FIRST ANNUAL REPORT

—OF THE—

KENTUCKY

AGRICULTURAL EXPERIMENT STATION

—OF THE—

STATE COLLEGE OF KENTUCKY.

—1888.—

-5
Public Information Dept.
University of Kentucky
UNIVERSITY OF KENTUCKY LIBRARY
WITHDRAWN JUN 18 '63
92
WITHDRAWN JUN 18 '63

FRANKFORT, KY.:
CAPITAL OFFICE, E. POLK JOHNSON, PUBLIC PRINTER AND BINDER.
1890.

20477

639.2
K419
V.1-5
1888-92

UNIVERSITY
OF KENTUCKY
LIBRARY

LIST OF OFFICERS.

BOARD OF CONTROL.

DR. R. J. SPURR, Chairman.

JUDGE W. B. KINKEAD, Chairman Executive Committee.

W. D. NICHOLAS, Treasurer.

JUDGE P. P. JOHNSTON.

PHIL BIRD.

R. A. SPURR.

DR. J. D. CLARDY.

J. K. PATTERSON, President of the College.

M. A. SCOVELL, Director-Secretary.

STATION OFFICERS.

M. A. SCOVELL, Director.

A. M. PETER, Assistant Chemist.

H. E. CURTIS, Second Assistant Chemist.

H. GARMAN, Entomologist and Botanist.

A. T. PARKER, Microscopist.

JAMES MURRAY, Practical Horticulture.

C. L. CURTIS, Assistant Agriculturist.

SAM E. BLACK, Secretary and Stenographer.

WITHDRAWN JUN 18 '63

LETTER OF TRANSMITTAL.

To His Excellency, GEN. S. B. BUCKNER, *Governor of Kentucky:*

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

Very respectfully,

M. A. SCOVELL, *Director.*

FEBRUARY 1, 1889.

REPORT OF THE DIRECTOR.

The Kentucky Agricultural Experiment Station is, by act of Congress, a department of the Agricultural and Mechanical College of Kentucky. It was in existence nearly two years before Congress passed the Hatch act.

HISTORICAL.

As this is the first report that has been officially made, it is thought best to briefly sketch the history of the Station from the time of its organization.

WITHDRAWN JUN 18 '63

The Station owes its existence to a resolution of the Executive Committee of the Board of Trustees of the Agricultural and Mechanical College of Kentucky in September, 1885. No special organization was undertaken at this time, as it was the desire of the Board to build up the Station only as rapidly as the means of the College would allow. At a meeting of the Executive Committee, on September 25, 1885, Prof. M. A. Scovell was elected Director of the Station. He assumed his duties the following November. One room in the basement of the College was fitted up for an office, chemical laboratory and general work-room.

In the winter of 1886 the Legislature designated the Station as the Kentucky Agricultural Experiment Station, and passed an act controlling the sale of commercial fertilizers in the State, and empowered the Director of the Station to make all official analyses under the law, and authorized him to make all necessary rules and regulations for its proper enforcement.

In the spring of 1886 such tillable land as the College had was assigned to the Station for field experiments. The field assigned contained about twelve acres, most of which was found to be unfit for this purpose, on account of the very marked unevenness of fertility of the soil, caused by having the surface soil taken off here and there over various portions of the field for making brick for building the College.

In June of the same year Prof. A. M. Peter was elected Assistant

Chemist of the Station. Before this the Director was alone in the work of the Station, except that, by a resolution of the Executive Committee, the Professors of Chemistry, Agriculture and Botany were to assist in the work of the Station insofar as such work did not interfere with their proper College duties. After Congres, passed the Hatch act, in March, 1887, the authorities at once took steps to put the Station on a firmer basis.

The Executive Committee of the College placed the management of the Station in the hands of a Board of Control, consisting of the Executive Committee, the President of the College and the Director of the Station; the action of the Board of control to be subject to the Executive Committee and the General Board of Trustees.

Action was taken, looking to the purchase of a farm for experimental purposes, for the erection of a Station building for offices, laboratories, etc., and for increasing the working force of the Station, but by a decision of the Comptroller of the Treasury the funds due under the operation of the Hatch act did not become available until the following year, and no great increase of the working force could at once be made. In June another Assistant Chemist was employed, Mr. H. E. Curtis. In the fall a farm of forty-eight-and one half acres was purchased, and in May, 1888, the contract was let for the Station building. In June, 1888, steps were taken for the employment of an agriculturist and an assistant agriculturist, and for procuring the necessary books, apparatus, etc., which would be required as soon as the new quarters were ready.

EQUIPMENT.

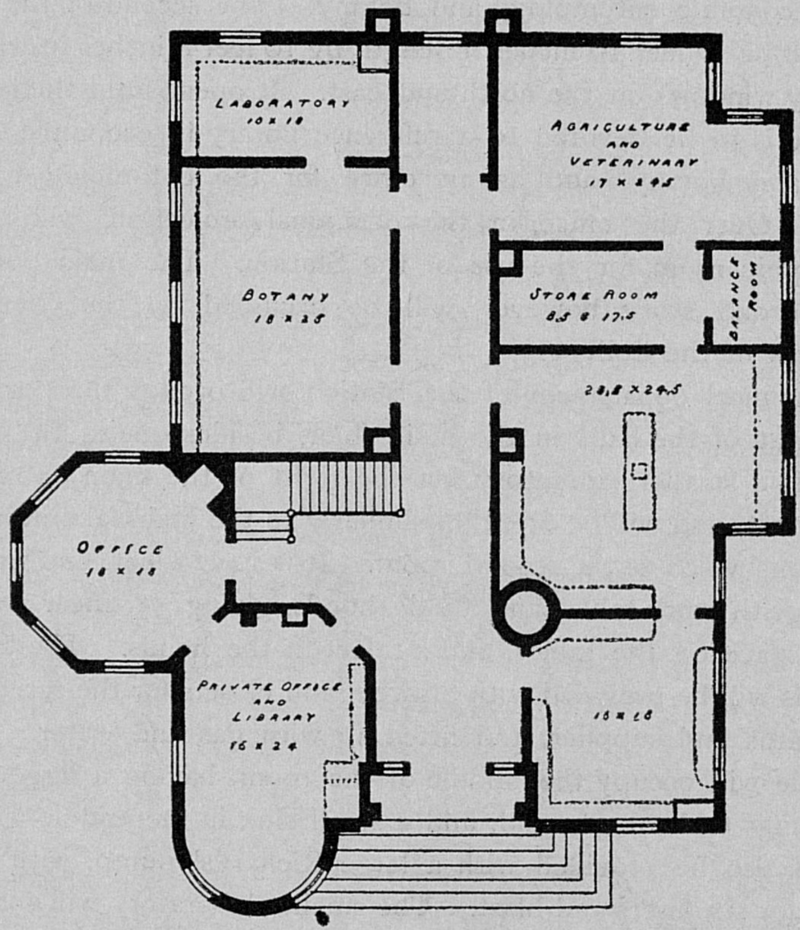
As stated above, the erection of a Station building was commenced last year, and it is now nearly completed, and almost ready for occupation. It is 70 feet in length by 54 feet in width, with a tower projection in front and an octagonal projection 18x18 on the north side. The building is two stories high, and has a basement 11 feet from floor to ceiling. The main entrance is on the first floor, on the west side of the building, through an archway 15 feet wide. From the main entrance a hallway 8 feet wide extends to the opposite end of the building. On the left of this hall, as you enter, will be first the Director's room and library, 16x25, lighted by one window on the north and two tower windows on the west. Adjoining this room will be the general office. It will occupy the octagonal projection, and is entered from the main hall. It is also connected with the Director's office by a doorway. Rooms for entomological and botanical work will be also on the left of the hall, on the first floor of the building. The larger of these, 25 feet 10 inches by 17 feet 10 inches in dimensions, and lighted by windows on the north side, will be fitted up for laboratory work, and for reference collections in economic entomology and botany. The second of the two rooms will be 17 feet 10 inches in length by 10 feet 8 inches in width, lighted by windows on the north and east. It opens from the larger room, and is to be devoted to a reference library in economic entomology and botany, and as an office for the entomologist and botanist. Over the office, in the octagonal projection, will be a photographic room for the use of the Station. The main portion of the second story, however, will be occupied by the chemical department of the College.

