	0.27		0.71	0.98	1.19	0.92	1.24	15.64	30788
12.07	2.31	14.38	0.23		0.57	0.80	0.97		1.18	19.62	35378
8.00	*1.00*	*9.00*				*0.82*	*1.00*		*1.50*	*14.67*	
9.94	1.08	11.02	0.23		0.35	0.58	0.70	0.70	3.49	19.28	30789
10.36	0.57	10.93	0.27		0.28	0.55	0.67	2.08	1.43	18.39	35179
9.55	0.23	9.78	0.28		0.42	0.70	0.85	2.40	1.18	18.65	35379
8.00	*1.00*	*9.00*				*0.41*	*0.50*		*4.00*	*16.24*	
9.78	1.66	11.44				1.88	2.28	0.78	1.46	21.51	30790
8.32	0.91	9.23	0.49		1.11	1.60	1.94	1.78		17.72	35180
9.33	1.35	10.68		0.45	1.07	1.52	1.85	2.09		19.15	35380
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*2.00*	*18.18*	
11.23	1.07	12.30	0.32		1.19	1.51	1.83	1.72	0.77	21.84	30791
10.00	*2.00*	*12.00*				*1.65*	*2.00*		*2.00*	*20.98*	
7.59	1.40	8.99	0.32		0.71	1.03	1.25	0.72	1.52	15.82	30792
8.00	*1.00*	*9.00*				*0.82*	*1.00*		*1.50*	*14.67*	
8.23	1.64	9.87	0.35		1.54	1.89	2.29	1.14	3 12	22.04	30793
7.00	*1.00*	*8.00*				*1.65*	*2.00*		*4.00*	*19.38*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Jones Fertilizer Co.	
30794	Jones Truck Grower.....	Manufacturer .....
35181		Rogers-Harlow & Co., Glasgow.
	Kaufman Fertilizer Co., Cincinnati, Ohio.	
30912	Corn, Wheat & Oats Grower..	Manufacturer .....
30913	Harvest King	Manufacturer .....
35183		W. H. Hunt & Son, Dunmor...
30914	Golden Rule	Manufacturer .....
30915	Special Potato & Tobacco Fertilizer	Manufacturer .....
35184		W. H. Hunt & Son, Dunmor...
30916	Banner Crop Grower.....	Manufacturer .....
30917	Half & Half.....	Manufacturer .....
30922	Kentucky Tobacco Grower...	Manufacturer .....
35186		W. H. Hunt & Son, Dunmor...
	Kentucky Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.	
30566	O. K. 20% Fertilizer.....	Manufacturer .....
30567	O. K. Tobacco & Vegetable Grower	Manufacturer .....

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
8.46	0.99	9.45	0.39		0.81	1.20	1.46	10 60		$25 35	30794
8.26	0.45	8.71	0.28		1.35	1.63	1.98	1.28	9.41	28.37	35181
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*10.00*	*27.78*	
7.82	0.82	8.64		0.38	0.96	1.34	1.63	2.96		17.36	30912
8 00	*1.00*	*9.00*				*1.23*	*1.50*	*2.50*		*16.81*	
8.49	1.77	10.26				1.00	1.21	2.15		16.55	30913
7.72	1.61	9.33				0.93	1.13	2.18		15.34	35183
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*2.00*		*14.87*	
9.21	1.82	11.03				0.93	1.13	4.08		19.12	30914
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*2.00*	*2.00*	*17.27*	
6.94	1.10	8.04				1.78	2.16	1.14	5.30	22.50	30915
7.17	0.85	8.02		0.79	0.77	1.56	1.89	5.78		20.18	35184
6.00	*1.00*	*7.00*				*1.65*	*2.00*		*6.00*	*20.58*	
8.23	0.89	9.12				1.00	1.21	1.11		14.85	30916
7.00	*1.00*	*8.00*				*0.82*	*1.00*	*1.00*		*12.67*	
10.83	10.59	21.42		0.55	1.50	2.05	2.49	1.12		25.54	30917
11.00	*5.00*	*16.00*				*1.65*	*2.00*	*1.00*		*21.98*	
8.77	1.80	10.57				0.97	1.18	2.16		16.80	30922
8.86	1.21	10.07				1.01	1.23	2.44		17.09	35186
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*2.00*		*14.87*	
9.55	4.60	14.15				1.68	2.04		10.69	32.01	30566
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*10.00*	*28.98*	
9 37	0.52	9.89				2.01	2.44	1.50	5.02	26.01	30567
8.00	*4.00*	*12.00*				*1.23*	*1.50*		*6.00*	*22.71*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Kentucky Fertilizer Co., Branch Federal Chemical Co.	
30568	O. K. Golden Leaf Tobacco Grower	Manufacturer
35009		C. W. Caldwell, Danville
35187		J. B. Hatcher, Glasgow Jct
30569	O. K. Corn & Wheat Grower	Manufacturer
35382		Geo. Sturgeon, Waynesburg
30570	O. K. High Grade Mixture	Manufacturer
30571	O. K. Crop & Tobacco Grower.	Manufacturer
35188		T. A. Porter, London
30572	O. K. Complete Manure	Manufacturer
35189		J. B. Hatcher, Glasgow Jct
30573	O. K. Corn, Wheat & Oat Grower	Manufacturer
35190		Geo. Sturgeon, Waynesburg
35383		Geo. Sturgeon, Waynesburg
30574	O. K. Grain Grower	Manufacturer
35384		Woodson Lewis, Greensburg
	Louisville Fertilizer Co., Louisville, Ky.	
30735	Eagle Special Corn Grower	Manufacturer
35390		Taylor & Son, Greensburg
30736	Eagle Special Wheat Grower.	Manufacturer
35391		Taylor & Son, Greensburg

Complete Fertilizers.

Phosphoric Acid.			Nitrogen.				Equivalent to Ammonia.	Potash.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
9.16	0 68	9.84				1.88	2.28	1.30	0.85	$20.16	30568
7.56	1.71	9.27		1.25	0.26	1.51	1.83	1.73		16.77	35009
9.19	0.68	9.87		0 81	1.35	2.16	2.62	1.76		20.62	35187
8.00	*4.00*	*12.00*				*1.65*	*2.00*		*2.00*	*19.38*	
10.88	0.89	11.77				0.98	1.19	1.24	0.73	18.97	30569
8.98	3.48	12.46				0.52	0.63	1.12		15.11	35382
10.00	*4.00*	*14.00*				*0.82*	*1.00*		*2.00*	*18.87*	
12.34	0.79	13.13				1.07	1.30	1.56	1.43	22.16	30570
11.00	*4.00*	*15.00*				0.82	*1.00*		*3.00*	*21.27*	
9.17	0.56	9.73				0.99	1.20	1.44	2.87	19.57	30571
11.21	0.57	11.78	0.23		0.70	0.93	1.13	0.58	2.26	20.23	35188
8.00	*4.00*	*12.00*				*0.82*	*1.00*		*4.00*	*18.87*	
9.12	0.73	9.85				1.03	1.25	1.44	1.54	18.13	30572
8.52	1.10	9.62		0.76	1.31	2.07	2.51		1.16	19.30	35189
8.00	*4.00*	*12.00*				*0.82*	*1.00*		*2.50*	*17.07*	
12.03	0.98	13.01				0.76	0.92		1.13	18.85	30573
11.66	2.21	13.87		0.61	0.60	1.21	1.47	0.76	0.83	20.87	35190
9.24	1.56	10.80	0.24		0.79	1.03	1.25	0.72	0.34	16.45	35383
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.44*	
12.02	0.99	13.01				0.78	0.95		1.16	18.94	30574
11.84	0.99	12.83				1.12	1.36		0.58	19.11	35384
11.00	*4.00*	*15.00*				*0.41*	*0.50*		*1.00*	*17.44*	
7.18	2.11	9.29				0.95	1.15	1.23		14.02	30735
7.75	1.39	9.14				0.71	0.86	0.88	0.34	13.64	35390
7.00	*1.00*	*8.00*				*0.82*	*1.00*		*1.00*	*12.87*	
7.63	1.73	9.36				1.10	1.34	1.28		14.98	30736
7.75	1.70	9.45	0.22		0.62	0.84	1.02	0.81		13.78	35391
7.00	*1.00*	*8.00*				*0.82*	*1.00*		*1.00*	*12.87*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Louisville Fertilizer Co.	
30737	Eagle Soluble Bone.....	Manufacturer .....
35195		Smith & Flora, Campbellsville.
35392		Smith & Flora, Campbellsville.
30738	Eagle Grain Grower.....	Manufacturer .....
35196		L. S. Brough, Bowling Green...
35393		L. S. Brough, Bowling Green...
30739	Eagle Slaughter House Bone..	Manufacturer .....
35197		W. R. Johnson, Coburg.....
35394		Orndorff & Co., Adairville.....
30740	Eagle Guano	Manufacturer .....
30741	Eagle Special Tobacco Grower	Manufacturer .....
35198		Smith & Flora, Campbellsville.
35395		Taylor & Son, Greensburg.....
30742	Eagle High Grade Tobacco & Potato Grower	Manufacturer .....
35199		Smith & Flora, Campbellsville.
30743	Eagle Tobacco Grower.....	Manufacturer .....
35200		L. S. Brough, Bowling Green..
30744	Eagle Potato Grower.....	Manufacturer .....
30745	Eagle Truck Grower.....	Manufacturer .....
35201		L. S. Brough, Bowling Green..
	Meridian Fertilizer Factory, Meridian, Miss.	
35007	Meridian Home Mixture Guano	Manufacturer .....

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
7.92	1.22	9.14	0.28		0.67	0.95	1.15	0.80	1.29	$15.67	30737
8.86	1.39	10.25	0.20		0.62	0.82	1.00	0.70	0.78	15.70	35195
10.12	1.16	11.28				0.83	1.01		1.64	17.48	35392
8.00	*1.00*	*9.00*				*0.82*	*1.00*		*1.50*	*14.67*	
9.55	0.78	10.33	0.20		0.34	0.54	0.66	0.90	3.27	18.48	30738
9.35	0.57	9.92	0.21		0.31	0.52	0.63	2.86	0.80	17.09	35196
8.19	0.71	8.90				0.52	0.63	5.04		16.97	35393
8.00	*1.00*	*9.00*				*0.41*	*0.50*		*4.00*	*16.24*	
9.55	1.54	11.09				1.84	2.23	0.90	1.19	20.85	30739
10.04	0.84	10.88	0.60		0.90	1.50	1.82		2.26	20.35	35197
9.82	1.87	11.69	0.44	0.24	0.78	1.46	1.77	2.09		19.73	35394
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*2.00*	*18.18*	
11.14	0.93	12.07	0.28		1.18	1.46	1.77	1.78	0.63	21.39	30740
10.00	*2.00*	*12.00*				*1.65*	*2.00*		*2.00*	*20.98*	
7.87	1.25	9.12	0.22		0.72	0.94	1.14	0.78	1.54	15.86	30741
9.65	0.64	10.29	0.47		0.59	1.06	1.29	1.22	1.16	18.16	35198
10.21	0.84	11.05				0.72	0.87		1.21	16.56	35395
8.00	*1.00*	*9.00*				*0.82*	*1.00*		*1.50*	*14.67*	
7.90	1.62	9.52	0.36		1.47	1.83	2.22	1.40	2.68	21.16	30742
10.42	0.93	11.35	0.59		0.86	1.45	1.76		2.43	20.87	35199
7.00	*1.00*	*8.00*				*1.65*	*2.00*		*4.00*	*19.38*	
8.45	1.11	9.56	0.39		1.82	2.21	2.68	6.12		24.44	30743
9.90	0.66	10.56	1.04		1.11	2.15	2.61	0.84	4.11	25.44	35200
8.00	*1.00*	*9.00*				*2.47*	*3.00*		*6.00*	*25.85*	
9.14	0.87	10.01	0.26		1.88	2.14	2.60	6.02		24.83	30744
8.00	*1.00*	*9.00*				*2.47*	*3.00*		*6.00*	*25.85*	
8.41	0.99	9.40	0.37		0.77	1.14	1.38	10.05		24.53	30745
9.17	0.91	10.08				1.53	1.86		9.55	28.18	35201
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*10.00*	*27.78*	
11.08	1.21	12.29	0.24	0.32	1.20	1.76	2.14	0.84	1.31	22.35	35007
10.00						*1.65*	*2.00*	*2.00*		*19.78*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Morris & Co., Chicago, Ill.	
30855	Big Three	Manufacturer
30856	Big Four	Manufacturer
35206		Redman & Burba Co., Hodgenville
30857	Big Five	Manufacturer
35207		C. R. Barnes, Bardstown
30860	Big Eight, Ammoniated Acid Phosphate & Potash	Manufacturer
35210		C. R. Barnes, Bardstown
30861	Big Nine	Manufacturer
30862	Big Ten, Grain Grower	Manufacturer
	Mt. Pleasant Fertilizer Co., Mt. Pleasant, Tenn.	
30466	Big Success Blood, Bone & Potash	Manufacturer
35213		C. J. White, Princeton
30468	Big Success Universal	Manufacturer
30470	Black Patch Grain & Seeding Down	Manufacturer
35405		Morganfield Dept. Store, Morganfield
30471	Black Patch Farmers Friend	Manufacturer

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
5.99	3.25	9.24				2.83	3.44	0.64	1.77	$21.16	30855
6.00	*4.00*	*10.00*				*2.47*	*3.00*		*2.00*	*19.85*	
7.70	2.82	10.52				4.06	4.93	1.28	2.73	29.14	30856
9.99	2.72	12.71				4.30	5.22	0.62	3.31	32.72	35206
7.00	*5.00*	*12.00*				*4.12*	*5.00*		*4.00*	*29.62*	
6.85	3.99	10.84				2.69	3.27	0.82	1.40	21.74	30857
7.08	4.02	11.10				2.50	3.04		1.07	20.14	35207
6.00	*4.00*	*10.00*				*2.47*	*3.00*		*1.00*	*18.65*	
7.13	2.14	9.27				1.14	1.38	1.13		14.54	30860
6.76	1.76	8.52				1.22	1.48	0.58	0.33	14.06	35210
7.00	*1.00*	*8.00*				*0.82*	*1.00*		*1.00*	*12.87*	
7.10	3.25	10.35				1.99	2.42	1.20	4.42	23.29	30861
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*5.00*	*22.18*	
7.92	4.27	12.19				2.28	2.77	0.74	1.54	21.78	30862
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*2.00*	*18.58*	
9.05	4.08	13.13				1.07	1.30	1.34	5.31	23.95	30466
10.04	6.31	16.35				1.19	1.44	0.96	2.20	22.34	35213
9.00	*2.00*	*11.00*				*0.82*	*1.00*		*7.00*	*22.87*	
9.07	5.57	14.64				1.03	1.25	4.67		21.39	30468
8.00	*2.00*	*10.00*				*0.82*	*1.00*		*4.00*	*18.07*	
10.77	3.47	14.24	0.67		1.28	1.95	2.37	2.08		23.22	30470
7.55	2.51	10.06				1.52	1.85	4.09		19.47	35405
10.00	*2.00*	*12.00*				*1.65*	*2.00*	*2.00*		*20.58*	
9.82	2.22	12.04		1.02	1.02	2.04	2.48	1.30	11.09	34.42	30471
10.00	*2.00*	*12.00*				*0.82*	*1.00*		*3.00*	*19.27*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Mt. Pleasant Fertilizer Co.	
30473	Black Patch Best By Test....	Manufacturer .....
30475	Big Success Potato Special...	Manufacturer .....
30477	Big Success Cantaloupe & Vegetable Special	Manufacturer .....
30478	Big Success Corn Special.....	Manufacturer .....
30479	Black Patch Tobacco Special..	Manufacturer .....
35216		H. A. McElroy, Bowling Green.
30480	Black Patch Tobacco Grower..	Manufacturer .....
30481	Tennessee & Kentucky Tobacco Grower	Manufacturer .....
30482	Big Success Tobacco Grower..	Manufacturer .....
	National Fertilizer Co., Nashville, Tenn.	
30834	Old Hickory Tobacco Grower.	Manufacturer .....
35217		Peay & Riley, Kuttawa.....
30835	Old Hickory Corn & Wheat Guano	Manufacturer .....
35218		C. C. Cooper & Son, Eubanks..
35407		Daniel & Myers, Shepherdsville
30836	Old Hickory Special Tobacco Grower No. 2.....	Manufacturer .....