The chemical department of the Station will occupy three rooms on the right of the hall, on the main floor, besides one in the basement. The smaller laboratory, on the right of the main entrance, is 16x18 feet, and will be fitted up similarly to the main laboratory of the Station, which is the second room. It is 24x23 feet, and will be fitted up with work tables and ample hoods, giving 35 linear feet of working space on the tables, and 21 feet in the hoods. The tables and hoods will be provided with drawers and closets for the reception of apparatus and supplies, and fitted up with gas and water. One large table will occupy the middle of the room, having a large sink and draining table at one end, and a small sink in the middle. This table will also be provided with a large Richards' pump, with connections for six filters and blast. The smaller laboratory will contain 17 linear feet of table and 10 of hood space. The hoods in both laboratories will communicate with a large ventilating stack two feet inside diameter. The next room, 8 1-2x24 feet, will be used as a balance and storage room. It will be furnished with a table 7x2 1-2 feet for the analytical balances; a smaller table for torsion balance; a desk for laboratory records, and two large cases for apparatus and chemicals. The last room on the right of the hall will be the agriculturist's room, 17x24 feet in dimensions.

The following cuts show the floor places of the building in detail:

KENTUCKY AGRICULTURAL EXPERIMENT STATION BUILDING

FIRST FLOOR



SCALE
20 FEET TO AN INCH

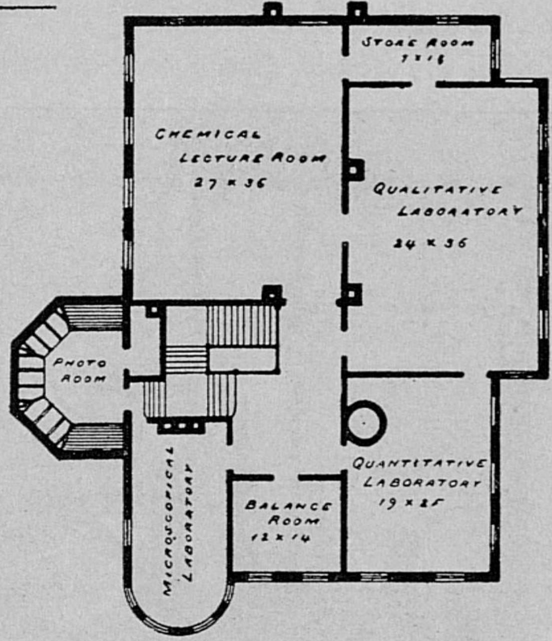
g in detail:

DING

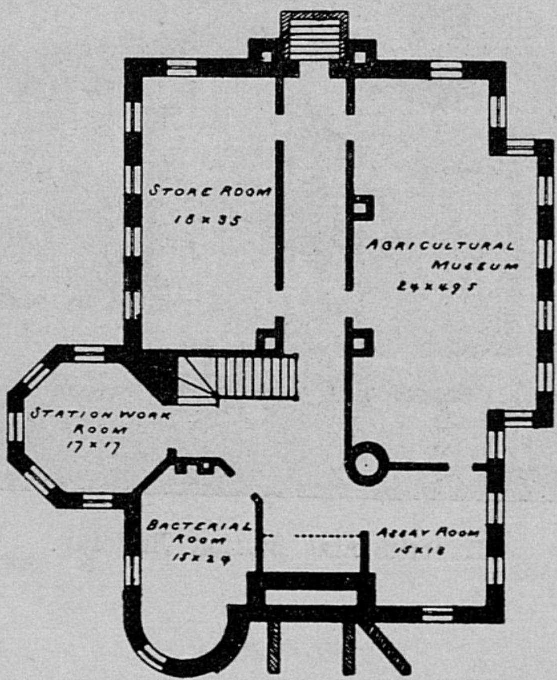
N INCH

KENTUCKY AGRICULTURAL EXPERIMENT STATION BUILDING

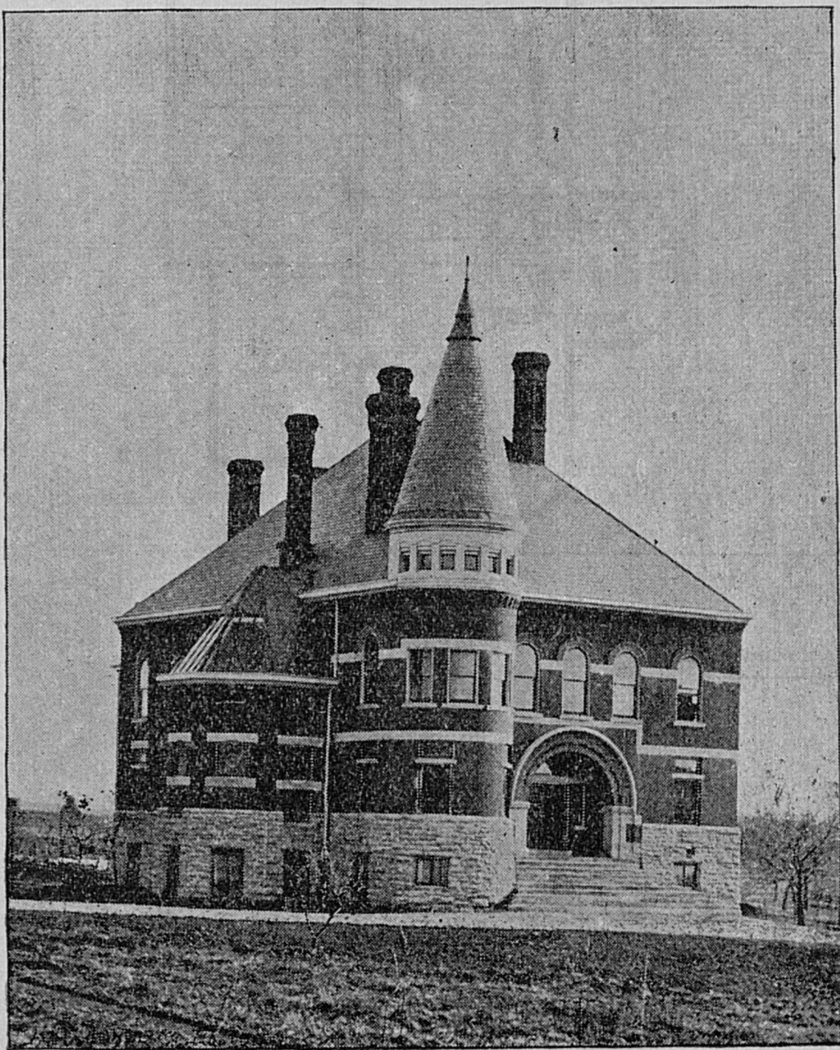
SECOND FLOOR



BASEMENT



SCALE
30 FEET TO AN INCH



Experimental Station Building.

The farm of the Experiment Station is situated about three-quarters of a mile from the College, and contains forty-eight-and-one half acres. The front part of the farm is in pasture and orchard. The back portion is divided off into two hundred one-tenth-acre plats, each plat being twenty-four feet wide and one hundred and eighty and one-half feet long, each acre being separated by roads ten to fourteen feet wide, and each tenth separated by paths three feet wide. Permanent posts, 4x4 inches, are set at the acre corners, three feet in the ground and one foot above. These stakes were set by means of chain and transit. In the top and centre of each stake is driven a large spike, and the tenth-acre stakes are placed by means of a coil of wire stretched from one permanent stake to another. The wire has brass tags soldered on at intervals of twenty-four feet and three feet, showing where the stakes are to be placed. This wire is coiled on a reel when not in use, and when any of these small stakes are misplaced they can readily be replaced by means of the wire.

There are two barns on the farm, one large horse barn containing twenty-two large box-stalls, 12x12, besides a large loft. This barn is being arranged for storing away filed experiments, and for making proper stalls for feeding purposes. The barn is ample for all such purposes, and quite convenient. The smaller barn contains three horse stalls and seven cow stalls, besides a loft and two carriage sheds. There is also a large brick dwelling house on the farm, now occupied by the Director. There is an old apple orchard of five acres, and ten acres in pasture.

ORGANIZATION.

As before stated, the Station is governed by a Board of Control, consisting of an Executive Committee, the President of the College, and the Director of the Station. The officers of the Station include the Director and Chemist, two assistant chemists, an agriculturist, farm superintendent, practical horticulturist, and secretary and stenographer.

LINES OF WORK.

The work has been almost entirely confined to chemical analyses and investigations and field experiments. Much of the time of the chemists has heretofore been occupied by fertilizer analyses, and analyses of the products of the various field experiments. Many analyses of hays, grasses, corn fodders, etc., have been made and published in Bulletins Nos. 2 and 5.

The field experiments, which have been planned and undertaken, will aid to a great extent in the study of soil fertility of the State. At the Station fertilizer experiments with corn, potatoes, hemp, tobacco, wheat and oats have been undertaken, with results which show clearly that potash is needed on our soil. The tests of varieties of various crops, methods of seeding and cultivation have received attention.

Much of the time of the Director has been occupied in answering inquiries from the farmers of the State. This bureau of information has been made a permanent feature of Station work.

PUBLICATIONS.

Since the organization of the Station sixteen bulletins have been published, giving the results of the various experiments, under the following titles:

1. Do Fertilizers Affect the Quality of Tobacco?
2. Corn Fodder as a Food for Stock.
3. Milk.
4. Distillery Slops.
5. Analyses of Feeding-stuffs.
6. Clover.
7. Commercial Fertilizers.
8. Wheat Experiments.
9. Experiments with Potatoes.
10. Commercial Fertilizers.
11. Wheat Experiments.
12. Commercial Fertilizers.
13. Commercial Fertilizers.
14. Commercial Fertilizers.
15. Wheat Experiments.
16. Experiments with Potatoes.

The editions of nearly all these bulletins are entirely exhausted, and as there is a constant demand for them, they are reproduced in this report almost entire, except where the explanations and introductions of one will answer for others, as in the case of fertilizer bulletins, in which case the preliminary remarks are left out.

Many analyses, and some chemical investigations, made in the Station laboratory, have not appeared in any of the bulletins, and, by request, Prof. A. M. Peter, Assistant Chemist, has compiled them for this report. They are given below.

GRASSES, HAYS AND FEED-STUFFS.

Besides the analyses of grasses, hays, feed-stuffs and potatoes, given in Bulletins Nos. 2, 3, 5 and 9, thirty-one analyses of grasses and hays, and five of miscellaneous feed-stuffs have been made. These are given in the following pages. The analyses of grasses grown at the Station have mostly been made to show the differences in composition at different stages of growth, and in such cases, where several samples of the same grasses have been taken at different times, every precaution has been observed in collecting and preparing the sample, so that the results may be strictly comparable. In making the analyses, the method of the association and official agricultural chemists has been followed. It is to be noted, however, that Squibbs' ether, as was then recommended, has been used in extracting the fats, and hence the ether extract is larger in amount than would be obtained by the use of absolute ether. The analyses have been calculated upon the water-free substance throughout.

KENTUCKY BLUE-GRASS—(*Poa Pratense*).

In the spring of 1887 some experiments were made with fertilizers upon a series of tenth acre plots, laid out on the blue-grass sward of the College campus. Various fertilizers were applied, but it was only on the plots receiving fertilizers containing nitrogen that any very marked effect was observed. On these the grass very soon became of a darker-green color, and grew more rapidly than where no nitrogen had been applied in the fertilizer. The most luxuriant growth was obtained on the plot receiving 30 pounds of sulphate of ammonia, or at the rate of 300 pounds per acre; the grass on this plot, at the time of flowering, being six to eight inches higher than that on the unfertilized plots. Samples of grass for analysis were from this plot, and also from an adjoining plot which received no fertilizer, and the results are given in the following table. One analysis (No. 375) of blue-grass hay, made in 1886, on another part of the campus, is also given.

225. Kentucky blue-grass, from the college grounds; fertilized with 300 pounds sulphate of ammonia per acre; cut May 13th when headed out, but not in flower.

226. Kentucky blue-grass, from a plot adjoining that from which sample No. 225 was taken; this plot received no fertilizer; sample taken at the same time as No. 225.

228. Same plot as 225; cut May 27th when just done flowering; 2 feet high.

229. Same plot as 226; cut May 27; about 16 inches high, and just done flowering.

237. Same plot as 225; cut June 9th; seed nearly ripe, but stems still green.

236. Same plot as 226; cut June 9th; seed nearly ripe, but stems still green.

375. Blue-grass hay, State College grounds; cut May 29, 1886, when in bloom.

Table Showing Effect of Fertilizers on the Composition of Kentucky Blue-grass.

Station Number . . .	Fertilizer.	Amount Applied, per A.	Time of Application . .	Per Ct. of Dry Substance.	Analysis of Dry Substance, Per Cent.				
					Crude Protein . .	Ether Extract . .	Nitrogen Free Extract	Crude Fiber . . .	Crude Ash . . .
225	Sul. Ammonia.	300	May 13, '87	26.11	17.70	4.03	48.37	22.83	7.07
226	None.	. . .	"	29.46	12.85	5.20	53.50	23.38	7.07
228	Sul. Ammonia.	300	May 27, '87	29.91	12.32	4.04	51.83	25.01	6.80
229	None.	. . .	"	33.95	9.18	3.06	55.51	25.49	6.76
237	Sul. Ammonia.	300	June 9, '87	36.75	9.80	3.16	56.05	25.16	5.83
236	None.	. . .	"	45.42	9.02	2.92	56.85	25.13	6.08
375	None.	. . .	May 29, '86	90.61	11.51	2.67	55.65	21 63	8.54

ENGLISH BLUE-GRASS.

Three samples of this grass were taken at different times from a plot in the Station garden. Three other samples were brought by Dr. R. J. Spurr from his farm near Greendale, Fayette county, Kentucky; but as the original weights of these last were not preserved, the amounts of dry substance in the fresh grass can not be given; and, therefore, they are called "hays" in the following table.