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
12.79	0.96	13.75		1.10	0.67	1.77	2.15	1.18	5.90	$30.19	30473
12.00	*2.00*	*14.00*				*1.65*	*2.00*		*6.00*	*28.18*	
7.84	4.72	12.56	1.77		0.81	2.58	3.13	1.80	5.68	28.95	30475
7.00	*2.00*	*9.00*				*2.47*	*3.00*		*6.00*	*25.05*	
6.86	3.57	10.43		0.35	3.05	3.40	4.13	7.14	3.20	32.54	30477
6.00	*2.00*	*8.00*				*3.29*	*4.00*		*10.00*	*31.52*	
11.44	6.31	17.75		0.35	1.52	1.87	2.27		1.90	25.08	30478
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	
9.74	2.27	12.01		0.93	0.99	1.92	2.33	1.26	11.23	34.08	30479
8.82	5.04	13.86		0.63	1.38	2.01	2.44	1.26	10.77	33.82	35216
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*10.00*	*28.18*	
8.65	7.00	15.65	0.53		0.60	1.13	1.37	0.74	1.23	19.36	30480
8.00	*2.00*	*10.00*				*0.82*	*1.00*		*4.00*	*18.07*	
8.28	7.37	15.65		0.22	1.55	1.77	2.15	0.96	2.79	23.40	30481
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*4.00*	*20.98*	
10.03	6.27	16.30				1.89	2.29	1.90		23.07	30482
8.00	*2.00*	*10.00*				*3.29*	*4.00*		*10.00*	*33.92*	
9.70	2.91	12.61				2.16	2.62	2.02		22.38	30834
10.33	2.93	13.26				1.61	1.95	1.40	1.08	21.91	35217
10.00	*1.00*	*11.00*				*1.65*	*2.00*		*2.00*	*20.58*	
11.94	1.38	13.32				1.26	1.53	2.16		21.45	30835
8.28	6.29	14.57				0.74	0.90	1.69		16.74	35218
8.43	6.85	15.28				0.94	1.14	2.21		18.36	35407
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*2.00*		*14.87*	
9.16	3.94	13.10				1.79	2.17	2.18	3.52	25.24	30836
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*5.00*	*21.78*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	National Fertilizer Co.	
30837	Old Hickory Guano.....	Manufacturer .....
35219		C. C. Cooper & Son, Eubanks..
35408		Plain Hdw. Co., Madisonville..
30838	Old Hickory Corn Grower....	Manufacturer .....
35220		D. B. Moore, Marion.....
30839	Old Hickory Millers Tobacco Grower	Manufacturer .....
30938	Old Hickory Brand Blood & Bone	Manufacturer .....
35222		Barnett Bros., London.....
30942	Old Hickory Brand Millers Special Tobacco Grower.....	Manufacturer .....
35224		I. K. Miller & Sons, Campbellsville .....
30973	Old Hickory Wheat Grower..	*Manufacturer .....
30981	Old Hickory Special Wheat Grower	*Manufacturer .....
30985	Old Hickory High Grade Wheat Grower	*Manufacturer .....
30987	Special High Grade Wheat Grower	*Manufacturer .....
35002		M. E. Webb, Guthrie.....

*The manufacturer failed to furnish sample as required by law.

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
8.00	4.19	12.19				1.88	2.28	3.32		$21.18	30837
8.94	4.08	13.02		0.51	0.87	1.38	1.68	0.90	5.24	24.38	35219
8.37	5.02	13.39				1.89	2.29	3.40		22.07	35408
8.00	*1.00*	*9.00*				*1.65*	*2.00*	*2.00*		*17.78*	
9.54	5.07	14.61				1.08	1.31	1.39		18.65	30838
10.67	2.03	12.70	0.51		0.62	1.13	1.37	1.72		19.29	35220
10.00	*1.00*	*11.00*				*0.82*	*1.00*	*1.00*		*16.27*	
8.39	4.17	12.56				1.85	2.25	3.17		21.39	30839
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*2.00*	*18.18*	
8.85	5.20	14.05				1.08	1.31	1.52		18.00	30938
10.65	7.33	17.98		0.27	1.12	1.39	1.69	1.91		22.49	35222
10.00	*1.00*	*11.00*				*0.82*	*1.00*	*1.00*		*16.27*	
7.87	5.28	13.15				1.62	1.97		6.56	25.09	30942
8.61	6.25	14.86				1.21	1.47	5.87		22.94	35224
8.00	*1.00*	*9.00*				*1.23*	*1.50*		*6.00*	*21.51*	
											30973
10.00	*1.00*	*11.00*				*1.65*	*2.00*	*2.00*		*20.18*	
											30981
10.00	*1.00*	*11.00*				*2.47*	*3.00*	*3.00*		*24.05*	
											30985
12.00	*1.00*	*13.00*				*1.65*	*2.00*	*4.00*		*24.58*	
											30987
11.84	1.45	13.29		0.81	1.00	1.81	2.20	4.34	2.10	27.99	35002
12.00						*1.65*	*2.00*		*6.00*	*27.38*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Peruvian Guano Corporation, Charleston, S. C.	
30931	Peruvian Guano	Manufacturer
	A. W. Pickerill, Hodgenville, Ky.	
30936	Pickerill's Tobacco & Vegetable Grower	Manufacturer
35227		Mfgrs. Warehouse
	Queen City Fertilizer Co., Cincinnati, Ohio.	
30923	Miami Valley Grain Grower	Manufacturer
30924	Valley Gem Phosphate	Manufacturer
30925	Big Bonanza Tobacco & Potato Grower	Manufacturer
35228		C. L. Dudley, Flemingsburg
	Read Phosphate Co., Nashville, Tenn.	
30700	Read's Farmers Special Manure	Manufacturer
35229		Barren Co. Grocery & Hdw. Co., Glasgow
35418		Barren Co. Grocery & Hdw. Co., Glasgow
30701	Read's Blood & Bone Special.	Manufacturer
35230		J. B. Benjamin, Providence
30702	Read's Wheat & Clover Grower	Manufacturer
35419		Wheeler & Spalding, Bardstown
30703	Read's Red Diamond Special.	Manufacturer

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
9.96	3.31	13.27	0.44	1.77	2.73	4.94	6.00	0.94	1.16	$32.89	30931
9.00	*4.00*	*13.00*				*4.94*	*6.00*		*2.25*	*32.39*	
10.95	0.33	11.28		3.33	0.83	4.16	5.05	1.44	2.69	32.50	30936
8.94	0.91	9.85	3.01		0.55	3.56	4.32	4.47		28.02	35227
10.00	*2.00*	*12.00*				*3.29*	*4.00*	*4.00*		*28.32*	
7.78	0.70	8.48		0.51	0.93	1.44	1.75	3.02		17.68	30923
8.00	*1.00*	*9.00*				*1.23*	*1.50*	*2.50*		*16.81*	
8.24	1.84	10.08				0.92	1.12	2.20		16.05	30924
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*2.00*		*14.87*	
9.32	1.72	11.04				0.94	1.14	4.16		19.32	30925
9.62	1.05	10.67	0.20	0.27	0.57	1.04	1.26	3.97		19.57	35228
8.00	*1.00*	*9.00*				*0.82*	*1.00*	*2.00*	*2.00*	*17.27*	
11.04	2.60	13.64				1.06	1.29	1.22	2.31	21.99	30700
10.24	3.00	13.24				2.13	2.59	3.14		24.09	35229
11.88	1.56	13.44				0.66	0.80	2.54		19.73	35418
10.00	*2.00*	*12.00*				*0.82*	*1.00*	*3.00*		*18.67*	
13.75	2.11	15.86				0.50	0.61		1.34	20.70	30701
10.67	2.44	13.11				1.01	1.23	1.23		18.54	35230
10.00	*2.00*	*12.00*				*0.82*	*1.00*	*1.00*		*16.67*	
11.22	2.92	14.14				1.13	1.37		2.87	22.03	30702
10.07	2.46	12.53				1.02	1.24	2.30		18.93	35419
10.00	*2.00*	*12.00*				*0.82*	*1.00*	*2.00*		*17.67*	
11.39	1.01	12.40		2.09	0.75	2.84	3.45	1.12	1.83	27.33	30703
10.00	*2.00*	*12.00*				*2.47*	*3.00*		*3.00*	*25.05*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Read Phosphate Co.	
30710	Read's Special Corn Grower..	Manufacturer .....
30711	Read's Standard Tobacco Grower	Manufacturer .....
35235		W. M. Leming, Hodgenville....
30712	Read's Blood & Bone No. 1...	Manufacturer .....
35236		T. S. Frith, Brodhead.....
35425		Wm. Leming, Hodgenville.....
30713	Read's High Grade Tobacco Grower	Manufacturer .....
35237		B. F. Smith, Cerulean.....
30714	Read's High Grade Tobacco Special	Manufacturer .....
30960		G. P. Heath, Bedford.....
30983		G. P. Heath, Bedford.....
35426		Carrell & Dodson, Steubenville.
30715	Read's Soluble Bone.....	Manufacturer .....
35238		W. M. Leming, Hodgenville....
35427		W. M. Leming, Hodgenville....
30716	Read's Russell County Special	Manufacturer .....
30717	Read's Special Potato Grower	Manufacturer .....
30718	Read's Vegetable, Fruit & Vine Grower	Manufacturer .....
30719	Read's High Grade Ammoniated Dissolved Bone.....	Manufacturer .....
35428		D. H. Hatter & Son, Franklin..

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
9.88	2.69	12.57				0.97	1.18	1.44	0.36	$18 21	30710
10.00	*2.00*	*12.00*				*0.41*	*0.50*	*1.00*		*15.24*	
9.60	1.54	11.14		1.04	0 75	1.79	2.17	0.64	2.19	21.68	30711
7.96	4.31	12.27		0.48	1.49	1.97	2 39	2.67		20.84	35235
8 00	*2.00*	*10.00*				*1.65*	*2.00*		*2.00*	*18.58*	
9.74	1.30	11.04		1.05	0.67	1.72	2.09	0.72	2.35	21.77	30712
8.47	2.49	10.96		0.65	0.89	1.54	1.87	2.71		19.26	35236
8.93	3 44	12.37				1.70	2.06	1.76		19.82	35425
8.00	*2.00*	*10 00*				*1.65*	*2.00*	*2.00*		*18.18*	
9.68	1.07	10.75		1.05	0.63	1.68	2.04	2.28	2.16	22.80	30713
8.44	2.93	11.37				1.45	1.76	1.00	2.66	20.57	35237
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*4.00*	*20.98*	
9.33	1.47	10.80		0.83	0.65	1.48	1.80	1.60	8.25	28.47	30714
7.13	1.59	8 72		0.79	0.77	1.56	1.89	8.08		22.74	30960
7.57	1.12	8.69				2.83	3.44	3.45		22.89	30983
8.68	1.01	9.69				1.61	1.95	7.32		24 08	35426
8.00	*2.00*	*10.00*				*1.65*	*2 00*		*8.00*	*25 78*	
9.13	2.64	11.77		0.87	0 38	1.25	1.52	2.56		18.96	30715
8.40	2.79	11.19	0.22		0.75	0.97	1.18	2.18		16.78	35238
8.23	4 05	12.28				0.91	1.10	1.69		16.36	35427
8.00	*2.00*	*10.00*				*0.82*	*1.00*	*2.00*		*15.27*	
9.14	1.49	10.63				1.17	1.42	0.80	2.63	19 63	30716
8.00	*2.00*	*10.00*				*0.82*	*1.00*		*3 00*	*16.87*	
8.73	1.39	10.12		0.91	0.75	1.66	2.02	2.32	5.90	26.25	30717
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*6.00*	*23.38*	
6.72	1.64	8.36		1.52	0.44	1.96	2.38	2.74	5.33	24.72	30718
6.00	*2.00*	*8.00*				*1.65*	*2.00*		*8.00*	*23.38*	
11.92	0.74	12.66		1.95	0.79	2.74	3.33	0 58		24.77	30719
11.06	1.28	12.34				1 54	1.87	1.80		20.97	35428
10.00	*2.00*	*12.00*				*1.65*	*2.00*	*2.00*		*20.58*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Smith Brothers, Louisville, Ky.	
30875 35239	Grain Special	Manufacturer ..... I. K. Miller & Sons, Campbellsville .....
30878 35240	Success Crop Grower.....	Manufacturer ..... Clarkson Hdw. Co., Clarkson...
30880	Corn & Wheat Grower.....	Manufacturer .....
30881 35242	Standard Tobacco Grower....	Manufacturer ..... I. K. Miller & Sons, Campbellsville .....
30882 35243	Kentucky Tobacco Grower...	Manufacturer ..... I. K. Miller & Sons, Campbellsville .....
30883	High Grade Potato Grower...	Manufacturer .....
30886	Special Tobacco Grower.....	Manufacturer .....
30887	Beef, Blood & Bone.....	Manufacturer .....
	Southern Seed Co., Louisville, Ky.	
30967	Potato Grower	Manufacturer .....
30988	"Elk Brand" Corn & Wheat Grower	Manufacturer .....

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
10.64	1.70	12.34				1.09	1.32	2.37		$19.64	30875
10.78	1.13	11.91	0.22		0.56	0.78	0.95	0.78	0.85	17.92	35239
10.00	*2.00*	*12.00*				*0.82*	*1.00*	*2.00*		*17.67*	
7.24	1.64	8.88				0.98	1.19	1.41		14.19	30878
7.81	1.39	9.20	0.23		1.52	1.75	2.12	1.04	1.04	18.35	35240
7.00	*2.00*	*9.00*				*0.82*	*1.00*	*1.00*		*13.07*	
8.61	2.00	10.61				1.81	2.20	2.42		19.89	30880
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	
8.05	2.60	10.65				1.73	2.10	2.18		18.94	30881
8.76	1.12	9.88	0.81		0.50	1.31	1.59	0.56	1.08	17.41	35242
8.00	*2.00*	*10.00*				*1 65*	*2.00*		*2.00*	*18.58*	
7.67	1.94	9.61				1.63	1.98	1.40	3.22	20.95	30882
7.74	0 70	8.44	0.95		0.57	1.52	1.85	3.60		18.49	35243
7.00	*2.00*	*9.00*				*1.65*	*2.00*		*4.00*	*19.78*	
8.30	2.23	10.53				2.87	3.48	6.27		27.17	30883
8.00	*2.00*	*10.00*				*2.47*	*3.00*		*6.00*	*26.25*	
7.73	2.49	10.22				1.54	1.87	2.34	3.25	21.91	30886
8.00	*0.50*	*8.50*				*1.65*	*2.00*		*5.00*	*21.58*	
9.86	2.42	12.28				1.80	2.19	2.30		21.40	30887
10.00	*0.50*	*10.50*				*1.65*	*2.00*	*2.00*		*19.98*	
8.64	1.15	9.79	1.26		1.14	2.40	2.91		6.63	27.19	30967
8.00	*1.00*	*9.00*				*2.47*	*3.00*		*6.00*	*25.85*	
7.80	0.38	8.18				0.92	1.12	1.68		14.41	30988
7.00	*1.00*	*8.00*				*0.82*	*1 00*		*1.00*	*12.87*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Swift and Co., Chicago, Ill.	
30607	Swift's Superphosphate	Manufacturer .....
35245		F. C. Parrish, Horse Cave.....
35432		Farmers Union Warehouse & Supply Co., Munfordville.....
30609	Swift's Complete Fertilizer...	Manufacturer .....
35247		Farmers Hdw. & Gro. Co., Glasgow .....
35434		I. K. Miller & Sons, Campbellsville .....
30610	Swift's Tobacco & Truck Grower	Manufacturer .....
35248		I. K. Miller & Sons, Campbellsville .....
30611	Swift's Onion, Potato & Tobacco Fertilizer	Manufacturer .....
35249		F. C. Parrish, Horse Cave.....
35435		Lambert-Walker Hdw. Co., Henderson .....
30614	Swift's Champion Wheat & Corn Grower	Manufacturer .....
35438		I. K. Miller & Sons, Campbellsville .....
30616	Swift's Kentucky Tobacco Grower	Manufacturer .....
35253		I. K. Miller & Sons, Campbellsville .....
30617	**Swift's Vegetable & Tobacco** Grower	Manufacturer .....
35254		W. R. Turner, Cerulean.....