In this connection is given also an analysis of English blue-grass seed, No. 126.

223. English blue-grass, from College grounds, cut when $\frac{8}{12}$ foot high, May 12, 1887.

232. Same, from same plot as No. 223; cut June 3, 1887, when just coming into flower, $\frac{3}{4}$ foot high.

239. Same; cut June 13, 1887; $\frac{3}{4}$ foot high; seed in milky stage, some nearly as hard as dough.

376. English blue-grass hay; Dr. Spurr; cut when heading.

378. English blue-grass hay; Dr. Spurr; cut when in bloom.

382. Same; seed fully formed.

126. English blue grass seed from I. Reese, Fern Leaf, Mason county, Kentucky.

Station Number	Substance Analyzed.	Per Cent. Dry Subtance	Analysis of Dry Substance, Per Cent.				
			Crude Protein	Ether Extract	Nitrogen Free Extract	Crude Fiber	Crude Ash
223	English blue-grass, State College grounds, May 12, 1887	23.43	15.50	5.50	46.71	20.81	11.48
232	English blue grass, State College grounds. June 3, 1887	25.64	9.76	3.02	49.82	28.72	8.68
239	English blue-grass, State College grounds, June 13, 1887	30.38	8.39	2.37	52.79	28.89	7.56
376	English blue-grass hay, Dr. Spurr, cut when heading	89.22	8.41	2.08	53.05	28.62	7.84
378	English blue-grass hay, Dr. Spurr, cut when in bloom	89.38	7.06	1.60	50.38	33.95	7.01
382	English blue-grass hay, Dr Spurr, cut when seed was fully formed	92.03	8.28	1.97	50.51	28.33	10.91
126	English blue-grass seed	91.13	13.99	1.62	56.50	21.67	6.22

TIMOTHY.

Two samples were taken from the Station grounds at different times. Besides these, four analyses of timothy hay from different parts of the State were made. Mr. A. P. Farnsley, of Louisville, sent in two samples (Nos. 397 and 398) of the same hay, the one housed in barn and the other stacked, with a view to ascertain what difference, if any, could be found in the composition of the hay preserved in the two ways.

233. Timothy from College grounds; cut June 3, 1878, when just headed out completely, but not in bloom; 2½ to 3½ feet high.

238. Same; cut June 13th, when in full bloom; 3 to 4 feet high.

377. Timothy hay; Dr. Spurr; crop, 1886; ripe and in good condition.

397. Timothy hay; A. P. Farnsley, Louisville, Kentucky; grown on rich land; made two tons per acre; cut when in full bloom; cured and stored in barn.

398. Same as 397, but taken from stack January 1, 1887.

371. Timothy hay; W. A. Reese, Eminence, Kentucky; cut when most of the bloom had fallen.

Station Number	Substance Analyzed.	Per Cent. Dry Substance	Analysis of Dry Substance, Per Cent.				
			Crude Protein	Ether Extract	Nitrogen Free Extract	Crude Fiber	Crude Ash
233	Timothy; College grounds, June 3, 1887	20.59	10.33	2.32	50.07	30.49	6.79
238	Timothy; College grounds, June 13, 1887	30.67	8.80	2.16	50.30	31.12	7.6
377	Timothy hay; R. J. Spurr; crop 1886; ripe; good	90.23	5.26	1.64	56.55	31.26	5.19
397	Timothy hay; A. P. Farnsley; from barn	88.87	4.56	1.80	51.27	27.10	4.14
398	Timothy hay; A. P. Farnsley; from stack	86.48	4.34	1.41	48.30	27.61	4.8
371	Timothy hay; W. A. Reese, Eminence, Ky.; crop of 1887	90.44	5.25	3.04	54.95	32.33	4.5

RED CLOVER.

Two samples of red clover were taken at different times from the College grounds to show the difference in composition at different stages of its growth. One sample, No. 231, was taken when the clover was just coming into full bloom; the other when the field was mown for hay two weeks later. The sample No. 227, was taken from the second crop of hay harvested in 1886 to determine how this compared in quality with the first crop, or with clover hay of ordinary quality. This sample was taken from the shock before it was perfectly cured, hence the large percentage of moisture.

231. Red clover; College grounds; cut May 28, 1887, when in full bloom. Only a few withered heads are to be seen.

242. Red clover; College grounds; cut June 13, 1887, at time of cutting for hay. In full bloom, and many heads brown and withered.

34. Red clover hay; State College grounds; cut May 22, 1886, when in full bloom.

227. Red clover hay; College grounds; second crop; cut July 30, 1886; sample taken from shock, and not perfectly cured.

396. "Saplin clover" hay; A. P. Farnsley, Louisville, Ky.; cut when blossoms commenced showing themselves; cured and stored in barn; grown on rich land.

372. Clover hay; W. A. Reese, Eminence, Ky.; cut when a few of the heads had begun to turn brown.

Station Number	Substance Analyzed.	Per Cent. Dry Substance.	Analysis of the Dry Substance, Per Cent.				
			Crude Protein	Ether Extract	Nitrogen Free Extract	Crude Fiber	Crude Ash
231	Red clover; State Col. grounds, May 28, 1887	24.75	15.31	3.71	51.59	21.57	7.82
242	Red clover; State Col. grounds, June 13, 1887	22.42	15.17	2.80	53.01	22.19	6 83
396	"Saplin clover" hay; A. P. Farnsley, Louisville Ky.	88.20	15.06	2.31	49.49	24.24	8.9
372	Clover hay; W. A. Reese, Eminence, Ky.; crop 1887	89.13	10.34	4.69	49.86	27.28	7.83
34	Red clover hay; Col. grounds, cut May 22, 1886	90.17	17.47	2.25	46.20	24.73	9 35
227	Red clover hay; Col. grounds, July 30, 1886	73.93	14.02	3.48	52.68	22.29	7 53

ALFALFA.

Three samples were collected at different times from a plot in the Station garden, to show its variation in composition at different periods of growth.

224. Alfalfa; College grounds; May 17, 1887; cut when about two feet high; flowers just beginning to appear.

230. Alfalfa; College grounds; cut May 22, 1887, when just fairly in bloom. Some heads have three or four of the lowest blossoms withered; all have the upper ones unopened. Plants two and one-half to three and one-half feet high.

240. Same; cut June 13, 1887; still flowering, but most of the heads are withered or have formed pods of considerable size.

Analysis of the Dried Substance.	224.	230.	240.
Crude protein	23.38	16.86	14.83
Ether Extract	4.48	3.00	2.07
Nitrogen free extract	40.53	47.27	51.22
Crude fiber	19.76	25.15	25.19
Crude ash	11.85	7.72	6.69
	100.00	100.00	100.00
Per cent. dry substance in the fresh sample	18.07	26.35	31.96

234. Orchard Grass (*dactylis glomerata*), from the College grounds; cut June 3, 1887, when in full bloom.

394. Red-top hay, from A. P. Farnsley, Louisville, Kentucky; grown on rich land; yielded 1½ ton per acre; cut in full bloom; cured and stored in barn.

395. Alsike clover hay, from A. P. Farnsley, Louisville, Kentucky; grown on rich land; cut when full ripe; cured and stored in barn.