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
8.36	5.07	13.43				1.94	2.36	2.50		$21.35	30607
8.31	2.84	11.15				1.94	2.36	2.07		19.97	35245
8.09	0.93	9.02				1.68	2.04	1.82		17.78	35432
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	
9.56	3.25	12.81				1.31	1.59	1.63		18.99	30609
5 67	0.14	5.81				0.96	1.17	1.88		12.10	35247
7.99	0.32	8.31				1.02	1.24	0.78		14.07	35434
8.00	*1.00*	*9.00*				*1.03*	*1.25*	*1.00*		*14.61*	
9.79	2.86	12.65				1.15	1.40	0.94	0.62	18.60	30610
9.16	0.38	9.54				0.86	1.04	0 74	3.24	18.78	35248
8.00	*1.00*	*9.00*				*0.82*	*1.00*		*4.00*	*17.67*	
9.01	2.64	11.65				1.81	2 20	7.83		26.04	30611
10.03	4.49	14.52				1.75	2 12		7.25	28.67	35249
9.19	0.32	9.51				1 28	1.55	2.12	4.94	23.69	35435
8.00	*2.00*	*10.00*				*1.65*	*2.00*		*7.00*	*24.58*	
11.91	1.62	13.53				2.14	2.60	2.52		24.95	30614
12.10	0.80	12.90				1.78	2.16	1.87		22 94	35438
12.00	*2.00*	*14.00*				*1.65*	*2.00*	*2.00*		*22.98*	
11.45	1.91	13.36				2.01	2.44	1.54	1.22	24.54	30616
10.52	0.65	11.17				1.82	2.21	1.69		20.94	35253
10.00	*2.00*	*12.00*				*1.65*	*2.00*		*2.00*	*20.98*	
8.92	0.88	9.80				2.95	3 58		11.17	34.78	30617
8.15	0.84	8.99				2.97	3.61	3 36	2 82	27.26	35254
8.00	*1.00*	*9.00*				*2.47*	*3.00*		*10.00*	*30 65*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Swift & Co.	
30621	Swift's Special Tobacco Grower	Manufacturer
35256		Green Bros., Falls of Rough
	Taylor and Powell, Springfield, Tenn.	
30979	Grain Special	Manufacturer
	Tennessee Chemical Co., Nashville, Tenn.	
30771	Ox Special Corn Grower	Manufacturer
35258		T. A. Porter, London
30772	Ox Special Wheat Grower	Manufacturer
35446		J. I. Rice, Adairville
30773	Ox Grain Grower	Manufacturer
35259		B. F. Beard & Co., Hardinsburg.
35447		Bourland & Moore, Madisonville
30774	Ox Slaughter House Bone	Manufacturer
35260		F. A. Yost Co., Hopkinsville
35448		W. F. Grainger, Franklin
30775	Ox Ammoniated Bone	Manufacturer
30776	Ox Pride Tobacco Grower	Manufacturer
35261		I. K. Miller & Sons, Campbellsville
30777	Ox High Grade Tobacco & Potato Grower	Manufacturer
35262		Farmers Hdw. & Gro. Co., Glasgow

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
10.95	0.75	11.70				2.72	3.30		3.85	$27.58	30621
9.71	0.85	10.56				3.02	3.67	1.94	1.84	26.71	35256
10.00	*2.00*	*12.00*				*2.47*	*3.00*		*3.00*	*25.05*	
12.12	3.88	16.00				0.82	1.00	1.04	1.22	21.46	30979
12.00						*0.82*	*1.00*	*2.00*		*19.27*	
7.38	2.14	9.52				0.95	1.15	0.70	0.63	14.51	30771
8.37	1.93	10.30	0.30		0.65	0.95	1.15		1.11	15.47	35258
7.00	*1.00*	*8.00*				*0.82*	*1.00*		*1.00*	*12.87*	
7.52	1.72	9.24				1.08	1.31	0.82	0.52	14.93	30772
8.24	1.24	9.48	0.30		0.94	1.24	1.51	1.47		16.20	35446
7.00	*1.00*	*8.00*				*0.82*	*1.00*		*1.00*	*12.87*	
8.56	0.75	9.31	0.27		0.31	0.58	0.70	1.06	3.35	17.68	30773
10.16	0.61	10.77	0.21		0.30	0.51	0.62	4.11		18.33	35259
10.26	1.73	11 99				0.56	0.68	0.98	2 98	19.52	35447
8.00	*1.00*	*9.00*				*0.41*	*0.50*		*4.00*	*16.24*	
9.70	1.66	11 36				1.81	2.20	0.68	1.53	21.16	30774
9.26	0.84	10.10		0.73	0.93	1.66	2.02	1.48	0.88	19.80	35260
9 92	0 84	10.76		0.44	1.06	1 50	1.82	2.11		19.60	35448
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*2.00*	*18.18*	
11.50	0.94	12.44	0.23		1.33	1.56	1.89	1.58	0.95	22.36	30775
10.00	*2.00*	*12.00*				*1.65*	*2.00*		*2.00*	*20 98*	
8.00	1.17	9.17	0.31		0.70	1.01	1.23	0.84	1.42	16.15	30776
11.37	1.03	12.40	0.30		0.57	0.87	1.06		1.50	18.90	35261
8.00	*1.00*	*9.00*				*0.82*	*1.00*		*1.50*	*14.67*	
8.16	1.72	9.88	0.35		1.58	1.93	2.34	1.64	2.44	21.81	30777
8.24	1.03	9.27	0.67		0.95	1.62	1.97		3.56	20.24	35262
7.00	*1.00*	*8.00*				*1,65*	*2.00*		*4.00*	*19.38*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Tennessee Chemical Co.	
30778 35263	Ox Special Tobacco Guano...	Manufacturer ..... W. F. Grainger, Franklin.....
30779	Ox Truck Grower.....	Manufacturer .....
	Tennessee Valley Fertilizer Co., Florence, Ala.	
30989	Ashcraft's Tobacco Special...	Manufacturer .....
30990	Ashcraft's Special	Manufacturer .....
30991	Cotton Seed Meal & Bone....	Manufacturer .....
30992	Pride of Kentucky.....	Manufacturer .....
30993	Monarch	Manufacturer .....
30994	Blood & Bone.....	Manufacturer .....
	The T. J. Turley Co., Owensboro, Ky.	
30933 35265	Ideal Truck & High Grade Tobacco Grower	Manufacturer ..... Manufacturer's Warehouse.....
30934 35266	Ideal Tobacco Grower.....	Manufacturer ..... J. B. Taylor, Lewisport.....
30946 35451	Turley's Ideal Grain Grower..	Manufacturer ..... Manufacturer's Warehouse.....

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
11.24	1.06	12.30	0.39		1.18	1.57	1.91	2.00	0.57	$22.09	30778
11.07	1.22	12.29	0.40		1.07	1.47	1.78	1.04	0.74	20.85	35263
10.00	*2.00*	*12.00*				*1.65*	*2.00*		*2.00*	*20.98*	
8.44	1.22	9.66	0.43		0.78	1.21	1.47	10.34		25.20	30779
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*10.00*	*27.78*	
8.58	3.12	11.70				1.06	1.29	5.66		20.92	30989
8.00						*1.65*	*2.00*		*4.00*	*20.18*	
9.49	0.91	10.40				1.73	2.10	2.12		19.93	30990
10.00						*1.65*	*2.00*		*2.00*	*20.18*	
8.66	2.88	11.54				1.91	2.32	2.05		20.28	30991
8.00						*1.65*	*2.00*		*2.00*	*17.78*	
11.12	3.23	14.35				0.60	0.73	4.58		21.31	30992
10.00						*0.82*	*1.00*		*4.00*	*19.67*	
8.27	3.26	11.53				1.63	1.98	1.78		18 71	30993
8.00						*1.65*	*2.00*		*2.00*	*17.78*	
12.51	3.30	15.81				0.18	0.22	1.05		18.01	30994
10.00						*0.82*	*1.00*		*1.00*	*16.07*	
11.52	1.24	12.76				1.92	2.33	1.74	6.12	30.12	30933
12.10	0.33	12.43	1.34		0.47	1.81	2.20		5 87	28.03	35265
10.00	*0.50*	*10.50*				*1.65*	*2.00*		*8.00*	*27.58*	
8.58	1 29	9.87				2.12	2.57	1.54	4.07	24.66	30934
9.34	1.29	10.63	0.26		1.11	1.37	1.66		3.79	21.08	35266
8.00	*0.50*	*8.50*				*1.65*	*2.00*		*4.00*	*20.38*	
8.29	1.31	9.60		0.63	0.51	1.14	1.38	3.82		18.28	30946
9.56	1.01	10.57				1.00	1.21	2.45		17.82	35451
8.00	*0.50*	*8.50*				*0.82*	*1.00*	*3.00*		*15.67*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Tuscarora Fertilizer Co., Chicago, Ill.	
30813	Wheat & Corn Grower.....	Manufacturer .....
30814	Tobacco Special	Manufacturer .....
30816	Ammoniated Phosphate	Manufacturer .....
30818	Big Four	Manufacturer .....
35453		C. Browning, Greensburg.....
30822	Standard	Manufacturer .....
35455		C. Browning, Greensburg.....
30823	Trucker	Manufacturer .....
	Virginia-Carolina Chemical Co., Memphis, Tenn.	
30844	Beef, Blood & Bone Fertilizer.	Manufacturer .....
30953		Jno. E. Wilson, McDaniels.....
35267		D. M. Brakefield, Adairville....
35456		Warren-Miller Imp. Co., Elizabethtown .....
30845	Royal Blood, Bone & Potash..	Manufacturer .....
30846	National Tobacco Fertilizer...	Manufacturer .....
35268		Olive & Walker, Marion.....
30847	Royal Tobacco Fertilizer.....	Manufacturer .....
35269		I. K. Miller & Sons, Campbellsville .....

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.				Equivalent to Ammonia.	POTASH.		Estimated Value per Ton.	Station Number.
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.		From Muriate.	From Sulphate.		
9.69	2.38	12.07				1.64	1.99	2.32		$20.64	30813
10.00						*1.65*	*2.00*	*2.00*		*19.78*	
8 00	2.08	10.08				1.65	2.00	2.58	3.13	22.55	30814
8.00						*1.65*	*2.00*		*5.00*	*21.38*	
7.56	1.31	8.87				0.91	1.10	1.44		14.22	30816
7.00						*0.82*	*1.00*	*1.00*		*12.27*	
7.60	1.72	9.32				1.65	2.00	4.47		20.06	30818
9.56	2.44	12.00	0.20		1.37	1.57	1.91	3.80		21.76	35453
7.00						*1.65*	*2.00*		*4.00*	*18.98*	
8.54	2.68	11.22				1.81	2.20	2.37		20.03	30822
8.84	1.03	9.87	0.24		1.06	1.30	1.58	1.89		17.46	35455
8.00						*1.65*	*2.00*	*2.00*		*17.38*	
8.02	2.14	10.16		2.74	1.37	4.11	4.99	3.86	3.40	32.81	30823
8.00						*4.12*	*5.00*		*7.00*	*32.42*	
9.08	0.65	9.73	0.28	0.52	1.14	1.94	2.36	2.23		20.18	30844
7.69	1.64	9.33		0.97	0.67	1.64	1.99	1.72		17.35	30953
8.31	1.89	10.20	0.87		0.69	1.56	1.89	2.06		18.20	35267
11.46	0.60	12.06		1.06	0.75	1.81	2.20	1.99		22.32	35456
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	
9.41	0.70	10.11		0.58	1.28	1.86	2.26	2.39		20.47	30845
8.00	*2.00*	*10.00*				*1.65*	*2.00*	*2.00*		*18.18*	
8.00	0.64	8.64	0.23	0.48	1.55	2.26	2.74		3.92	22.47	30846
8.95	0.52	9.47	0.40		1.11	1.51	1.83		4.83	22.04	35268
7.00	*2 00*	*9.00*				*1.65*	*2.00*		*4.00*	*19.78*	
8.58	0.57	9.15		0.57	1.44	2.01	2.44		4.97	23.53	30847
8.86	0.82	9.68		1.00	0.74	1.74	2.11		5.07	23.13	35269
8.00	*1.00*	*9.00*				*1.65*	*2.00*		*5.00*	*21.78*	

TABLE I.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Virginia-Carolina Chemical Co.	
30848	Champion Corn & Wheat Grower	Manufacturer
30956	Royal High Grade Guano	Manufacturer
	Wood, Stubbs & Co., Louisville, Ky.	
30582	Acme Brand Special Truckers Fertilizer	Manufacturer
30583	Acme Brand Wheat & Corn Fertilizer	Manufacturer
30584	Acme Brand Potato & Tobacco Fertilizer	Manufacturer
30585	Acme Brand Blood, Bone & Potash	Manufacturer
30586	Acme Brand High Grade Vegetable Fertilizer	Manufacturer

Complete Fertilizers.

PHOSPHORIC ACID.			NITROGEN.					POTASH.			
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia.	From Muriate.	From Sulphate.	Estimated Value per Ton.	Station Number.
8.82	1.21	10.03				1.04	1.26	2.34		$17.04	30848
8.00	*2.00*	*10.00*				*0.82*	*1.00*	*2.00*		*15.27*	
10.78	1.13	11.91		1.04	0.68	1.72	2.09	2.21		21.62	30956
10.00	*2.00*	*12.00*				*1.65*	*2.00*	*2.00*		*20.58*	
8.86	0.60	9.46		0.83	1.88	2.71	3.29	2.53		22.89	30582
8.00	*4.00*	*12.00*				*2.47*	*3.00*		*2.00*	*22.25*	
11.13	0.54	11.67				1.04	1.26	1.34	0.58	19.26	30583
10.00	*4.00*	*14.00*				*0.82*	*1.00*		*2.00*	*18.87*	
9.31	0.57	9.88				2.73	3.31	2.14	3.18	26.92	30584
8.00	*4.00*	*12.00*				*2.47*	*3.00*		*6.00*	*27.05*	
10.63	0.68	11.31				1.84	2.23	1.54	3.66	25.40	30585
10.00	*4.00*	*14.00*				*1.65*	*2.00*		*2.00*	*21.78*	
11.04	0.66	11.70		2.81	0.89	3.70	4.49	4.09		30.55	30586
10.00	*4.00*	*14.00*				*3.29*	*4.00*		*4.00*	*29.92*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The American Agr'l Chemical Co., Cincinnati Sales Dept., Cincinnati, Ohio.	
30626	Special Bone Meal.....	Manufacturer .....
30627	Ground Bone	Manufacturer .....
30628	Fine Raw Bone.....	Manufacturer .....
35278		Peak & Wiseman, Rineyville...
	The American Agr'l Chemical Co., Bowker Fert. Works, Cincinnati, Ohio.	
30651	Bowker's Pure Bone & Potash Mixture	Manufacturer .....
35035		W. H. Murray, London.....
30652	Bowker's Bone Meal.....	Manufacturer .....
30653	Bowker's Pure Ground Bone..	Manufacturer .....
35036		H. Willis & Sons, Caneyville...
35292		Richeson & Turner, Campbellsville .....
	The American Agr'l Chemical Co., Michigan Carbon Works, Cincinnati, Ohio.	
30666	Homestead Special Bone Meal	Manufacturer .....
35048		F. C. Parrish, Horse Cave.....
30667	Wolverine Pure Ground Bone.	Manufacturer .....
35299		Woodson Lewis, Greensburg...

BONES, TANKAGE, &C.

Percentage of Fineness,		Total Phosphoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia	Potash.		Estimated Value Per Ton.	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulphate.		
70	30	24.07	52.57	1.31	1.59			$22 40	30626
		25.00	*54.59*	*1.23*	*1.50*			*19.31*	
74	26	24.23	52.92	2.09	2.54			25.44	30627
		20.00	*43.67*	*2.47*	*3.00*			*20.65*	
100	0	20 37	44.48	3.71	4.50			29.29	30628
100	0	20.78	45.37	3.89	4.72			30.29	35278
		23.00	*48.06*	*3.29*	*4.00*			*24 72*	
73	27	18.21	39.77	1.01	1.23	3 46		20.59	30651
64	36	20.40	44.56	1.21	1.47	3.54		22.63	35035
		18.00	*39 31*	*0.82*	*1.00*	*3.00*		*16.67*	
70	30	23.97	52.36	1.32	1.60			22.35	30652
		25.00	*54.59*	*1.23*	*1.50*			*19.31*	
78	22	23.82	52.02	2.06	2.50			25.21	30653
68	32	20.91	45.66	2.44	2.96			23.93	35036
77	23	21.16	46.21	2.56	3.11			24.92	35292
		20.00	*43.67*	*2.47*	*3.00*			*20.65*	
74	26	24.30	53.07	1.30	1.58			22.72	30666
77	23	28.58	62.42	1.15	1.40			25.58	35048
		25.00	*54.59*	*1.23*	*1.50*			*19 31*	
80	20	24.56	53.64	2.04	2.48			25.81	30667
69	31	26.88	58.70	1.87	2.27			26.39	35299
		20.00	*43.67*	*2.47*	*3.00*			*20.65*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The American Agr'l Chemical Co., Cincinnati Sales Dept., Cincinnati, Ohio.	
30685	N-W Horse Shoe Brand Special Bone Meal	Manufacturer
30686	N-W Horse Shoe Brand Pure Ground Bone	Manufacturer
35057		E. P. Barnes & Bro., Beaver Dam
35307		E. P. Barnes & Bro., Beaver Dam
	The American Agr'l Chemical Co., Cincinnati Sales Dept., Cincinnati, Ohio.	
30698	Packers Boars Head Brand Special Bone Meal	Manufacturer
30699	Packers Boars Head Brand Chicago Bone Meal	Manufacturer
	The Armour Fertilizer Works, Chicago, Ill.	
30602	Raw Bone Meal	Manufacturer
35075		Dickey & Martin, Munfordville.
35316		O. A. Lutes & Co., Shepherdsville
30603	Bone Meal	Manufacturer
35076		Mardis & Wray, Campbellsville.
35317		E. S. Ferriell & Son, Buffalo...
30604	Steamed Bone Meal	Manufacturer
35077		Mardis & Wray, Campbellsville.
35318		Forbes Mfg. Co., Hopkinsville..

BONES, TANKAGE, &C.

Percentage of Fineness.		Total Phosphoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia	Potash.		Estimated Value Per Ton.	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulphate.		
70	30	24.25	52.96	1.31	1.59			$22.53	30685
		25.00	*54.59*	*1.23*	*1.50*			*19.31*	
80	20	23.23	50.74	2.00	2.43			24.65	30686
72	28	19.41	42.38	2.68	3.25			23.82	35057
62	38	21.78	47.56	2.32	2.82			23.89	35307
		20.00	*43.67*	*2.47*	*3.00*			*20.65*	
73	27	23.74	51.86	1.27	1.54			22.16	30698
		25.00	*54.59*	*1.23*	*1.50*			*19.31*	
76	24	24.28	53.03	2.11	2.56			25.65	30699
		20.00	*43.67*	*2.47*	*3.00*			*20.65*	
85	15	23.97	52.36	3.64	4.42			31.20	30602
56	44	24.63	53.78	3.69	4.48			30.46	35075
67	33	24.96	54.51	3.84	4.66			31.78	35316
		22.00	*48.06*	*3.71*	*4.50*			*26.19*	
78	22	22.98	50.18	2.71	3.29			26.84	30603
59	41	23.21	50.68	2.87	3.48			26.72	35076
88	12	24.91	54.40	2.76	3.35			28.99	35317
		24.00	*52.42*	*2.47*	*3.00*			*23.05*	
86	14	19.53	42.66	1.84	2.23			21.52	30604
91	9	24.50	53.51	2.61	3.17			28.30	35077
82	18	20.71	45.23	1.49	1.81			21.04	35318
		20.00	*43.67*	*1.65*	*2.00*			*17.78*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Armour Fertilizer Works.	
30606 35319	Bone & Potash Mixture.....	Manufacturer ..... Forbes Mfg. Co., Hopkinsville..
	The Cincinnati Phosphate Co., Cincinnati, Ohio.	
30908	Capitol Ground Bone.....	Manufacturer .....
	Continental Fertilizer Co., Nashville, Tenn.	
30763 35323	Bear Bone Meal.....	Manufacturer ..... J. L. Durham, Greensburg.....
30764	Bear Raw Bone.....	Manufacturer .....
30765	Bear Standard Raw Bone.....	Manufacturer .....
	The Evansville Packing Co., Evansville, Ind.	
30864 35093	Pure Raw Bone.....	Manufacturer ..... W. E. Ellis, Hartford.....
30865	Packing House Tankage.....	Manufacturer .....
	Federal Chemical Co., Louisville, Ky.	
30511 35332	Daybreak Fine Raw Bone....	Manufacturer ..... Warren-Miller Imp. Co., Elizabethtown .....
30512 35333	Daybreak Raw Bone.....	Manufacturer ..... Mardis & Wray, Campbellsville.

BONES, TANKAGE, &C.

Percentage of Fineness.		Total Phosphoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia	Potash.		Estimated Value Per Ton.	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulphate.		
76	24	19.71	43.06	2.14	2.60	3.29		$25.60	30606
89	11	21.68	47.36	2.16	2.62	3.80		28.23	35319
		20.00	*43.67*	*1.85*	*2.25*	*3.00*		*21.48*	
93	7	25.76	56.25	2.36	2.87			28.51	30908
		20.00	*43.67*	*2.47*	*3.00*			*20.65*	
94	6	20.68	45.16	1.34	1.63			20.98	30763
92	8	17.75	38.76	1.86	2.26			20.42	35323
		20.00	*43.67*	*1.65*	*2.00*			*17.78*	
75	25	26.54	57.96	2.60	3 16			29 00	30764
		24.00	*52.42*	*2.47*	*3.00*			*23.05*	
68	32	26.02	56.83	3.81	4.63			32.49	30765
		22.00	*48.06*	*3.71*	*4.50*			*26.19*	
47	53	22.98	50.18	3.83	4.65			29.37	30834
43	57	23.74	51.86	3.64	4.42			29 03	35093
		21.50	*46.95*	*3.60*	*4.37*			*25.50*	
47	53	10.07	21.99	7.24	8.79			32.32	30865
		16.00	*34.95*	*5.00*	*6.07*			*27.10*	
90	10	21.16	46.21	2.69	3.27			25.93	30511
83	17	24.84	54.26	2.80	3.40			28.83	35332
		24.00	*52.42*	*2.47*	*3.00*			*23.05*	
26	74	22.70	49.58	1.21	5.11			29.54	30512
85	15	21 50	46.95	2.47	3.00			25.20	35333
		22.00	*48.06*	*3.71*	*4 50*			*26.19*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Fox Chemical Co., Branch Federal Chemical Co., Louisville, Ky.	
30535	Fox Ground Raw Bone.....	Manufacturer .....
35121		Will Brown, Somerset.....
30536	Fox Raw Bone.....	Manufacturer .....
35122		H. Austin, Beaver Dam.....
35341		Warren-Miller Imp. Co., Elizabethtown .....
	Globe Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.	
30563	Acorn Raw Bone.....	Manufacturer .....
35140		Planters Hardware Co., Hopkinsville .....
35351		C. M. Langdon, Science Hill....
30564	Globe Raw Bone.....	Manufacturer .....
35352		Todd Co. Hardware Co., Elkton
	The Groves Co., Cincinnati, Ohio.	
30832	Pure Ground Bone.....	Manufacturer .....
35147		J. H. Thurman, Somerset.....
35358		W. T. McAllister, Cane Valley..
30833	Pure Raw Bone.....	Manufacturer .....
35148		I. K. Miller & Sons, Campbellsville .....
30963	Fine Ground Bone & Potash..	Manufacturer .....

BONES, TANKAGE, &C.

Percentage of Fineness.		Total Phosphoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia	Potash.		Estimated Value Per Ton.	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulphate.		
89	11	20 88	45.60	2.73	3 31			$25 80	30535
86	14	22.95	50.12	2.45	2.97			26.30	35121
		24.00	*52.42*	*2.47*	*3.00*			*23.05*	
27	73	23.36	51.02	4.15	5.04			29.81	30535
38	62	21.88	47.78	3.86	4.69			28.31	35122
55	45	22.01	48.07	3 87	4.70			29.18	35341
		22.00	*48.06*	*3.71*	*4.50*			*26.19*	
86	14	21 01	45.88	2.82	3.42			26.09	30563
90	10	22 19	48.46	2.39	2.90			25.68	35140
93	7	23.94	52.28	2.22	2.70			26.53	35351
		24.00	*52.42*	*2.47*	*3.00*			*23.05*	
18	82	22.90	50.01	4.29	5.21			29.59	30564
60	40	23.49	51.30	4 32	5.24			32.03	35352
		22.00	*48.06*	*3.71*	*4.50*			*26.19*	
100	0	21.45	46.86	3.22	3.91			28.43	30832
71	29	19.99	43.65	3.21	3.90			26 07	35147
83	17	22.41	48.95	2.25	2.73			25.05	35358
		20.00	*43.67*	*2.47*	*3.00*			*20.65*	
72	28	22.11	48.28	4.64	5.63			32.69	30833
45	55	18 95	41.38	4.66	5.66			29.38	35148
		22.00	*48.06*	*3.29*	*4.00*			*24.72*	
77	23	22.44	49.01	1.49	1.81	6.10		28.24	30963
		20.00	*43.67*	*0.82*	*1.00*	*5.00*		*19.87*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Hirsh, Stein & Co., Chicago, Ill.	
30809	Calumet Brand Special Pure Bone Meal & Potash.....	Manufacturer .....
35158		Salsman & New, Clarkson.....
35364		Jas. Pearson & Co., Hickory Flat .....
30810	Calumet Brand Pure Bone Meal	Manufacturer .....
35159		J. W. Sublett & Bro., Cave Valley
35365		Forbes Mfg. Co., Hopkinsville..
30811	Calumet Brand Special Pure Bone Meal	Manufacturer .....
35366		Forbes Mfg. Co., Hopkinsville..
30812	Calumet Brand Pure Raw Bone Meal	Manufacturer .....
35160		Grayson Co. Farmers Union Exchange, Leitchfield .....
30969	Bland & Albert's Pure Raw Bone Meal	Manufacturer .....
30970	Bland & Albert's Pure Bone Meal & Potash	Manufacturer .....
	Hopkins Fertilizer Co., New Albany, Ind.	
30484	"Old Times" Pure Raw Bone.	Manufacturer .....
36162		J. T. Harmon, Lebanon Jct....
	The Jarecki Chemical Co., Sandusky & Cincinnati, Ohio.	
30891	Pure Ground Bone.....	Manufacturer .....
35372		J. C. Canada, Millsprings.....

BONES, TANKAGE, &C.

Percentage of Fineness.		Total Phosphoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia	Potash.		Estimated Value Per Ton.	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulphate		
70	30	23.82	52.02	1.44	1.75	4.77		$27.44	30809
80	20	21.16	46.21	1.00	1.21	4.61		24.19	35158
65	35	23.56	51.47	1.16	1.41	5.57		26.83	35364
		20.00	*43.67*	*0 82*	*1.00*	*4.00*		*18.87*	
84	16	25.74	56.22	3.11	3.78			30.66	30810
77	23	24.43	53.37	2.43	2.95			26.93	35159
57	43	24.79	54.15	2.88	3.50			27.78	35365
		22.00	*48.06*	*2.47*	*3.00*			*21.85*	
56	44	33.04	72.14	1.24	1.51			27.86	30811
85	15	33.46	73.10	0.89	1.08			28.88	35366
		29.00	*63.34*	*0 82*	*1.00*			*20.27*	
73	27	21.42	46.77	4.58	5.56			32 01	30812
77	23	23.31	50.91	3.22	3.91			28.85	35160
		20.00	*43.67*	*3.71*	*4.50*			*24.99*	
53	47	25.84	56.44	3.94	4.78			32.03	30969
		22.00	*48.06*	*3.71*	*4.50*			*26.19*	
58	42	23.13	50.52	1.10	1.34	5.07		25.49	30970
		20.00	*43.67*	*0.82*	*1.00*	*4.00*		*18.87*	
53	47	23.59	51.52	3 94	4.78			30.44	30484
37	63	22.03	48.11	3.84	4.66			28.29	35162
		22.00	*48.06*	*3.50*	*4.25*			*25.45*	
90	10	26.70	58.31	2.25	2.73			28.70	30891
56	44	28.10	61 37	2.26	2 74			29.90	35372
		20.00	*43.67*	*2.47*	*3 00*			*20.65*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Jones Fertilizer Co., Louisville, Ky.	
30795	Jones Bone Meal	Manufacturer
30796	Jones Raw Bone	Manufacturer
35182		D. H. Hatter & Son, Franklin
30797	Jones Standard Raw Bone	Manufacturer
	Kaufman Fertilizer Co., Cincinnati, Ohio.	
30921	Pure Bone	Manufacturer
35185		W. H. Hunt & Son, Dunmor
	Kentucky Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.	
30580	O. K. Fine Raw Bone	Manufacturer
30581	O. K. Raw Bone	Manufacturer
	Louisville Fertilizer Co., Louisville, Ky.	
30746	Eagle Raw Bone Mixture	Manufacturer
30747	Eagle Bone Meal	Manufacturer
35396		Orndorff & Co., Adairville
30748	Eagle Raw Bone	Manufacturer
35202		L. S. Brough, Bowling Green
35397		L. S. Brough, Bowling Green
30749	Eagle Standard Raw Bone	Manufacturer
35203		L. S. Brough, Bowling Green

BONES, TANKAGE, &C.

Percentage of Fineness.		Total Phosphoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia	Potash.		Estimated Value Per Ton.	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulphate.		
81	19	21.93	47.89	1.45	1.76			$21.79	30795
		20.00	*43.67*	*1.65*	*2.00*			*17.78*	
	26	26 82	58.57	2.38	2.89			28.39	30796
	34	23.38	51.06	3.89	4.72			30.73	35182
		24.00	*52.42*	*2.47*	*3.00*			*23.05*	
58	42	26.06	56.91	3.96	4.81			32.52	30797
		22.00	*48.06*	*3 71*	*4.50*			*26.19*	
92	8	26.02	56.83	2.22	2.70			28.17	30921
71	29	26.94	58.84	1.76	2.14			26.15	35185
		20.00	*43.67*	*2.47*	*3.00*			*20.65*	
86	14	21.27	46.46	2.70	3.28			25.87	30580
		24.00	*52.42*	*2.47*	*3 00*			*23.05*	
14	86	23.46	51.24	4.23	5.14			29.54	30581
		22.00	*48.06*	*3.71*	*4.50*			*26.19*	
76	24	18.69	40 82	1.51	1.83	1.24		20.58	30746
		15.00	*32.76*	*1.65*	*2.00*		*1.00*	*15.98*	
94	6	20.66	45.12	1.32	1.60			20.90	30747
82	18	20.32	44.37	1.83	2.22			21.94	35396
		20.00	*43.67*	*1.65*	*2.00*			*17.78*	
73	27	26.20	57.22	2.64	3.20			28 78	30748
86	14	23.26	50.79	2 90	3.52			28.11	35202
68	32	25.50	55.68	2.30	2.79			26.82	35397
		24.00	*52.42*	*2.47*	*3.00*			*23.05*	
46	54	25.22	55.07	3.80	4.61			30.76	30749
41	59	24.53	53.57	3.88	4.71			30.31	35203
		22.00	*48.06*	*3.71*	*4.50*			*26.19*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Morris & Co., Chicago, Ill.	
30853	Big One, Ground Raw Bone..	Manufacturer .....
35204		Redman & Burba Co., Hodgenville .....
35398		Redman & Burba Co., Hodgenville .....
30854	Big Two, Pure Bone Meal....	Manufacturer .....
35205		D. H. Hatter & Son, Franklin..
35399		D. H. Hatter & Son, Franklin..
30858	Big Six, Special Bone Meal...	Manufacturer .....
35208		C. R. Barnes, Bardstown.....
35400		I. K. Miller & Sons, Campbellsville .....
30859	Big Seven, Special Bone Meal & Potash	Manufacturer .....
35209		Redman & Burba Co., Hodgenville .....
35401		Redman & Burba Co., Hodgenville .....
30863	Big Eleven, Bone Meal & Potash	Manufacturer .....
35211		Redman & Burba Co., Hodgenville .....
35402		D. H. Hatter & Son, Franklin..
	Mt. Pleasant Fertilizer Co., Mt. Pleasant, Tenn.	
30474	Pure Ground Bone.....	Manufacturer .....
	National Fertilizer Co., Nashville, Tenn.	
30986	Bone, Nitrogen & Potash.....	*Manufacturer .....
35413		F. A. Yost & Co., Hopkinsville..

*The manufacturer failed to furnish sample as required by law.

BONES, TANKAGE, &C.

Percentage of Fineness.		Total Phosphoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia	Potash.		Estimated Value Per Ton	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulphate.		
79	21	24.94	54.47	3.47	4.21			$31.05	30853
67	33	26.40	57.67	2.96	3.59			29.74	35204
74	26	26.88	58.70	3.13	3.80			31.04	35398
		24.00	*52.42*	*3.29*	*4.00*			*25.92*	
82	18	30.02	65.56	2.21	2.68			30.68	30854
80	20	30.90	67.50	2.01	2.44			30.53	35205
78	22	28.10	61.37	2.11	2.56			28.64	35399
		28.00	*61.16*	*2.06*	*2.50*			*24.01*	
87	13	27.92	60.98	0.92	1.12			24.83	30858
72	28	28.80	62.89	1.09	1.32			25.25	35208
81	19	29.22	63.81	1.14	1.38			26.26	35400
		27.00	*58.96*	*0.82*	*1.00*			*19.07*	
81	19	16.12	35.20	1.40	1.70	0.66	3.18	21.67	30859
81	19	15.58	34.03	1.52	1.85	1.16	1.97	20.72	35209
82	18	16.45	35.93	2.05	2.49	0.98	2.52	23.75	35401
		16.00	*34.95*	*1.23*	*1.50*		*3.00*	*17.51*	
87	13	17.09	37.33	1.32	1.60	1.04	8.63	29.25	30863
89	11	16.09	35.15	0.84	1.02	1.84	8.51	27.51	35211
76	24	16.45	35.93	1.10	1.34		8.95	26.96	35402
		16.00	*34.95*	*0.82*	*1.00*		*10.00*	*24.47*	
80	20	25.68	56.08	2.24	2.72			27.35	30474
		23.00	*50.24*	*2.47*	*3.00*			*22.45*	
83	17	19.13	41.77	3.31	4.02	3.32		29.56	30986 35413
		23.00	*50.24*	*2.47*	*3.00*	*3.00*		*25.45*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Pero & Stoecker, Louisville, Ky.	
30947	Pure Animal Matter Corn & Wheat Grower	Manufacturer .....
35414		Watkins & Co., Elizabethtown.
30948	Pure Animal Matter & Potash.	Manufacturer .....
30949	Pure Bone Meal.....	Manufacturer .....
35415		Watkins & Co., Elizabethtown.
	A. W. Pickerill, Hodgenville, Ky.	
30972	Pickerill's Pure Raw Bone...	Manufacturer .....
35417		Manufacturer's Warehouse.....
	Read Phosphate Co., Nashville, Tenn.	
30965	Read's Raw Bone Meal.....	Manufacturer .....
	Smith Bros., Louisville, Ky.	
30876	Pure Bone Meal with Potash..	Manufacturer .....
30884	Pure Raw Bone.....	Manufacturer .....
30885	Pure Bone Meal.....	Manufacturer .....
35244		W. F. Grainger, Franklin.....
35430		W. F. Grainger, Franklin.....
	Southern Seed Co., Louisville, Ky.	
30966	Pure Raw Bone	Manufacturer .....