Analysis of the Dry Substance.	234	394	395
Crude protein	8.86	4.34	12.25
Ether extract	2.27	1.53	1.66
Nitrogen free extract	51.40	53.74	43.49
Crude fiber	29.94	24.27	24.36
Crude ash	7.55	5.16	7.82
	100.00	100.00	100.00
Per cent. dry substance in the original sample	28.09	89.04	89.58

129. Hominy waste, sent by G. V. Green, Hopkinsville, Ky. This is the germ, etc., of the corn.

129*a*. Hominy waste, sent by T. L. Graham, Casky, Ky.

260. A new feed, sent by T. L. Graham, Casky, Ky. This appears to be the hull or bran of the corn grain.

288. Cotton seed meal, sent by T. L. Graham, Casky, Ky.

ANALYSIS OF THE DRY SUBSTANCF.	129.	129*a*.	260.	288.
Crude protein	12.41	13.73	17.89	46.95
Ether extract	11.37	13.60	8.35	12.12
Nitrogen free extract	67.97	62.01	60.92	28.20
Crude fiber	4.91	7.49	10.92	5.85
Crude ash	3.34	3.17	1.92	6.88
	100.00	100.00	100.00	100.00
Per cent. of dry substance in the original sample.	93.69	89.22	89.11	92.65

FERTILIZERS.

Besides the analyses of commercial fertilizers published in Bulletins numbers 7, 10, 12, 13 and 14 (see pages), nine other manufacturers' samples have been analyzed, as also twenty-one samples of commercial fertilizers, and nine miscellaneous fertilizing materials for farmers and others. These analyses are given in the following tables For explanations, see page

RAW BONE MANURES—MANUFACTURERS' SAMPLES.

Station Number	Name and Address of Manufacturer.	Name of Brand.	Pounds in the Hundred. Moisture	Phoshhoric Acid. In Fine Bone	In Medium Bone	Total	Equivalent to Bone Phosphate	Nitrogen	Equivalent to Ammonia	Potash	Estimated Value per Ton
269	A. B. Mayer Mfg. Co., St. Louis, Mo.	Bone meal	6.53	22.04	...	22.04	48.14	3.86	4.69	...	$33 74
383	Central Chemical and Mfg. Co., Cincinnati	Ammoniated ground bone	5.26	20.06	8.14	28.20	61.58	1.90	2.31	...	31 40
399	C. & F. Singer, Nashville, Tenn.	Pure raw bone meal	8.00	9.28	10.38	19.66	42.94	4.56	5.54	...	33 07
400	A. B. Mayer Mfg Co., St. Louis, Mo.	Anchor bd. pure bone ml.	7.15	16.02	5.20	21.22	46.34	3.92	4.76	..	32 69
403	Wm. Skene & Co, Louisville, Ky.	Pure raw bone dust	7.71	12.31	8.35	20.66	45.11	3.89	4.72	...	31 76

SUPERPHOSPHATES, ETC.—MANUFACTURERS' SAMPLES.

SUPERPHOSPHATES, ETC.—MANUFACTURERS' SAMPLES.

Station Number	Name and Address of Manufacturer.	Name of Brand.	Pounds in the Hundred.							Estimated Value per Ton
			Moisture	Phosphoric Acid.			Nitrogen	Equivalent to Ammonia	Potash	
				Soluble	Reverted	Insoluble				
41*a*	Rasin Fertilizer Co., Baltimore, Md.	Soluble Sea Island Guano	. . .	3.83	1.91	4.72	1.80	2.20	1.43	$26 04
91	Dambmann Bros. & Co., Balt. Md.	Osborne's Clover Leaf	13.41	7.43	2.28	3 48	0.05	0.06	2.00	27 05
92	Dambmann Bros. & Co., Balt., Md.	Pride of Kentucky	13.27	7.13	2.18	2.56	1.50	1.82	2.42	31 48
268	A. B. Mayer Mfg. Co., St. Louis, Mo.	Missouri Queen Fertilizer	4 95	1.98	4.66	4.13	1.55	1.88	2.15	23 35
275	Currie Fertilizer Co., Louisville, Ky.	Bone Phosphate	6.65	6.03	1.74	0.37	1.65	2.00	2.87	24 65
389	Zell Guano Co., Baltimore, Md.	Zell's Calvert Guano	12.47	7.20	2.65	2.74	0.77	0.93	1.54	26 20
416	P. B. Mathiason & Co., St. Louis, Mo.	Ammon. Bone Superphosphate	6.99	1.89	5.15	12.00	3.09	3.75	0.94	35 74

RAW BONE MANURES—SAMPLED BY FARMERS.

Station Number . . .	Sent or Collected by	Name of Brand.	Pounds in the Hundred.								Estimated Value Per Ton. . . . . . .
			Moisture . . .	Phosphoric Acid.				Nitrogen . . .	Equivalent to Ammonia. . .	Potash	
				In Fine Bone.	In Medium Bone. . .	Total. . .	Equivalent to Bone Phosphate. . .				
79	M. A. Scovell	Pure bonemeal, A.B.Mayer	5 40	. . . .	. . .	22.84	49.88	3.70	4 49	. . .	$37 66
128	Hancock Taylor, Worthington Ky .	Fine raw bone, N.W.F.Co.	3.70	23.62	2.34	25.96	56.69	2.85	3.46	. .	42 10
130	J. W. Harned, Boston Ky.	Champion bone dust . .	7.58	21.28	. . .	21.28	46.47	3.64	4.42	. . .	40 13
131	J. W. Harned, Boston, Ky.	Bone meal	6.78	14.73	6.31	21.04	45.96	3.82	4.64	. . .	39 30
132	C. M. Hanna, Cropper, Ky.	Homest'd desiccated bone	4.26	22.11	3.13	25.24	55 12	3.76	4.57	. . .	44 74
145	E. Thompson, Louisville, Ky.. . . .	Ground bones	4.06	. . . . .	. . .	7.77	16.96	1.34	1.63	1.80	14 95
287	Brown Bros., Somerset, Ky.	Fertilizer.	4.31	22.34	. . .	22.34	48.78	3.51	4.26	. . .	32 75
388	A. M. Slop, Woodburn, Ky.	Pure raw bone meal . . .	6.59	12 85	6.53	19.38	42 33	4.23	5.14	. . .	32 02
401	Brown Bros. & Co. Somerset, Ky.. .	Bone meal	8.10	22.26	. . .	22.26	48.62	3.59	4.36	. . .	32 96
405	Henry Stark, Glendale, Ky.	Fertilizer.	9.19	14.06	2.00	16.06	35.06	4.68	5.68	. . .	31 10

SUPERPHOSPHATES, ETC., SAMPLED BY FARMERS.

405	Henry Stark, Glendale, Ky.	Fertilizer.	9.19	14.06	2.00	16.06	35.06	4.68	5.68	. . .	31 10

SUPERPHOSPHATES, ETC., SAMPLED BY FARMERS.