Bones, Tankage, &c

Percentage of Fineness.		Total Phosphoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia	Potash.		Estimated Value Per Ton.	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulphate.		
85	15	13.49	29.46	4 96	6.02			$27.75	30947
78	22	14.54	31.75	4.85	5.89			27.97	35414
		10.00	*21.85*	*4.00*	*4.86*			*20.00*	
85	15	11.86	25.90	4 44	5.39		4.13	29.63	30948
		10.00	*21.85*	*4.00*	*4.86*		*4.00*	*24.80*	
55	45	21.98	48.00	3.94	4.78			29.39	30949
75	25	23.44	51.19	3.79	4.60			30.85	35415
		22.00	*48.06*	*3.50*	*4.25*			*25.45*	
49	51	21.45	46.86	3.73	4.53				
46	54	24.17	52.78	3.74	4.54			28.03	30972
		22.50	*49.15*	*3.71*	*4.50*			29.82	35417
								26.49	
24	76	22.82	49.84	3.60	4.37			27.39	30965
		20.00	*43.67*	*2.88*	*3.50*			*22.08*	
67	33	24 05	52.53	2.09	2.54	3.74		28.69	30876
		23.00	*50.24*	*2.06*	*2.50*	*3.00*		*24.01*	
72	28	25.42	55.52	3.88	4.71			32.49	30884
		22.00	*48.06*	*3.71*	*4.50*			*26.19*	
83	17	27.52	60.10	2.46	2.99			29.69	30885
75	25	24 08	52 58	2.79	3.39			27.83	35244
90	10	27.60	60.28	2 63	3.19			22.74	35430
		24.00	*52.42*	*2.47*	*3.00*			*23.05*	
52	48	22.77	49 73	3.92	4.76			29.75	30966
		22.00	*48.06*	*3.71*	*4.50*			*26.19*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Standard Guano & Chemical Mfg. Co., New Orleans, La.	
30927	Pure Raw Ground Bone.....	Manufacturer .....
35431		Geo. Fuqua, Adairville.....
	Swift & Co., Chicago, Ill.	
30612	Swift's Pure Raw Bone Meal..	Manufacturer .....
35250		F. C. Parrish, Horse Cave.....
35436		Forbes Mfg. Co., Hopkinsville..
30613	Swift's Pure Bone Meal.....	Manufacturer .....
35251		F. C. Parrish, Horse Cave.....
35437		Woodson Lewis, Greensburg...
30615	Swift's Pure Bone Meal & Potash	Manufacturer .....
35252		W. F. Wilson, Somerset.....
35439		W. F. Wilson, Somerset.....
30618	Swift's Pure Bone Meal & Blood	Manufacturer .....
30619	Swift's Pure Ammoniated Bone	Manufacturer .....
30620	Swift's Ground Steamed Bone.	Manufacturer .....
35255		Forbes Mfg. Co., Hopkinsville..
35440		E. S. Ferriell & Son, Buffalo...
	Taylor and Powell, Springfield, Tenn.	
30977	Pure Raw Bone Meal.....	Manufacturer .....
30978	Half & Half.....	Manufacturer .....
35013		J. R. Riley, Olmstead.....

BONES, TANKAGE, &C.

Percentage of Fineness.		Total Phosphoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia	Potash.		Estimated Value Per Ton	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulphate.		
100		21.32	46.56	3.20	3.88			$28.26	30927
93	7	18.57	40.55	3.05	3.70			25.28	35431
		20.00	*43.67*	*3.09*	*3.75*			*22.82*	
	100	25.47	55.63	4.15	5.04			29.81	30612
56	44	23.64	51.63	4.02	4.88			30.90	35250
75	25	23.44	51.19	4.10	4.98			31.93	35436
		23.00	*50.24*	*3.71*	*4.50*			*26.79*	
77	23	27.16	59.32	3.38	4.10			32.31	30613
74	26	24.76	54.07	2.65	3.22			27.80	35251
74	26	25.35	55.36	2.45	2.97			27.54	35437
		25.00	*54.59*	*2.47*	*3.00*			*23.65*	
66	34	24.15	52.75	2.84	3.45	3.47		31.09	30615
83	17	21.83	47.68	2.61	3.17	4.00		29.87	35252
75	25	23.44	51.19	2.41	2.93	4.57		30.59	35430
		23.50	*51.33*	*2.47*	*3.00*	*3.00*		*25.75*	
77	23	24.10	52.64	3.69	4.48			31.09	30618
		23.00	*50.24*	*3.71*	*4.50*			*26.79*	
81	19	17.90	39.09	5.03	6.11			31.25	30619
		17.00	*37.13*	*4.94*	*6.00*			*27.49*	
83	17	21.16	46.21	1.97	2.39			23.11	30620
86	14	21.85	47.72	1.92	2.33			23.59	35255
83	17	25.62	55.96	1.86	2.26			26.14	35440
		20.00	*43.67*	*1.65*	*2.00*			*17.78*	
56	44	23.82	52.02	3.69	4.48			29.88	30977
		22.00	*48.06*	*3.71*	*4.50*			*26.19*	
60	40	21.88	47.78	1.80	2.31			22.00	30978
83	17	20.73	45.27	1.82	2.21			22.25	35013
		18.00	*39.31*	*1.85*	*2.25*			*17.28*	

TABLE II.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	Tennessee Chemical Co., Nashville, Tenn.	
30780	Ox Bone Meal	Manufacturer
35449		J. I. Rice, Adairville
30781	Ox Raw Bone	Manufacturer
35264		F. A. Yost Co., Hopkinsville
35450		W. F. Grainger, Franklin
30782	Ox Standard Raw Bone	Manufacturer
	The T. J. Turley Co., Owensboro, Ky.	
30968	Ideal Bone Meal	Manufacturer
35452		Manufacturer's Warehouse
	Tuscarora Fertilizer Co., Chicago, Ill.	
30817	Animal Bone	Manufacturer
30819	Raw Bone	Manufacturer
	Wood, Stubbs & Co., Louisville, Ky.	
35003	Acme Brand Pure Raw Bone Meal	Manufacturer

BONES, TANKAGE, &C.

Percentage of Fineness.		Total Phsophoric Acid.	Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia	Potash.		Estimated Value Per Ton.	Station Number.
Fine Bone.	Medium Bone.					From Muriate.	From Sulphate.		
95	5	20.96	45.78	1.42	1.72			$21.53	30780
79	21	21.02	43.73	1.88	2.28			21.76	35449
		20.00	*43 67*	*1.65*	*2.00*			*17.78*	
69	31	27.54	60.15	2.63	3.19			29.53	30781
68	32	22.82	49 84	2.61	3.17			25 94	35264
86	14	25.27	55.18	2.90	3.52			29 65	35450
		24.00	*52.42*	*2.47*	*3.00*			*23.05*	
61	39	26.44	57.75	3.96	4.81			32.95	30782
		22.00	*48.06*	*3.71*	*4.50*			*26.19*	
76	24	26.32	57 47	2.31	2.80			27.88	30968
74	26	24 66	53.87	2.14	2.60			25.94	35452
		24.00	*52.42*	*2.47*	*3.00*			*23.05*	
80	20	26.34	57.53	2.43	2.95			28.53	30817
		24.00	*52.42*	*2.47*	*3.00*			*23.05*	
67	33	25.98	56.75	4.03	4 89			33.17	30819
		22.00	*48.06*	*3.71*	*4.50*			*26.19*	
52	48	23.59	51.52	4.06	4.93			30.82	35003
		22.00	*48.06*	*3.29*	*4.00*			*24.72*	

TABLE III.—ACID PHOSPHATES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.	PHOSPHORIC ACID. Available.	Insoluble.	Total.	Estimated Value Per Ton.	Station Number.
	A. D. Adair & McCarty Bros., Chattanooga, Tenn.						
30450	Adair's High Grade Dissolved Bone	Manufacturer	16.33 *14.00*	0.04	16.37	$16.33 *14.00*	30450
	The American Agr'l Chemical Co., Cincinnati Sales Dept., Cincinnati, Ohio.						
30635	Bradley Fert. Works Soluble Dissolved Bone	Manufacturer	14.47	2.44	16 91	14.47	30635
35022		Jasper & Wesley, Science Hill.	16.02 *14.00*	1.63 *2.00*	17.65 *16.00*	16.02 *14.00*	35022
30639	Cleveland Dryer Works XXX Super Phosphate	Manufacturer	14.26	2.70	16.96	14.26	30639
35024		Green Bros., Falls of Rough	15.95 *14.00*	2.28 *2.00*	18.23 *16.00*	15.95 *14.00*	35024
30640	Cleveland Dryer Works Horsehead Phosphate	Manufacturer	11.22	2.63	13.85	11.22	30640
35282		O. A. Lutes & Co., Shepherdsville	11.22 *10.00*	1.35 *2.00*	12.57 *12.00*	11.22 *10.00*	35282

	The American Agr'l Chemical Co., Bowker Fert. Works, Cincinnati, Ohio.						
30641	Bowker's Soluble Bone.....	Manufacturer	14.55	2.61	17.16	$14.55	30641
35025		S. McKinley, Columbia.....	15.28	2.37	17.65	15.28	35025
35283		R. H. Kemp, Marion.....	16.67	2.17	18.84	16.67	35283
			14.00	*1.50*	*15.50*	*14.00*	
30642	Bowker's Acid Phosphate.....	Manufacturer	12.19	3.86	16.05	12.19	30642
35026		J. H. Thurman, Somerset.....	12.68	3.79	16.47	12.68	35026
35284		J. H. Thurman, Somerset... ..	13.97	1.20	15.17	13.97	35284
			12.00	*1.50*	*13.50*	*12.00*	
	The American Agr'l Chemical Co., Michigan Carbon Works, Cincinnati, Ohio.						
30665	Red Line Phosphate.....	Manufacturer	14.92	2.29	17.21	14.92	30665
35047		Cyrus Campbell, Burnside.....	15.00	2.19	17.19	15.00	35047
			14.00	*2.00*	*16.00*	*14.00*	
	The American Agr'l Chemical Co., Cincinnati Sales Dept., Cincinnati, Ohio.						
30683	N-W Horse Shoe Brand Square Deal Phosphate	Manufacturer	14.61	2.35	16.96	14.61	30683
			14.00	*2.00*	*16.00*	*14.00*	
30684	N-W Horse Shoe Brand Quick Acting Phosphate	Manufacturer	10.95	3.15	14.10	10.95	30684
35056		Clarkson Hdw. Co., Clarkson..	10.22	2.21	12.43	10.22	35056
35306		Watkins & Co., Elizabethtown.	11.81	1.35	13.16	11.81	35306
			10.00	*2.00*	*12.00*	*10.00*	

TABLE III.—ACID PHOSPHATES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.	PHOSPHORIC ACID			Estimated Value Per Ton.	Station Number.
			Available.	Insoluble.	Total.		
	The American Agr'l Chemical Co., Cincinnati Sales Dept., Cincinnati, Ohio.						
30696	Packers Boars Head Brand Gilt Edge Phosphate.....	Manufacturer	14.38 *14.00*	2.32 *2.00*	16.70 *16.00*	$14.38 *14.00*	30696
30697	Packers Boars Head Brand Soluble Phosphate	Manufacturer	11.11 *10.00*	3.07 *2.00*	14.18 *12.00*	11.11 *10.00*	30697
	The Armour Fertilizer Works, Chicago, Ill.						
30600	Star Phosphate	Manufacturer	13.94	1.95	15.89	13.94	30600
35073		J. H. Pelly, Columbia.....	13.82	1.30	15.12	13.82	35073
35314		Forbes Manufacturing Co., Hopkinsville	15.08 *14.00*	1.70 *2.00*	16.78 *16.00*	15.08 *14.00*	35314
30601	Cereal Phosphate	Manufacturer	10.20	1.44	11.64	10.20	30601
35074		J. H. Pelly, Columbia.....	10.17	2 18	12.35	10.17	35074
35315		J. H. Pelly, Columbia.....	12.11 *10.00*	1.28 *2.00*	13.39 *12.00*	12.11 *10.00*	35315

	The Cincinnati, Phosphate Co., Cincinnati, Ohio.						
30905	Capitol Wheat Grower.....	Manufacturer	12.41	2.13	14.54	$12.41	30905
			12.00	*1.00*	*13.00*	*12.00*	
30911	Capitol Acid Phosphate.....	Manufacturer	15.64	2.31	17.95	15.64	30911
			14.00	*1.00*	*15.00*	*14.00*	
	Continental Fertilizer Co., Nashville, Tenn.						
30750	Bear Phosphate	Manufacturer	11.84	2.07	13.91	11.84	30750
35079		Watkins & Co., Elizabethtown.	11.59	1.99	13.58	11.59	35079
35320		J. L. Durham, Greensburg.....	13.33	0.73	14.06	13.33	35320
			12.00	*1.00*	*13.00*	*12.00*	
30751	Bear High Grade Dissolved Bone	Manufacturer	13.69	1.71	15.40	13.69	30751
			14.00	*2.00*	*16.00*	*14.00*	
	Duncan & Bro., LaGrange, Ky.						
35012	Tiger Brand Phosphate.. ...	*Manufacturer					35012
			16.00	*2.00*	*18.00*	*16.00*	
	The Empire Guano Co., Nashville, Tenn.						
30726	High Grade Acid Phosphate..	Manufacturer	16.25	1.22	17.47	16.25	30726
			14.00	*2.00*	*16.00*	*14.00*	
30728	Acid Phosphate	Manufacturer	13.36	2.51	15.87	13.36	30728
			12.00	*2.00*	*14.00*	*12.00*	

*The manufacturer failed to furnish sample as required by law.

TABLE III.—ACID PHOSPHATES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.	PHOSPHORIC ACID. Available.	Insoluble.	Total.	Estimated Value Per Ton.	Station Number.
	Federal Chemical Co., Louisville, Ky.						
30508	Daybreak Royal Phosphate...	Manufacturer	15.08 *14.00*	1.11	16.19	$15.08 *14 00*	30508
30509	Daybreak Standard Phosphate	Manufacturer	13.13 *12.00*	1.11	14.24	13.13 *12 00*	30509
30510	Daybreak Star Phosphate....	Manufacturer	11.39	0.85	12.24	11 39	30510
35111		A. B. McKinney, Morehead.....	8.93 *10.00*	0.50	9.43	8.93 *10.00*	35111
	Fox Chemical Co., Branch Federal Chemical Co., Louisville, Ky.						
30531	Fox High Grade Acid Phosphate	Manufacturer	16.94 *16.00*	0.94	17.88	16.94 *16.00*	30531
30532	Fox Acid Phosphate.....	Manufacturer	15.20 *14.00*	1.03	16.23	15.20 *14.00*	30532

	Fox Chemical Co., Branch Federal Chemical Co.						
30533	Fox Standard Acid Phosphate.	Manufacturer	12.82	1.05	13.87	12.82	30533
35120		H. Austin, Beaver Dam	12.89	1.57	14.46	12.89	35120
35339		H. Austin, Beaver Dam	13.22	0.55	13.77	13.22	35339
			12.00			*12.00*	
30534	Fox AA Acid Phosphate	Manufacturer	11.36	0.98	12.34	11.36	30534
35340		A. B. Beale & Son, Murray	11.31	1.11	12.42	11.31	35340
			10.00			*10.00*	
	Globe Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.						
30559	Globe High Grade Acid Phosphate	Manufacturer	17.16	1.07	18.23	17.16	30559
			16.00			*16.00*	
30560	Globe Acid Phosphate	Manufacturer	14.94	1.10	16.04	14.94	30560
35349		F. W. Wilson & Son, Lewisburg	15.15	0.34	15.49	15.15	35349
			14.00			*14.00*	
30561	Globe Standard Acid Phosphate	Manufacturer	13.05	1.08	14.13	13.05	30561
35350		Jeffries Hardware Store, Columbia	13.68	0.61	14.29	13.68	35350
			12.00			*12.00*	
30562	Globe AA Acid Phosphate	Manufacturer	11.19	1.05	12.24	11.19	30562
35139		Carson & Co., Hartford	11.69	0.89	12.58	11.69	35139
			10.00			*10.00*	