Station Number . . .	Sent or Collected by	Name of Brand.	Pounds in the Hundred.							Estimated Value . . .
			Moisture	Phosphoric Acid.			Nitrogen	Equivalent to Ammonia	Potash	
				Soluble . . .	Reverted . . .	Insoluble . . .				
75	H. Clubb, Franklinton, Ky.	Homestead tobacco fertilizer	17.06	8.51	1.04	0 51	3.33	4.04	1.52	$36 37
77	F. M. Ingram, Farmers, Ky.	Charter Oak fertilizer	11.74	1.43	3.99	1.73	4.69	5.69	3.90	35 77
222	C. D. Runyon, Trenton, Ky.	Homestead tobacco grower .	15.56	7.75	1.46	1.15	2.90	3.52	2.20	31 98
235	C. D. Runyon, Trenton, Ky.	Homestead tobacco grower .	10.86	7.71	1.89	1.22	2.88	3 50	2.46	33 01
243	C. D. Runyon, Trenton, Ky.	Homestead tobacco grower .	12.54	7.72	2.09	0 85	2 86	3.47	2.79	33 39
337	Michigan Carbon Works, Detroit, Mich. .	Homestead tobacco grower .	. . .	. . .	. . .	0.17	3 67	4.46	8.47	. . .
338	Cincinnati Desiccating Co., Cincinnati, O. .	Tobacco grower	. . .	. . .	. . .	1.60	3.69	4.48	7.05	. . .
339	P. W. Justice, Halfway, Ky.	Rock City superphosphate .	7.70	1.64	7.93	1.06	2.09	2.54	2.58	30 09
402	Fird Pirtle, Beaver Dam, Ky.	Ralston's bone meal	7.23	0.35	7.07	3 15	1 77	2.15	. . .	23 73
404	Fird Pirtle, Beaver Dam, Ky.	Ralston's bone meal	6.35	0.24	5.00	10.09	1.86	2.26	. . .	25 25
406	L. T. Walker, Glendale, Ky.	Fertilizer	9.76	4.23	3.48	3.33	4 05	4.92	1.38	34 04
407	L. T. Walker, Glendale, Ky.	Homest'd corn & wh't grower.	9.12	8.51	2.39	1.47	1.85	2.25	1.83	31 47
411	W. R. Haynes, Elizabethtown, Ky.	Ralston's bone meal	19.39	0.19	4.42	7.57	2 40	2.91	. . .	23 92

333. Acidulated black obtained from the Michigan Carbon Works, Detroit, Mich., and used in the experiments on the Station farm.

Analysis.	333.
Available phosphoric acid	14.76 per cent.
Insoluble phosphoric acid	.32 per cent.
Total phosphoric acid	15.08 per cent.
Nitrogen	1.92 per cent.
Equivalent to ammonia	2.33 per cent.
Potash	0.45 per cent.

334. Sulphate of potash used in experiments on the Station farm.
335. Muriate of potash used on Station farm.

Analysis.	334.	335.
Potash per cent.	53.16	49.90

336. Sulphate of ammonia used in experiments on the Station farm.

Nitrogen	20.56 per cent.
Equivalent to ammonia	24.96 per cent.

100. Tan-bark ashes, sent by A. P. Farnsley, Louisville, Ky.

	100.
Phosphoric acid	0.54 per cent.
Potash	1.53 per cent.
Calcium oxide	43.10 per cent.

99. Tobacco stems sent by A. P. Farnsley, Louisville, Kentucky.
280. Tobacco stems sent by A. P. Farnsley, Louisville, Kentucky.

	99	280.
Moisture	....	16 65
Phosphoric acid	0.66	0.91
Nitrogen	3 47	2.24
Equivalent to ammonia	4.21	2 72
Potash	7.75	5 68

281. Saltpetre brought by Dr. J. F. Edgar, Lexington, Kentucky; sample from a lot bought by him of Wilder & Co., Louisville, to be used as a fertilizer.

	281.
Moisture	3.54 per cent.
Potassium, nitrate	4.24 per cent.
Sodium, nitrate	30.23 per cent.
Sodium, chloride	59.98 per cent.
Insoluble and undetermined	2.01 per cent.
	100.00 per cent.

189. Land plaster, sent by Hon. Abner King, Cox's Creek, Kentucky.

	189.
Water	19.85 per cent.
Calcium, sulphate	72.27 per cent.
Calcium, carbonate, insoluble and undetermined	7.88 per cent.
	100.00 per cent.

The analysis shows that the material contains about 92 per cent. o pure gypsum, and is, therefore, of very good quality.

MISCELLANEOUS ANALYSES.

276. Iron ore sent by Henry S. Barker, Louisville, Kentucky.
277. Iron ore sent by Henry S. Barker, Louisville, Kentucky.

	276.	277.
Iron	56.6	55.4
Phosphorus	0.08	0.84
Silica and insoluble matters	6.91	17.04

390. Iron ore from cut on the Spurr pike, near Greendale, Fayette county, Kentucky; brought by Dr. R. J. Spurr.

	390.
Ferric oxide	44.00, containing 30.8 iron.
Alumina	2.34
Phosphoric acid	2.55, containing 1.11 phosphorus
Sulphur	.06
Silica and insoluble	38.00
Water and undetermined	13.05
	100.00

370. Sandstone sent by W. W. Shelby, Henderson, Kentucky.

	370.
Ferric oxide and alumina	0.13
Lime	A trace.
Magnesia	0.04
Sand and insoluble matter	99.57
Moisture and undetermined	0.26
	100.00

387. Petroleum sent by V. H. Abbott, Winchester, Ky.

Specific gravity	0.920.	
Distillate from 242° to 262° F.	7.4	of specific gravity, 0.833.
Distillate from 262° to 302° F.	17.7	of specific gravity, .835.
Distillate from 302° to 322° F.	12.1	of specific gravity, .844.
Distillate above 322°	21.5	of specific gravity, .844.
Coke left in retort	19.0	
Gases and loss	22.3	
	100.0	

410. Pure New Orleans honey drip molasses, brought by Dr. R. J. Spurr, Greendale, Ky.

Water	24.2
Glucose, etc.	37.3
Dextrine, etc.	32.6
Ash	1.0
Undetermined and loss	4.9
	100.0

127. White Burley tobacco from A. L. Hamilton, Lexington, Ky.

Nicotine in the air-dried tobacco. . . . . 1.90 per cent.

CASE OF POISONING OF A COW FROM EATING TOBACCO.

In December, 1886, Mr. A. L. Hamilton, of Lexington, reported to the Station that, during the night, one of his valuable cows had gotten into a shed where tobacco was hanging, and was found dead in the shed next morning. Mr. Hamilton sent the viscera of the cow to the Station, where an inspection of the contents of the stomach showed the presence of numerous small fragments of tobacco leaves. The fragments were so small and so thoroughly mixed with the contents of the stomach, which was well filled, that no attempt was made to determine their amount. This, however, appeared to be small. A chemical examination of portions of the stomach and of its contents gave satisfactory evidence of the presence of nicotine. The liver also was examined, but in this case the chemical tests for nicotine were not clearly brought out.

The above circumstances seem to indicate conclusively that the cow died of nicotine poisoning resulting from eating tobacco. The case may serve to call attention to the danger of allowing stock access to places where tobacco is being cured, as a comparatively small quantity of tobacco swallowed will produce poisonous effects.

A sample of the tobacco also was sent by Mr. Hamilton. This was found to contain 1.90 per cent. of nicotine.

MINERAL WATERS.

42. From W. T. Elliott, Lewisport, Ky.
283. From B. F. Jenkins, Habit, Ky., from his "salts well."
284. From B. F. Jenkins, Habit, Ky., from his "chalybeate well."