Table III.—Acid Phosphates.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.	Phosphoric Acid. Available.	Phosphoric Acid. Insoluble.	Phosphoric Acid. Total.	Estimated Value Per Ton.	Station Number.
	Great Southern Phosphate Co., Mt. Pleasant, Tenn.						
30459	Great Southern Acid Phosphate	Manufacturer	17.50	0.99	18.49	$17.50	30459
35142		Farmers Union Warehouse & Supply Co., Munfordville	18.50	0.57	19.07	18.50	35142
			14.00	*2.00*	*16.00*	*10.00*	
30464	Great Southern Special Acid Phosphate	Manufacturer	15.59	1.90	17.49	15.59	30464
			16.00	*2.00*	*18.00*	*16.00*	
	The Groves Co., Cincinnati, Ohio.						
30824	Monarch Brand	Manufacturer	14.58	2.23	16.81	14.58	30824
35143		C. E. Young, Burnside	15.73	1.13	16.86	15.73	35143
			14.00	*2.00*	*16.00*	*14.00*	
	Hopkins Fertilizer Co., New Albany, Ind.						
30491	"Old Times" High Grade Acid Phosphate	Manufacturer	13.96	2.13	16.09	13.96	30491
			14.00	*1.00*	*15.00*	*14.00*	

	The Jarecki Chemical Co., Sandusky & Cincinnati, Ohio.						
30890	C. O. D. Phosphate	Manufacturer	12.67	2.68	15.35	12.67	30890
35169		M. B. Hines, Science Hill	12.46	3.06	15.52	12.46	35169
35371		M. B. Hines, Science Hill	12.84	2.83	15.67	12.84	35371
			12.00	*1.00*	*13.00*	*12.00*	
30897	Acid Phosphate	Manufacturer	16.21	2.18	18.39	16.21	30897
			14.00	*1.00*	*15.00*	*14.00*	
	Jones Fertilizer Co., Louisville, Ky.						
30783	Jones Phosphate	Manufacturer	12.21	2.22	14.43	12.21	30783
			12.00	*1.00*	*13.00*	*12.00*	
30784	Jones High Grade Dissolved Bone	Manufacturer	14.64	1.53	16.17	14.64	30784
			14.00	*2.00*	*16.00*	*14.00*	
	Kaufman Fertilizer Co., Cincinnati, Ohio.						
30920	Acid Phosphate	Manufacturer	12.85	2.46	15.31	12.85	30920
			12.00	*1.00*	*13.00*	*12.00*	
30930	Dissolved Phosphate	Manufacturer	16.59	1.82	18.41	16.59	30930
			14.00	*1.00*	*15.00*	*14.00*	
	Kentucky Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.						
30577	O. K. Phosphate	Manufacturer	15.03	0.96	15 99	15.03	30577
35192		Geo. Sturgeon, Waynesburg	16.94	0.50	17.44	16.94	35192
35387		Geo. Sturgeon, Waynesburg	16.01	1.72	17.73	16.01	35387
			14.00			*14.00*	

Table III.—Acid Phosphates.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.	Phosphoric Acid. Available.	Insoluble.	Total.	Estimated Value Per Ton.	Station Number.
	Kentucky Fertilizer Co.						
30578	Standard Phosphate	Manufacturer	13.02	1.12	14.14	$13.02	30578
35193		Geo. Sturgeon, Waynesburg....	16.24	0.74	16.98	16.24	35193
			12.00			*12.00*	
30579	Good Luck Phosphate.....	Manufacturer	10.96	1.10	12.06	10.96	30579.
			10.00			*10.00*	
	Louisville Fertilizer Co., Louisville, Ky.						
30732	Eagle Phosphate	Manufacturer	12.27	1.76	14.03	12.27	30732
35388		D. L. D. Sandefur, Beaver Dam..	13.70	0.77	14.47	13.70	35388
			12.00	*1.00*	*13.00*	*12.00*	
30733	Eagle High Grade Dissolved Bone	Manufacturer	13.88	1.57	15.45	13.88	30733
			14.00	*2.00*	*16.00*	*14.00*	
	Meridian Fertilizer Factory, Meridian, Miss.						
35008	Union Special Phosphate.....	Manufacturer	17.28	0.62	17.90	17.28	35008
			16.00			*16.00*	

	Mt. Pleasant Fertilizer Co., Mt. Pleasant, Tenn.						
30467	**Big Success Mt. Pleasant Special Acid Phosphate**	Manufacturer	17.18	1.33	18.51	17.18	30467
			14.00	*2.00*	*16.00*	*14.00*	
30472	**Black Patch Mt. Pleasant Soluble Bone**	Manufacturer	14.94	4.76	19.70	14.94	30472
35215		D. L. D. Sandefur, Beaver Dam	14.40	3.62	18.02	14.40	35215
35406		T. H. Cochran & Co., Marion	14.14	4.93	19.07	14.14	35406
			12.00	*2.00*	*14.00*	*12.00*	
30476	**Big Success High Grade Dissolved Bone**	Manufacturer	16.06	1.13	17.19	16.06	30476
			16.00	*2.00*	*18.00*	*16.00*	
	National Fertilizer Co., Nashville, Tenn.						
30842	**Old Hickory Acid Phosphate**	Manufacturer	11.76	5.11	16.87	11.76	30842
30955		Stailey & Horst, Hatcher	14 75	2.98	17.73	14.75	30955
35221		I. K. Miller & Sons, Campbellsville	15.63	3.72	19.35	15.63	35221
35410		E. S. Diuguid & Son, Murray	12.45	6.68	19.13	12.45	35410
			12.00	*1.00*	*13.00*	*12.00*	
30843	**Old Hickory Special Acid Phosphate**	Manufacturer	11.82	5.57	17.39	11.82	30843
			10.00	*1.00*	*11.00*	*10.00*	
30939	**Old Hickory Brand High Grade Bone Phosphate**	Manufacturer	14.54	1.98	16.52	14.54	30939
35223		I. K. Miller & Sons, Campbellsville	16.26	1.85	18.11	16.26	35223
			16.00	*1.00*	*17.00*	*16.00*	

TABLE III.—ACID PHOSPHATES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.	PHOSPHORIC ACID			Estimated Value Per Ton.	Station Number.
			Available.	Insoluble.	Total.		
	National Fertilizer Co.						
30975	Old Hickory High Grade Dissolved Bone	*Manufacturer	14.87	2.52	17.39	$14.87	30975
35412		Todd Co. Hdw. Co., Elkton	*14.00*	*1.00*	*15.00*	*14.00*	35412
	Read Phosphate Co., Nashville, Tenn.						
30707	Read's High Grade Acid Phosphate	Manufacturer	16.06	1.49	17.55	16.06	30707
35423		Carrell & Dodson, Steubenville	14.73	4.17	18.90	14.73	35423
			14.00	*2.00*	*16.00*	*14.00*	
30708	Read's XXX Dissolved Bone	Manufacturer	13.58	1.82	15.40	13.58	30708
35233		T. S. Frith, Brodhead	14.54	1.63	16.17	14.54	35233
35424		Moore & Gilbert, Adairville	14.20	2.89	17.09	14.20	35424
			13.00	*2.00*	*15.00*	*13.00*	
30709	Read's Quick Action Phosphate	Manufacturer	10.75	1.73	12.48	10.75	30709
35234		T. S. Frith, Brodhead	10.16	1.40	11.56	10.16	35234
			10.00	*2.00*	*12.00*	*10.00*	

*The manufacturer failed to furnish sample as required by law.

	Smith Bros., Louisville, Ky.						
30877	Soluble Phosphate	Manufacturer	14.37 *14.00*	1.24 *2.00*	15.61 *16.00*	14.37 *14.00*	30877
	Swift & Co., Chicago, Ill.						
30976	Swift's Garden City Phosphate	Manufacturer	15.69 *14.00*	1.45 *1.00*	17.14 *15.00*	15.69 14.00	30976
	Tennessee Chemical Co., Nashville, Tenn.						
30766	Ox Phosphate	Manufacturer	12.67	1.85	14.52	12.67	30766
35442		Sexton Bros., Murray.....	14.92 *12.00*	1.17 *1.00*	16.09 *13.00*	14.92 *12.00*	35442
30767	Ox High Grade Dissolved Bone	Manufacturer	13.71	1.85	15.56	13.71	30767
35443		Sexton Bros., Murray.....	15.16 *14.00*	1.11 *2.00*	16.27 *16.00*	15.16 *14.00*	35443
31000	Ox Best Tennessee Acid Phosphate	Manufacturer	15.99 *16.00*	0.59	16.58	15.99 *16.00*	31000
	Tennessee Valley Fertilizer Co., Florence, Ala.						
30997	Tiger High Grade Dissolved Bone	Manufacturer	16.05 *14.00*	0.83	16.88	16.05 14.00	30997
30998	Dissolved Bone	Manufacturer	13.73 *12.00*	5.56	19.29	13.73 *12.00*	30998
	Tuscarora Fertilizer Co., Chicago, Ill.						
30815	Acid Phosphate	Manufacturer	13.64 *14.00*	1.34	14.98	13.64 *14.00*	30815

TABLE III.—ACID PHOSPHATES.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.	PHOSPHORIC ACID			Estimated Value Per Ton.	Station Number.
			Available.	Insoluble.	Total.		
30820	**Tuscarora Fertilizer Co.** Bone Phosphate	Manufacturer	9.61 *10.00*	0.98	10.59	$ 9.61 *10.00*	30820
	Virginia-Carolina Chemical Co., Memphis, Tenn.,						
30849	Capital Dissolved S. C. Bone..	Manufacturer	12.00	1.43	13.43	12.00	30849
35270		Olive & Walker, Marion	13.10	1.95	15.05	13.10	35270
35457		E. S. Duiguid & Son, Murray	13.30 *12.00*	1.21 *2.00*	14.51 *14.00*	13.30 *12.00*	35457

TABLE IV—ACID PHOSPHATE AND POTASH MIXTURES

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.	PHOSPHORIC ACID.			POTASH.		Estimated Value Per Ton.	Station Number.
			Available.	Insoluble.	Total.	From Muriate	From Sulphate.		
	A. D. Adair & McCarty Bros., Chattanooga, Tenn.								
30448	Adair's High Grade Potash Compound	Manufacturer	12.04	0.19	12.23	3.65		$18.18	30448
			10.00			*4.00*		*16.00*	
30449	Adair's Formula	Manufacturer	10.42	0.47	10.89	1.61		14.30	30449
35014		W. T. Kirkman, Elkton	10.80	1.48	12.28		1.72	15.61	35014
			10.00			*2.00*		*14.00*	
	The American Agr'l Chemical Co., Cincinnati Sales Dept., Cincinnati, Ohio.								
30625	High Grade Bone and Potash.	Manufacturer	10.18	3.12	13.30	5.15		18.62	30625
35018		R. W. Newman, Lewisburg	10.70	2.89	13.59	5.05		19.05	35018
			10.00	*2.00*	*12.00*	*5.00*		*17.80*	
30634	Bradley Fertilizer Works Alkaline Bone & Potash	Manufacturer	10.03	2.01	12.04	2.17		15.01	30634
35021		Jasper & Wesley, Science Hill.	10.37	2.70	13.07	1.88		15.40	35021
			10.00	*2.00*	*12.00*	*2.00*		*14.80*	

TABLE IV—ACID PHOSPHATE AND POTASH MIXTURES

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.	PHOSPHORIC ACID. Available.	Insoluble.	Total.	POTASH. From Muriate.	From Sulphate.	Estimated Value Per Ton.	Station Number.
	The American Agr'l Chemical Co., Bowker Fert. Works, Cincinnati, Ohio.								
30643	Bowker's Dissolved Bone with Potash	Manufacturer	9.68	2.11	11.79	2.12		$14.58	30643
35027		J. T. Lawson, Greenup	9.97	3.01	12.89	2.00		15.16	35027
35285		Browning, McReynolds & Co., Lewisburg	11.07	2.04	13.11	1.96		16.06	35285
			10.00	*1.50*	*11.50*	*2.00*		*14.60*	
30644	Bowker's Potash Fertilizer	Manufacturer	10.39	2.83	13.22	5.46		19.06	30644
35028		H. Willis & Sons, Caneyville	11.15	2.91	14.06	4.82		19.36	35028
35286		C. P. Clark, Owensboro	10.75	2.54	13.29	4.85		18.77	35286
			10.00	*1.50*	*11.50*	*5.00*		*17.60*	
	The American Agr'l Chemical Co., Michigan Carbon Works, Cincinnati, Ohio.								
30664	Red Line Phosphate with Potash	Manufacturer	10.06	2.09	12.15	2.56		15.47	30664
35046		P. K. Hubbard, Munfordville	10.38	3.09	13.47	1.91		15.61	35046
35298		Woodson Lewis, Greensburg	10.08	2.41	12.49	1.90		14.96	35298
			10.00	*2.00*	*12.00*	*2.00*		*14.80*	

30668	High Potash Phosphate.....	Manufacturer	10.17	3.14	13.31	5.31	18.77	30668
35049		Cyrus Campbell, Burnside....	9.71	3.00	12.71	4.98	17.83	35049
35300		D. H. Hatter & Son, Franklin..	10.46	2.56	13.02	5.24	18.81	35300
			10.00	*2.00*	*12.00*	*5.00*	*17.80*	
	The American Agr'l Chemical Co., Cincinnati Sales Dept., Cincinnati, Ohio.							
30681	N-W Horse Shoe Brand 10-5							
	Potash Manure	Manufacturer	10.18	2.88	13.06	5.33	18.70	30681
35054		J. J. Smith, Brodhead.....	10.75	2.65	13.40	5.30	19.26	35054
			10.00	*2.00*	*12.00*	*5.00*	*17.80*	
30682	N-W Horse Shoe Brand Bone							
	& Potash	Manufacturer	9.90	2 05	11.95	2.20	14.90	30682
35055		Dickey & Co., Glasgow.....	10.61	2.69	13.30	1.90	15.71	35055
35305		Watkins & Co., Elizabethtown..	11.26	2.15	13.41	2 23	16.60	35305
			10.00	*2.00*	*12.00*	*2.00*	*14.80*	
	The American Agr'l Chemical Co., Cincinnati Sales Dept., Cincinnati, Ohio.							
30693	Packers Boars Head Brand							
	Potash Phosphate Fertilizer..	Manufacturer	10.36	2.84	13.20	5.50	19.07	30693
35062		J. F. Vigle, Burnside.....	10.16	3.05	13.21	5.06	18.47	35062
			10.00	*2.00*	*12.00*	*5.00*	*17.80*	
30695	Packers Boars Head Brand							
	Kentucky Potash Mixture....	Manufacturer	10.08	1.94	12.02	2.42	15.30	30695
			10.00	*2.00*	*12.00*	*2.00*	*14.80*	

TABLE IV—ACID PHOSPHATE AND POTASH MIXTURES

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.	PHOSPHORIC ACID. Available.	Insoluble.	Total.	POTASH. From Muriate.	From Sulphate.	Estimated Value Per Ton.	Station Number.
	The Armour Fertilizer Works, Chicago, Ill.								
30598	Phosphate and Potash.....	Manufacturer	10.58	1.52	12.10	2.41		$15.72	30598
35001		J. B. Cambron, Morganfield....	10.10	1.95	12.05	2.09		14.99	35001
35071		Barren Co. Grocery & Hardware Co., Glasgow	10.42	0.88	11.30		1.44	14.58	35071
35312		J. H. Pelly, Columbia.....	11.44	4.13	15.57	2.15		17.53	35312
			10 00	*2.00*	*12.00*	*2.00*		*14.80*	
30599	Soluble Phosphate & Potash..	Manufacturer	10.57	1 50	12.07	4.77		18.05	30599
35072		J. H. Pelly, Columbia.....	11.32	0.60	11.92		3.22	17.68	35072
35313		Simpson Co. Hardware Co., Franklin	9.72	2.77	12.49	3.20		15.97	35313
			10.00	*2.00*	*12.00*	*4.00*		*16.80*	
	The Cincinnati Phosphate Co., Cincinnati, Ohio.								
30903	Capitol Dissolved Phosphate & Potash	Manufacturer	10.78	2.09	12.87	4.09		17.87	30903
			10.00	*1.00*	*11.00*	*4.00*		*16.40*	
30904	Capitol Alkaline Phosphate..	Manufacturer	10.22	2.27	12.49	2.32		15.49	30904
			10.00	*1.00*	*11.00*	*2.00*		*14.40*	

	Continental Fertilizer Co., Nashville, Tenn.									
30752	Bear Potash Mixture.....	Manufacturer.....	10.59	1.87	12.46		2.20	16.10	30752
35080		W. F. Grainger, Franklin.....	10.10	0.93	11.03		1.18	13.91	35080
			10.00	*1.00*	*11.00*		*2.00*	*14.80*	
	The Empire Guano Co., Nashville, Tenn.								
30724	Bone and Potash.....	Manufacturer	10.50	1.19	11.69		2.17	15.68	30724
			10.00	*2.00*	*12.00*	*2.00*		*14.80*	
30725	Potash Mixture	Manufacturer	10.29	1.06	11.35		5.51	19.38	30725
35091		Sloss & Grover, Franklin.....	10.92	0.57	11.49	4.16		17.49	35091
			10.00	*2.00*	*12.00*	*4.00*		*16.80*	
	Federal Chemical Co., Louisville, Ky.								
30504	Daybreak Bone & Potash.....	Manufacturer	11.04	0.98	12.02		2.11	16 17	30504
35110		Mardis & Wray, Campbellsville.	10.24	1.02	11.26		1.06	13.97	35110
35331		Mardis & Wray, Campbellsville.	10 13	0.71	10.84		0.82	13.42	35331
			10.00	*1.00*	*11.00*		*2.00*	*14.80*	
30505	Daybreak Potash Mixture....	Manufacturer	10.68	0.96	11.64		3.65	17.59	30505
			10.00	*1.00*	*11.00*		*4.00*	*17.20*	
30506	Daybreak Phosphate & Potash	Manufacturer	13.30	0.89	14.19		1.98	18.70	30506
			12.00	*1.00*	*13.00*		*2.00*	*17.20*	
30507	Daybreak Potash Fertilizer...	Manufacturer	9.91	0.62	10.53	1.04	4.39	18.45	30507
			9.00	*1.00*	*10.00*		*5.00*	*17.20*	