Analysis in Grammes per Liter.	42.	283.	284.
Calcium carbonate	....	....	.041
Ferrous carbonate	.183	....	.040
Ferrous sulphate	.569	.002	.048
Manganous sulphate	.060	....	Trace.
Calcium sulphate	.998	1.474	.595
Magnesium sulphate	.255	2.928	.474
Sodium sulphate	.345	.651	.140
Potassium sulphate	.024	.041	.016
Sodium chloride	....	.348	.022
Lithium	Trace.	Trace.	Trace.
Silica	.500 }	.122	.110
Organic matter and loss	... }		
Total solids	2.934	5.566	1.486

49. From F. J. Crum, Beard, Kentucky.
259. From C. M. Crum, Beard, Kentucky.
282. From C. M. Crum, Beard, Kentucky.

Analysis in Grammes per Liter.	49.	259.	282.
Calcium carbonate	.407	.441	.426
Magnesium carbonate	....	....	.023
Ferrous carbonate	.002	Trace.	.062
Calcium sulphate	.867	1.426	.893
Magnesium sulphate	1.185	.771	1.257
Sodium sulphate	.048	.101	....
Potassium sulphate	.019	.020	.042
Sodium chloride	.207	.158	.232
Lithium	Trace.	Trace.	Trace.
Silica	.007	....	.005
Organic matter and loss	.075	....	....
Total solids	2.817	2.917	3.185

261. Mineral water from Gum Lick Spring, Grant county, Ky. Sent by J. A. Sechrest, Morgan, Ky.

Analysis in Grammes per Liter.	261.
Hydrogen sulphide gas	.020
Calcium carbonate	.087
Magnesium carbonate	.078
Sodium carbonate	.248
Sodium sulphate	.089
Potassium sulphate	.046
Sodium chloride	1.783
Sodium sulphide	.097
Silica	.005
Bromine, iodine, borates, lithium and strontium	Traces.
Total solids	2.432

This is a very good alkaline-saline sulphur water.

258. Sent by L. L. Buckner, Hopkinsville, Ky., from his well.
285. Brought by J. O. DeCourcy, Greenville, Ky., from his well.
286. Brought by J. O. DeCourcy, Greenville, Ky., from his spring.

Analysis in Grammes per Liter.	258.	285.	286.
Calcium carbonate	.332	.151	.069
Magnesium carbonate	.015	....	....
Ferrous carbonate	.007	....	.012
Calcium sulphate	....	1.102	.011
Magnesium sulphate	.009	2.549	.031
Sodium sulphate	....	.431	.017
Potassium sulphate	.013	.047	.008
Sodium chloride	.026	.189	Trace.
Lithium	....	Trace.	Trace.
Silica	.010	.037	.011
Total solids	.427	4.506	.159

MINERAL WATERS—QUALITATIVE ANALYSES.

276. Mineral water sent by R. S. Evans and Robert Walker, Scottsville, Kentucky. This water contains—

Calcium carbonate	Considerable quantity.
Carbonates of magnesium and iron	Traces.
Calcium sulphate	Considerable quantity.
Chloride of sodium	Considerable quantity
Sulphates of lithium and potassium	Small quantities.
Silica	Small quantity.

Total solid matters, 1.788 grammes per liter, equal 104.5 grains per gallon.

The sulphate of calcium is the largest constituent, amounting to 0.967 grammes per liter, equal to 56.5 grains per gallon. The quantity of lithium present is notable.

373. Water sent by B. F. Vanmeter. The water contains—

Calcium carbonate	All in small quantity.
Sulphates and chlorides of calcium, magnesium, potassium and sodium	All in small quantity.
Silica	All in small quantity.
Iron	A trace.
Organic matters	Notable.

Total solid matters, 0.459 gramme per liter, equal 26.8 grains per gallon.

The solid matter, chlorides and organic matter, are rather more than is usually found in our spring and well waters, which is a suspicious circumstance.

391. Water sent by G. W. Stevens, Livermore, Kentucky, from his well in McLean county. Qualitative tests were made, with following results:

Reaction, neutral.

Calcium carbonate	Considerable quantity.
Sulphates and chlorides of calcium, magnesium and sodium	Considerable quantity.
Nitra es	Notable quantity.

Total saline matters, 3.218 grammes per liter, equal 188 grains per gallon.

The principle constituent is magnesium sulphate, amounting to 2.037 grammes per liter, equal to 119 grains per gallon.

392. Mineral water sent by Mr. J. B. King, Bardstown, Ky. The water is from Elkton, the property of Mr. Ed. Weathers.

The water when received was colorless, but there were a few black flakes of ferrous sulphide at the bottom of the bottle. There was a slight smell of petroleum and strong smell of hydrogen sulphide.

The water contains—

Hydrogen sulphide	Considerable quantity.
Sodium sulphide	Considerable quantity.
Calcium carbonate	Small quanity.
Calcium sulphate	Considerable quantity.
Magnesium and sodium chlorides	Considerable quantity.
Lithium and potassium chlorides	Small quantity.

Total saline matters, 3.55 grammes per liter, equal 207.4 grains per gallon.

This is a good alkaline-saline sulphur water.

393. Mineral water sent by Mr. R. E. Duncan, Hawesville, Ky., from the farm of W. C Lambert, about four miles south of Hawesville.

Reaction, acid: Sulphates of iron, aluminium and of sodium	Considerable quantities.
Sulphate of calcium	Small quantity.
Soluble silica	Small quantity.
Sulphates of potassium and of lithium	Marked traces.

Total saline matters, 3.4 grammes per liter, equal to 198.6 grains per gallon.

The ferrous sulphate in this water amounts to 0.19 gramme per liter, equal to 11.1 grains per gallon.

ANALYSES OF DIFFERENT VARIETIES OF SORGHUMS.

The Department of Agriculture sent to this Station several varieties of sorghum for trial. The Sterling Syrup Works also sent us several varieties. Trials were made with these varieties in 1887 and 1888, the object being to find out what variety or varieties were richest in crystalizable sugar. A few fertilizer and other experiments were also made, which may be found in the tabulated results.

Table Giving Results of Analyses of Sorghum Juices, 1887.

Sorghum Cane, Season of 1887—Tests of Juice.	Specific Gravity	Degree Brix . .	Per Cent. Cane Sugar . . .	Per Ct Glucose.
Links Hybrid, topped and suckered; fertilized; Oct. 11.	1.071	17.2	10.71	0.73
Links Hybrid, suckered; fertilized; Oct. 11	1.080	19.3	11.83	0.96
Links Hybrid, natural growth; fertilized; Oct. 11 . .	1.077	18.6	11.98	1.04
Links Hybrid, natural growth; fertilized; Oct. 13 . .	1.080	19.3	12.57	0.77
Links Hybrid, natural growth; fertilized; Nov. 1*. .	1.089	21.3	14.35	0.62
Links Hybrid, suckers left; fertilized; Oct. 18. . . .	1.086	20.6	13.63	1.30
Links Hybrid, natural growth; not fertilized; Oct 11	1.079	19.0	12.34	0.70
Links Hybrid, natural growth; not fertilized; Oct. 20	1.085	20.4	15.52	0.61
Links Hybrid, natural growth; not fertilized; Oct. 20	1.081	19.5	12.52	0.59
Links Hybrid, natural growth; not fertilized; Nov. 1*	1 087	20.8	14.93	0.59
Links Hybrid, natural growth; not fertilized; Nov. 2*	1.079	19.0	12.89	1.11
Links Hybrid, natural growth; not fertilized; Nov. 2.	1.080	19.3	10.28	1.22
Links Hybrid, natural growth; not fertilized; Nov 2.	1.084	20.2	10.58	1.13
Links Hybrid, suckers left; not fertilized; Oct. 18. .	1.080	19.3	14.26	0.61
Links Hybrid, suckers left; not fertilized; Nov. 2*. .	1.080	19.3	11.23	1.02
Links Hybrid, topped and suckered; not fertilized; Oct. 18	1.080	19.3	14.02	0.75
Links Hybrid, topped and suckered; not fertilized; Nov. 2*.	1.070	17.0	10.52	1.11
Links Hybrid, suckered; not fertilized; Nov. 2* . . .	1.083	19.9	9.79	0.96
Links Hybrid, buried; Oct. 15	1.085	20.4	13.36	0.80
Early White, natural growth; fertilized; Oct. 12. . .	1.077	18.6	11.38	1.50
Early White, suckers left; fertilized; Oct. 20	1.064	15.6	8.98	1.83
Early White, natural growth; not fertilized; Oct. 12 .	1.073	17.7	10.09	1.50
Early White, natural growth; not fertilized; Nov. 1*.	1.064	15.6	9.93	1.18
Early White, suckers left; not fertilized; Nov. 20 . .	1.065	15.9	10.15	1.34
Early Orange, natural growth; not fertilized; Oct. 12.	1.077	18.6	11.91	2.46

Table Giving Results of Analyses of Sorghum Juices, 1887.—Continued.