TABLE IV—ACID PHOSPHATE AND POTASH MIXTURES

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.	PHOSPHORIC ACID. Available.	Insoluble.	Total.	POTASH. From Muriate.	From Sulphate.	Estimated Value Per Ton.	Station Number.
	Fox Chemical Co., Branch Federal Chemical Co., Louisville, Ky.								
30528	Fox Alkaline Bone.....	Manufacturer	11.08	0.98	12.06		2.02	$16.11	30528
			10.00	*1.00*	*11.00*		*2.00*	*14.80*	
30529	Fox Bone Phosphate & Potash	Manufacturer	11.82	7.97	19.79		4.63	22.93	30529
35338		W. W. Mitchell Co., Greensburg	12.76	0.32	13.08		2.92	18.94	35338
			10.00	*1.00*	*11.00*		*4.00*	*17.20*	
30530	Fox Bone & Potash.....	Manufacturer	9.91	0.84	10.75		1.46	13.98	30530
			9.00	*1.00*	*10.00*		*1.00*	*12.40*	
	Globe Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.								
30555	Potash Special	Manufacturer	10.93	0.94	11.87		2.00	15.90	30555
35137		Hubbard & Mitchell, Greensburg	11.30	0.88	12.18	1.89		15.80	35137
35348		C. M. Langdon, Science Hill...	10.16	1.07	11.23		1.33	14.22	35348
			10.00	*1.00*	*11.00*		*2.00*	*14.80*	
30556	Globe Bone Phosphate & Potash	Manufacturer	11.93	8.71	20.64		4.45	23.14	30556
35138		J. R. & S. J. Duncan, Burnside..	10.39	0.68	11.07		4.00	17.54	35138
			10.00	*1.00*	*11.00*		*4.00*	*17.20*	

30557	Potash Compound	Manufacturer	13.07 *12.00*	0.70 *1.00*	13.77 *13.00*		1.91 *2.00*	18.25 *17.20*	30557
30558	Big Four Phosphate	Manufacturer	10.16 *9.00*	0.84 *1.00*	11.00 *10.00*		1.50 *1.00*	14.33 *12.40*	30558
	Great Southern Phosphate Co., Mt. Pleasant, Tenn.								
30456	Great Southern Wheat Special	Manufacturer	11.11 *10.00*	5.43 *2.00*	16.54 *12.00*	3.73 *4.00*		19.23 *16.80*	30456
30458	Ever Ready Wheat Grower	Manufacturer	12.06 *10.00*	6.20 *2.00*	18.26 *12.00*	1.93 *2.00*		18.88 *14.80*	30458
	The Groves Co., Cincinnati, Ohio.								
30825	Wheat and Oats	Manufacturer	10.32	0.73	11.05	2.00		14.67	30825
35144		W. D. Johnson, King's Mountain	10.26 *10.00*	0.60 *2.00*	10.86 *12.00*	2.30 *2.00*		14.85 *14.80*	35144
30826	Potash Mixture	Manufacturer	10.46 *10.00*	0.96 *2.00*	11.42 *12.00*	5.54 *5.00*		18 47 *17.80*	30826
	Hopkins Fertilizer Co., New Albany, Ind.								
30490	"Old Time" Potash Mixture	Manufacturer	9.41 *10.00*	1.48 *1.00*	10.89 *11.00*	4.74 *4.00*		16.62 *16.40*	30490

TABLE IV—ACID PHOSPHATE AND POTASH MIXTURES

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	The Jarecki Chemical Co., Sandusky & Cincinnati, Ohio.								
30892	Square Brand Phosphate & Potash	Manufacturer	10.24	2.11	12.35	2.35		$15.48	30892
35170		M. B. Hines, Science Hill.....	10.89	2.86	13.75	2.22		16.43	35170
			10.00	*1.00*	*11.00*	*2.00*		*14.40*	
30895	Super Phosphate & Potash...	Manufacturer	10.33	2.29	12.62	4.38		17.70	30895
35172		M. B. Hines, Science Hill.....	11.57	2.38	13.95	4.32		19.15	35172
35374		J. C. Canada, Millsprings.....	10.36	2.33	12.69	4.07		17.43	35374
			10.00	*1.00*	*11.00*	*4.00*		*16.40*	
	Jones Fertilizer Co., Louisville, Ky.								
30785	Jones Potash Mixture.....	Manufacturer	11.51	1.61	13.12		1.98	16.83	30785
35176		Hoskins & Dyche, London.....	12.17	0.29	12.46		1.53	16.56	35176
35375		D. H. Hatter & Son, Franklin...	11.69	1.43	13.12	1.78		16.38	35375
			10.00	*1.00*	*11.00*		*2.00*	*14.80*	
30786	Jones Bone and Potash.....	Manufacturer	11.84	0.64	12.48	3.86		18.33	30786
35177		D. H. Hatter & Son, Franklin..	12.18	0.65	12.83		4.55	20.34	35177
35376		D. H. Hatter & Son, Franklin..	11.69	0.45	12.14	4.01		18.22	35376
			10.00	*1.00*	*11.00*	*4.00*		*16.40*	

	Kaufman Fertilizer Co., Cincinnati, Ohio.								
30918	Dissolved Bone & Potash.....	Manufacturer	10.26	2.44	12.70	4.07		17.36	30918
			10.00	*1.00*	*11.00*	*4.00*		*16.40*	
30919	Alkaline Bone & Potash.....	Manufacturer	10.29	2.37	12.66	2.35		15.65	30919
			10.00	*1.00*	*11.00*	*2.00*		*14.40*	
	Kentucky Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.								
30575	O. K. Potash Manure.....	Manufacturer	9.95	0.77	10.72	0.94	4.69	18.82	30575
35191		Geo. Sturgeon, Waynesburg....	11.85	0.71	12.56		4.95	20.44	35191
35385		Woodson Lewis, Greensburg...	11.81	1.31	13.12	1.02	0.72	16.57	35385
			9.00	*1.00*	*10.00*		*5.00*	*17.20*	
30576	O. K. Potash Special.....	Manufacturer	10.91	0.92	11.83		1.89	15.73	30576
35386		Woodson Lewis, Greensburg...	9.28	1.02	10.30		1.10	12.87	35386
			10.00	*1.00*	*11.00*		*2.00*	*14.80*	
	Louisville Fertilizer Co., Louisville, Ky.								
30734	Eagle Potash Mixture.....	Manufacturer	10.61	1.81	12.42		2.00	15.85	30734
35194		W. R. Johnson, Coburg.....	11.17	1.07	12.24	1.31		15.14	35194
35389		Smith & Flora, Campbellsville.	9.31	0.66	9.97	1.93		13.36	35389
			10.00	*1.00*	*11.00*		*2.00*	*14.80*	
30959	Eagle Bone & Potash Compound	Manufacturer	10.41	5.64	16.05	1.54	6.80	24.45	30959
			10.00				*4.00*	*16.80*	

TABLE IV—ACID PHOSPHATE AND POTASH MIXTURES

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	Mt. Pleasant Fertilizer Co., Mt. Pleasant, Tenn.								
30465	Big Success Banner Grain Grower	Manufacturer	13.15	6.69	19.84	2.04		$20.50	30465
35212		Logan Co. Hardware Co., Russellville	10.30	10.79	21.09	2.09		18.77	35212
35403		Warren-Miller Imp. Co., Elizabethtown	10.48	4.81	15.29	1 96		16.46	35403
			10.00	*2.00*	*12.00*		*2.00*	*15.20*	
30469	Black Patch Wheat Special...	Manufacturer	10.41	5.27	15.68	3.89		18.49	30469
35214		T. H. Cochran & Co., Marion...	11.56	7 39	18.95	3.97		20.80	35214
35404		Warren-Miller Imp. Co., Elizabethtown	10.20	6.87	17.07	1.46	2.68	19.67	35404
			10.00	*2.00*	*12.00*		*4.00*	*17.60*	
30483	Big Success	Manufacturer	10.12	1.48	11.60	1.78	12.48	29.49	30483
			12.00	*2.00*	*14.00*		*12.00*	*29.60*	
30999	Black Patch	Manufacturer	10.62	1.72	12.34	5.96		19.39	30999
			10.00	*2.00*	*12.00*	*6.00*		*18.80*	
	National Fertilizer Co., Nashville, Tenn.								

30840	Old Hickory Acid Phosphate & Potash	Manufacturer	9.90	5.76	15.66	1.82	16.00	30840
		Todd Co., Hdw. Co., Elkton	9.84	6.58	16.42	2.15	16.59	35409
35409			*10.00*	*1.00*	*11.00*	*2.00*	*14.40*	
30841	Old Hickory Sadler's Formula.	Manufacturer	10.77	3.29	14.06	2.20	16.44	30841
			12.00	*1.00*	*13.00*	*2.00*	*16.80*	
30937	Old Hickory Brand Special Bone & Potash	Manufacturer	8.20	5.52	13.72	2.79	14.84	30937
			8.00	*1.00*	*9.00*	*2.00*	*12.00*	
30974	Old Hickory Anti-Trust Acid & Potash	*Manufacturer						30974
		D. B. Moore, Marion	14.38	1.89	16.27	2 68	20.70	35225
35225		Todd Co. Hdw. Co., Elkton	10.66	6.69	17.35	3.51	18.98	35411
35411			*10.00*	*1.00*	*11.00*	*4.00*	*16.40*	
30982	Old Hickory Special Acid & Potash	*Manufacturer	*8.00*	*1.00*	*9.00*	*2.00*	*12.00*	30982
	A. W. Pickerill, Hodgenville, Ky.							
30935	Pickerill's Wheat & Corn Grower	Manufacturer	9.51	0.56	10.07	4.99	16.62	30935
		Manufacturer's Warehouse	10.48	1.33	11.81	4.36	17.47	35226
35226		Manufacturer's Warehouse	9.52	0.73	10.25	3.81	15.52	35416
35416			*10.00*	*2.00*	*12.00*	*4.00*	*16.80*	
	Queen City Fertilizer Co., Cincinnati, Ohio.							
30926	Phosphate & Potash	Manufacturer	10.73	2.07	12.80	2.25	15.96	30926
			10.00	*1.00*	*11.00*	*2.00*	*14.40*	

*The manufacturer failed to furnish sample as required by law.

TABLE IV—ACID PHOSPHATE AND POTASH MIXTURES

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	Read Phosphate Co., Nashville, Tenn.								
30704	Read's Alkaline Bone.....	Manufacturer	10.93	1.03	11.96		2.11	$16.06	30704
35231		Barren Co. Gro. & Hdw. Co., Glasgow	10.15	2.77	12.92	2.27		15.56	35231
35420		Barren Co. Gro. & Hdw. Co., Glasgow	8.91	4.68	13.59	3.18		15.74	35420
			10.00	*2.00*	*12.00*	*2.00*		*14.80*	
30705	Read's High Grade Special Potash Mixture.....	Manufacturer	10.63	0.97	11.60		5.72	20.01	30705
35232		Barren Co. Gro. & Hdw. Co., Glasgow	10.08	2.29	12.37	4.43		17.45	35232
35421		Barren Co. Gro. & Hdw. Co., Glasgow	9.77	3.62	13.39	4.97		18.14	35421
			10.00	*2.00*	*12.00*	*4.00*		*16.80*	
30706	Read's Special Wheat Grower.	Manufacturer	11.61	0.83	12.44		6.36	21.89	30706
35422		D. H. Hatter & Son, Franklin..	10.10	3.67	13.77	3.24	3.87	21.47	35422
			10.00	*2.00*	*12.00*	*6.00*		*18.80*	

	Smith Bros., Louisville, Ky.								
30879	Bone & Potash	Manufacturer	10.30	0.82	11.12	1.96		14.65	30879
35241		I. K. Miller & Sons, Campbellsville	10.48	1.05	11.53	1.12		14.12	35241
			10.00	*2.00*	*12.00*	*2.00*		*14.80*	
	Swift & Co., Chicago, Ill.								
30608	Swift's Special Phosphate & Potash	Manufacturer	10.52	1.85	12.37	2.06		15.42	30608
35246		Farmers Hdw. & Gro. Co., Glasgow	10.49	0.18	10.67	1.89		14.56	35246
35433		I. K. Miller & Sons, Campbellsville	10.09	0.73	10.82	1.95		14.35	35433
			10.00	*1.00*	*11.00*	*2.00*		*14.40*	
30971	Swift's High Grade Phosphate & Potash	Manufacturer	10.84	1.35	12.19	4.37		17.92	30971
35441		Forbes Mfg. Co., Hopkinsville	10.84	0.37	11.21	3.80		16.96	35441
			10.00	*1.00*	*11.00*	*4.00*		*16.40*	
	Taylor & Powell, Springfield, Tenn.								
30980	12-2 Wheat Grower	Manufacturer	10.41	6.26	16.67	1.58	0.89	17.64	30980
			12.00				*2.00*	*16.80*	
	Tennessee Chemical Co., Nashville, Tenn.								
30768	Ox Potash Mixture	Manufacturer	10.81	1.84	12.65		2.02	16.13	30768
35444		W. F. Grainger, Franklin	11.45	1.94	13.39		1.62	16.46	35444
			10.00	*1.00*	*11.00*		*2.00*	*14.80*	
30769	Ox Potash Formula	Manufacturer	11.64	0.57	12.21	3.81		18.01	30769
35257		W. F. Grainger, Franklin	12.22	0.45	12.67		3.30	18 80	35257
35445		W. F. Grainger, Franklin	11.05	1.98	13.03	3.29		17.34	35445
			10 00	*1.00*	*11.00*		*4.00*	*17.20*	
30770	Ox Alkaline Bone	Manufacturer	12.67	0.69	13.36	2.79		18.27	30770
			12.00	*1.00*	*13.00*	*2.00*		*16.80*	

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	Tennessee Valley Fertilizer Co., Florence, Ala.								
30995	Tiger Potash Guano	Manufacturer	10.38	1.89	12.27	3.63		$16.85	30995
			10.00				*4.00*	*16.80*	
30996	Tiger Guano	Manufacturer	10.95	3.23	14.18	2.00		16.43	30996
			10.00				*2.00*	*14.40*	
	Tuscarora Fertilizer Co., Chicago, Ill.								
30821	Bone & Potash	Manufacturer	10.16	0.91	11.07	2.22		14.77	30821
35454		C. Browning, Greensburg.....	11.07	1.45	12.52	1.23		15.09	35454
			10.00			*2.00*		*14.00*	
	Virginia-Carolina Chemical Co., Memphis, Tenn.								
30850	Royal Grain Grower.....	Manufacturer	10 68	1.31	11.99	4 10		17 44	30850
35271		D. H. Hatter & Son, Franklin..	10.84	0.65	11.49	3.62		16.89	35271
			10.00	*2.00*	*12.00*	*4.00*		*16.80*	

30851	Capital Bone & Potash Compound	Manufacturer	10.38	1.26	11.64	2.07		15.03	30851
35272		I. K. Miller & Sons, Campbellsville	10.39	1.28	11.67	1.99		14.97	35272
35458		E. S. Duiguid & Son, Murray	10.84	0.56	11.40	1.98		15.21	35458
			10.00	*2.00*	*12.00*	*2.00*		*14.80*	
30852	Victor Bone & Potash	Manufacturer	15.68	0.74	16.42	3.19		22.31	30852
35273		D. H. Hatter & Son, Franklin	16.17	0.15	16.32	2.60		22.06	35273
			15.00	*2.00*	*17.00*	*3.00*		*21.80*	

TABLE V.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.
	The Cincinnati Phosphate Co., Cincinnati, Ohio.	
30907	Capitol Bonus A Humus Phosphate	Manufacturer
	Federal Chemical Co., Louisville, Ky.	
30499	Daybreak Harvest Bone	Manufacturer
35106		Mardis & Wray, Campbellsville.
35329		Mardis & Wray, Campbellsville.
	Fox Chemical Co., Branch Federal Chemical Co., Louisville, Ky.	
30524	Fox Ammoniated Bone	Manufacturer
	Globe Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.	
30549	Golden Harvest Bone Meal	Manufacturer
35345		Todd Co. Hdw. Co., Elkton
	J. C. Jones Fertilizer Co., Louisville, Ky.	
30945	Jones Corn Producer	*Manufacturer
	Kentucky Fertilizer Co., Branch Federal Chemical Co., Louisville, Ky.	
30565	O. K. Bone Meal Mixture	Manufacturer
35381		Woodson Lewis, Greensburg
	Read Phosphate Co., Nashville. Tenn.	
30964	Read's Half & Half	Manufacturer
35429		Grayson Co. Supply Co., Leitchfield

*The manufacturer failed to furnish sample as required by law.

NITROGENOUS SUPERPHOSPHATES.

PHOSPHORIC ACID.			NITROGEN.						
Available.	Insoluble.	Total.	In Nitrates.	In Ammonia Salts.	Organic.	Total.	Equivalent to Ammonia.	Estimated Value Per Ton.	Station Number.
12.79	1.35	14.14				0.47	0.57	$17.54	30907
12.00	*1.00*	*13.00*				*0.41*	*0.50*	*16.24*	
11.30	0.65	11.95				2.70	3.28	23.27	30499
13.41	1.10	14.51				2.53	3.07	25.39	35106
11.90	0.68	12.58		0.28	1.18	1.46	1.77	19.66	35329
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*22.25*	
11.18	0.98	12.16				2.55	3.10	22.74	30524
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*22.25*	
10.99	0.91	11.90				2.69	3.27	22.97	30549
12.43	1.85	14.28		0.63	1.30	1.93	2.34	22.42	35345
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*22.25*	
									30945
3.50	*0.50*	*4.00*				*1.65*	*2.00*	*10.18*	
11.25	0.82	12.07				2.69	3.27	23.25	30565
10.98	1.11	12.09		0.27	1.71	1.98	2.40	20.55	35381
10.00	*4.00*	*14.00*				*2.47*	*3.00*	*22.25*	
10.74	5.70	16.44				3.48	4.22	27.35	30964
8.88	2.29	11.17	1.07		2.09	3.16	3.84	22.64	35429
8.00	*7.00*	*15.00*				*3.29*	*4.00*	*23.92*	

TABLE VI.—POTASH SALTS.

Station Number.	Name and Address of Manufacturer and Name of Brand.	From Whom Obtained.	POTASH. From Muriate.	POTASH. From Sulphate.	Estimated Value Per Ton.	Station Number.
	German Kali Works, Baltimore, Md.					
35004	Muriate of Potash.....	Manufacturer	51.45 *50.00*		$51.45 *50.00*	35004
35005	Sulphate of Potash.....	Manufacturer		50.75 *48.00*	60.90 *57.60*	35005
35006	Kainit	Manufacturer	13.54 *12.00*		13.54 *12.00*	35006

Dec. 31, 1910.

M. A. SCOVELL, Director
H. E. CURTIS, Chemist.

MINERAL WATERS

ANALYSES OF MINERAL WATERS, ETC.,
by
S. D. Averitt and O. M. Shedd.

ANDERSON COUNTY.

25719—Water from a well 104 feet deep, bored in 1905, near Van Buren, Anderson County, Ky. Sent by T. J. Leathers, Leathers' Store, January 3, 1910.

ANALYSIS.

	Grams per Liter.	Grains per Gallon.
Total solid matter	.530	30.9
Ignited solid matter	.436	25.4
Organic and volatile matter	.094	5.5
Calcium Carbonate ($CaCo_3$)	.180	10.4
Sodium carbonate (Na_2Co_3)	.159	9.2
Sodium chloride (NaCl)	.093	8.9

There are, also, traces of magnesium carbonate, potassium sulphate, sodium bromide, sodium borate, ferrous carbonate and silica.

This is an alkaline carbonated water.

25918—Water from a dug well, 2 miles from Lawrenceburg, Anderson County, Ky. Sample sent July 23, 1910, by C. T. Case, of Lawrenceburg.

ANALYSIS.

One gallon contains 52.7 grains of solid matter (0.904 gram per liter), composed of calcium carbonate, sodium chloride, magnesium carbonate and calcium sulphate, with traces of iron, silica and potassium sulphate.

It contains more solid matter than the usual shallow well water of this region.

BOURBON COUNTY.

25851—Water from a well 90 feet deep, at Collins & Richmond's house, about one mile from North Middletown, Bourbon County, Ky., on Thatcher's Mill pike. The well was bored in 1908. Sample sent April 28, 1910.

ANALYSIS.

One gallon contains 29.9 grains of solid matter (0.51 gram per liter), composed of sodium chloride, calcium carbonate and magnesium carbonate. There are also traces of potassium sulphate, silica, iron and zinc carbonate.

This is about like the average well water in composition and containing a trace of zinc, which is not unusual in deep wells.

CALDWELL COUNTY.

25934—Water received August 20, 1910, from J. S. Cartwright, Princeton, Caldwell County, Ky.

ANALYSIS.

One gallon contains 35.7 grains of solid matter (0.612 gram per liter), composed of calcium carbonate, calcium sulphate and sodium chloride, with traces of iron and silica.

It is about like the average well water in composition.

FAYETTE COUNTY.

25967—Salt water from a well 160 feet deep, recently bored on the Israel farm, 3½ miles from Lexington, on the Richmond road. Sample sent October 17, 1910, by Miss Olivia E. Israel, Lexington, Ky.

ANALYSIS.

One gallon contains 336.4 grains of solid matter (5.768 grams per liter), composed mainly of sodium chloride and calcium carbonate, with a small quantity of magnesium carbonate. There are traces of iron, potassium sulphate, zinc carbonate, silica, iodides and bromides.

This is a moderately strong salt water, quite common in deep wells in this region.

HARRISON COUNTY.

25933—Salt-sulphur water from a well, 95 feet deep, on the farm of Robert T. Berry, 1½ miles from Cynthiana. Said to equal the Blue Lick water in its medicinal effect. Sample sent August 18, 1910, by H. D. Frisbie, Cynthiana, Ky.

ANALYSIS.

	Grams per Liter.	Grains per Gallon.
Total solid matter	6.12	356.8
Ignited solid matter	5.73	334.1
Organic and volatile matter	0.39	22.7
Sodium chloride (Na Cl)	3.46	331.1
Calcium Carbonate (Ca Co_3)	.29	17.0
Free and combined hydrogen sulphide (H_2S)	.0007	0.04

In addition to the above, there are small amounts of magnesium carbonate, potassium and lithium sulphates and zinc carbonate, traces of iron, silica, bromides and borates.

It is a moderately strong salt-water, containing a little hydrogen sulphide.

HART COUNTY.

25871—Salt-sulphur water from a well located 2 miles southeast of Horse Cave, Hart County, Ky. Sample sent in June, 1910, by D. L. Vancleave, Cave City, Barren County, Ky.

ANALYSIS.

One gallon contains 3884.0 grains of mineral matter (66.586 grams per liter), composed of sodium chloride, calcium chloride, magnesium chloride and sodium sulphate. There is some sodium sulphate present and traces of iodides, bromides, silica, iron, potassium and lithium chlo-

rides. Free and combined hydrogen sulphide is present to the extent of 9.6 grains per gallon.

It is a strong salt-sulphur water containing much calcium chloride.

KENTON COUNTY.

25932—Well (?) water received from W. S. Berger, Covington, Kenton County, Ky., August 13, 1910.

ANALYSIS.

One gallon contains 39.1 grains of solid matter (0.67 gram per liter), composed of calcium carbonate, calcium sulphate and small amounts of magnesium carbonate and sodium chloride, also traces of iron and silica.

The analysis indicates an ordinary well water.

LOGAN COUNTY.

25970—Water from a well, 106 feet deep, sent October 27 by George D. Richardson, Auburn, Logan County, Ky. Said to be a flow of natural gas when the water is pumped out.

ANALYSIS.

One gallon contains 60.5 grains of solid matter (1.037 grams per liter), composed of sodium carbonate, calcium carbonate and sodium sulphate, also traces of sodium chloride, magnesium carbonate, silica and iron.

The water is strongly alkaline, due to the sodium carbonate present. It is an alkaline carbonated water.

McCRACKEN COUNTY.

25957—Water sent, September 29, 1910, by I. D. Wilcox, Paducah, McCracken County, Ky.

One gallon contains 313.8 grains of solid matter (5.383 grams per liter), composed of magnesium sulphate, calcium sulphate and sodium chloride, with small quantities of calcium carbonate and sodium sulphate and iron. There are

traces of bromides, silica, potassium and lithium sulphates.

This is a magnesia water, containing a good deal of salt.

NICHOLAS COUNTY.

25943—Water from a well near Blue Lick Springs, drilled in an attempt to find the original Blue Lick water, as it is now exhausted in the spring. Sample sent August 29, 1910, by Hon. C. M. Clay, Paris, Ky.

ANALYSIS.

	Grams per Liter.	Grains per Gallon.
Total solid matter	27.344	1594.2
Ignited solid matter	26.852	1565.5
Organic and volatile matter	0.492	28.7
Sodium chloride (Na Cl)	20.431	1185.0
Calcium chloride ($Ca Cl_2$)	4.312	251.5
Magnesium chloride ($Mg Cl_2$)	2.560	149.4
Silica (Sio_2)	0.03	1.7
Ferric oxide and alumina	0.006	0.3

In addition to the above there are traces of potassium and lithium chlorides, calcium sulphate, strontium sulphate, bromides and borates. It contains a good deal more sodium chloride, calcium chloride and magnesium chloride than the Blue Lick, and does not contain any sulphur.

OHIO COUNTY.

25841—Water from a well, 60 feet deep, in a hilly portion of Ohio County, Ky. Sent April 14, 1910, by A. P. Taylor, Owensboro, Ky.

ANALYSIS.

One gallon contains 91.3 grains of solid matter (1.566 grams per liter), composed of magnesium sulphate, sodium chloride and calcium carbonate, with traces of potassium sulphate, silica and lithium carbonate.

The total alkalinity of the water is equivalent to 24.4 grains of calcium carbonate per gallon.

It is a magnesia water.

WARREN COUNTY.

25966—Water from a well, 28 feet deep, on the farm of R. L. Hurd, 7½ miles west of Bowling Green. Sent October 17, 1910.

Analysis.

One gallon contains 44.3 grains of solid matter (0.76 gram per liter), composed of calcium carbonate and sodium carbonate, with small quantities of magnesium carbonate, calcium sulphate and ferrous carbonate. There are traces of iodides, potassium sulphate and silica.

It would be classed as a weak chalybeate water.

WOODFORD COUNTY.

25974—Well water sent by J. O. Shouse, Versailles, Ky., November 7, 1910.

Analysis.

One gallon contains 39.7 grains of solid matter (0.69 gram per liter), composed of calcium carbonate, sodium chloride, calcium sulphate, magnesium carbonate and a small amount of ferrous carbonate. There are also traces of potassium sulphate, silica and zinc carbonate.

This would be classed as a weak chalybeate water.

25980—Water from a well on M. Crutcher's farm, near Ducker's Station, Woodford County, Ky. Sent November 8, 1911, by T. W. Freeman, Georgetown, Ky.

Analysis.

One gallon contains 117.7 grains of solid matter (2.018 grams per liter), composed of sodium chloride, calcium car-

bonate, calcium sulphate, and magnesium carbonate, also traces of iron, silica and potassium sulphate.

It contains more solid matter than the average shallow well water of this region, and would be classed as a saline water.

Meteorological Summaries

FOR THE YEAR 1910.

Compiled from the records of the U. S. Weather Bureau Station in the main building of State University.

PRESSURE.

Elevation of the Barometer Cistern Above Mean Sea Level, December 31, 989 feet.

Months.	Monthly In.	Highest Observ'd In.	Date.	Lowest Observ'd In.	Date.	Absolute Range In.
January	29.05	29.69	10	28.57	18	1.12
February	29.10	29.42	25	28.76	9	.66
March	29.05	29.23	19	28.87	13	.36
April	28.87	29.22	1	28.65	18	.57
May	28.98	29.34	28	28.73	23	.62
June	28.93	29.12	13	28.66	1	.46
July	28.92	29.13	20	28.75	17	.38
August	28.99	29.14	26	28.87	4	.28
September	29.04	29.24	15	28.85	3	.39
October	29.00	29.38	30	28.65	27	.74
November	28.95	29.17	3	28.64	14	.53
December	29.05	29.63	13	28.64	20	1.00
	Mean 28.99	Highest 29.69	Jan. 10	Lowest 28.57	Jan. 18	Mean .59

PRECIPITATION.

(Amount in inches and hundredths.)

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

MONTH.	Total Amount.	Greatest Amount in any 24 consecutive hours.		No. days on which .01 in. or more fell.	No. days on which no rain, except "Trace," fell.	Greatest No. of consecutive days without rainfall (dates inclusive).	Normal rainfall.
		Am't.	Date.				
January	4.46	1.23	5–6	15	4	8–12	3.83
February	4.11	1.55	16–17	11	3	4– 7	3.23
March	0.46	.30	1	3	4	23–30	4.72
April	4.22	1.09	16–17	14	4	7–10	3.34
May	6.24	2.06	7–8	15	3	26–28	3.52
June	5.92	1.95	10	9	4	12–14	3.99
July	7.66	1.42	6–7	19	1	18–22	4.44
August	4.15	1.48	25–26	9	0	11–17	3.57
September	7.92	4.26	18–19	10	1	26–30	2.42
October	1.67	1.07	6	6	1	7–20	2.22
November	1.72	1.33	27–28	7	1	11–22	3.48
December	2.81	1.00	29–30	11	3	14–17	3.32
Total	51.34			129	29		42.08

MISCELLANEOUS PHENOMENA.

MONTHS.	Number of Days with			
	Thunder Storms.	Snows.	Hail.	Dense Fog.
January	0	6	0	1
February	0	4	0	2
March	3	0	0	0
April	3	2	0	0
May	6	0	0	0
June	10	0	0	0
July	21	0	0	0
August	6	0	0	0
September	12	0	0	1
October	1	1	0	2
November	3	1	0	1
December	0	6	0	3
Summary	65	20	0	10

CLOUDINESS.

MONTHS.	Mean Cloudiness (0 to 10).		Character of Day.		
	7 A. M.	Monthly.	Clear.	Partly Cloudy.	Cloudy.
January	8.0	7.7	5	8	18
February	6.4	6.2	7	8	13
March	5.2	5.3	10	11	10
April	6.8	6.6	5	10	15
May	6.3	5.6	9	12	10
June	4.3	5.2	9	12	9
July	7.4	6.7	6	7	18
August	4.4	4.9	14	7	10
September	5.1	5.5	10	12	8
October	2.6	3.4	15	12	4
November	4.8	5.6	11	8	11
December	6.7	6.4	7	9	15
Summary			108	116	141
Mean	5.7	5.8	.....	.....	

WIND.

Elevation of the Anemometer Cups above ground Dec. 31, 102 feet.

MONTHS.	Prevailing Direction.	Maximum Hourly Velocity During Month.			No. of Days with Gales.*	No. of Calms.
		Miles	From	Date.		
January	S.	46	W.	26	2	0
February	S. W.	38	W	9	0	0
March	S. W.	35	W.	13	0	0
April	S. W.	40	S. W	5	1	1
May	S. W.	40	S. W	23	1	0
June	N. E.	37	N. W	19	0	1
July	S. W	35	N. W.	17	0	0
August	S. E.	36	S. W.	21	0	0
September	S	36	S. W.	19	0	2
October	S.	30	S.	4	0	0
November	W.	36	W.	24	0	0
December	W.	37	N. W.	29	0	0
Mean	S.					

*Days with 40 miles per hour and over.

TEMPERATURE.

MONTHS	Elevation of the Dry Thermometer Bulb Above Ground Dec. 31st, 75 Feet. From Self-Registering Instruments.										No. of Days.			Normal Monthly Temperature.
	Mean.			Highest	Date.	Lowest.	Date.	Range.		Mean daily change.	Max. below 32 degrees.	Max. above 90 degrees.	Min. below 32 degrees.	
	Max.	Min.	Monthly					Absolute.	Mean daily.					
January	39.5	24.4	32.0	60	26	4	7	56	15	8.0	9	0	23	33
February	40.0	22.9	31.4	60	27	4	18	56	17	8.6	8	0	22	36
March	65.0	43.8	54.4	85	24	18	15	67	21	5.5	0	0	4	43
April	63.9	44.3	54.1	81	30	28	24	53	20	6.2	0	0	2	54
May	67.9	50.3	59.1	82	2	36	14	46	18	4.1	0	0	0	64
June	78.0	59.5	68.8	90	24	40	3	50	18	2.8	0	1	0	73
July	82.4	67.1	74.8	89	1	56	19	33	15	1.9	0	0	0	77
August	81.4	63.7	72.6	91	17	51	27	40	18	2.7	0	0	0	75
September	78.1	61.0	69.6	87	7	52	16	35	17	3.5	0	0	0	68
October	69.6	49.6	59.6	84	3	25	29	59	20	4.7	0	1	3	56
November	47.8	31.4	39.6	68	9	22	12	46	16	5.9	1	0	17	45
December	35.3	21.9	28.6	56	29	9	13	47	13	6.3	12	0	29	36
Mean	62.4	45.0	53.7	Max. 91	Aug. 17	Min. 4	Jan. 7	49	17	5	30	2	100	For year 55

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