SORGHUM CANE, SEASON OF 1887—TESTS OF JUICE.	Specific Gravity	Degree Brix . .	Per Cent. Cane Sugar . . .	Per Ct. Glucose
Early Orange, natural growth; not fertilized; Oct. 13.	1.073	17.7	10.25	1.79
Early Orange, natural growth; not fertilized; Oct. 21	1.076	18.4	11.88	2.74
Early Orange, natural growth; not fertilized; Nov. 1*	1.067	16.3	10.01	1.64
Early Orange, buried; Oct. 15	1.079	19.0	12.09	2.10
Early Orange, natural growth; from shock; Oct. 13 .	1.094	22.4	6.86	9.69
Honduras, large selected stalks; Oct. 15.	1.047	11.6	5.26	3.72
Honduras, large selected stalks; Oct. 21.	1.055	13.5	6.58	4.45
Honduras, large selected stalks; Oct. 30*	1.051	12.6	6.98	4.07
African; Oct. 21	1.074	17.9	10.53	1.37
African; Oct. 30*	1.071	17.2	10.15	1.46

* Severe frost October 2; heavy freeze on night of October 29.

A series of experiments was made with a view of testing the effect of fertilizers on the sugar content of sorghum canes. The variety used was Honduras Hybrid, which proved to be an inferior cane for the production of crystallizable sugar. Tests of the juice are given in the following table. The analysis of October 11th was made after a severe frost on October —.

Table Showing Effect of Fertilizers on the Sugar Content.

FERTILIZER EXPERIMENTS UPON HONDURAS HYBRID CANE, 1888—TESTS OF JUICE.	Specific Gravity	Degree Brix . .	Per Cent. Cane Sugar . . .	Per Cent. Glucose . . . .
Red tops, complete fertilizer, October 1	1.056	16.1	9.01	4.32
Red tops; complete fertilizer, October 11	1.059	14.5	6.16	5.76
Black tops; complete fertilizer, October 2	1.064	15.6	9.11	3.76
Red tops; acid black and sulphate of potash, Oct. 1. .	1.062	15.2	8.57	3.92

Table Showing Effect of Fertilizers on the Sugar Content—Continued.

Fertilizer Experiments Upon Honduras Hybrid Cane, 1888—Tests of Juice.	Specific Gravity	Degree Brix . .	Per Cent. Cane Sugar . . .	Per Cent. Glucose . . . .
Red tops; acid black and sulphate of potash, Oct. 11. .	1.065	15.9	9.52	3.75
Black tops; acid black and sulphate of potash, Oct. 2. .	1.059	14.5	7.86	3.93
Red tops; acid black and sulphate ammonia, Oct. 1. .	1.064	15.6	9.48	3.40
Red tops; acid black and sulphate ammonia, Oct. 11	1.060	14.7	7.95	4.39
Black tops; acid black and sulphate ammonia, Oct. 2 .	1.057	14.0	7.39	3.56
Red tops; sulph. potash and sulphate ammonia, Oct. 2.	1.054	13.3	6.45	3.89
Red tops; sulph. potash and sulphate ammonia, Oct. 11.	1.057	14.0	6.72	4.87
Black tops; sulph. potash and sulph. ammonia, Oct. 2.	1.054	13.3	6.17	4.41
Red tops; no fertilizer, October 1	1.069	16.8	10.21	3.60
Red tops; no fertilizer, October 11	1.062	15.2	8.40	4.28
Black tops; no fertilizer, October 2	1.060	14.7	8.21	3.63

Table Giving Analyses of Sorghums, 1888.

Varieties of Sorghum Cane, Season 1888—Tests of Juice.	Specific Gravity.	Degree Brix . .	Per Cent. Cane Sugar . . .	Per Ct. Glucose.
No Name; sampled September 29th.	1.047	11.7	4 02	4.87
Golden Rod; sampled September 29th	1.054	13.3	8.82	3.00
Golden Rod; sampled September 29th	1.052	12.9	5 86	3.45
Golden Rod; sampled October 3d	1.045	11.2	3.50	5 31
Golden Rod; sampled October 4th	1.060	14.7	8.45	3.57
Golden Rod; sampled October 6th	1.053	13.1	4.71	5.03
Early Amber; sampled September 29th	1.075	18.2	12.38	2 51
Early Amber; sampled October 3d	1.072	17.5	11.33	3.01
Early Amber; sampled October 10th	1.070	17.0	11.59	2 60

Table Giving Analyses of Sorghums, 1888.—Continued.

Varieties of Sorghum Cane, Season 1888—Tests of Juice.	Specific Gravity	Degree Brix . .	Per Cent. Cane Sugar . . .	Per Ct. Glucose.
Early Amber; sampled October 20th	1.055	13.6	9.58	3.20
Russell's New; sampled October 3d.	1.063	15.4	8.70	3.24
Russell's New; sampled October 10th.	1.056	13.8	7.77	3.23
Russell's New; sampled October 20th.	1.053	13.1	6.87	3.55
New Orange; sampled October 3d	1.063	15.4	6.99	4.84
New Orange; sampled October 20th	1.055	13.6	6.56	4.15
Links Hybrid; sampled October 3d.	1.063	15.4	9.32	3.24
Links Hybrid; sampled October 3d.	1.062	15.2	9.20	2.85
Links Hybrid; sampled October 10th	1.050	12.4	6.25	3.60
Links Hybrid; sampled October 20th	1.053	13.1	7.04	3.28
Little Sumach; sampled October 3d.	1.058	14.3	6.04	5.56
Amber and Honduras; sampled October 3d	1.051	12.6	4.10	6.13
Early Orange; sampled October 3d	1.064	15.7	9.25	3.41
Early Orange; sampled October 4th	1.066	16.1	9.48	3.75
Early Orange; sampled October 10th	1.048	11.9	4.79	4.96
Early Orange; sampled October 20th	1.056	13.8	7.47	3.72
Chinese Sugar; sampled October 4th	1.047	11.7	4.99	3.00
Honduras; sampled October 6th	1.045	11.2	1.59	6.03
Goose Neck from Texas; sampled October 4th	1.057	14.00	6.90	4.59
Honey Drip; sampled October 4th	1.059	14.5	6.55	5.05
Honey Drip; sampled October 4th	1.061	15.0	7.08	4.96
Honey Drip; sampled October 5th	1.065	15.9	8.32	4.26
Honey Drip; sampled October 20th.	1.055	13.6	6.92	3.95
Kansas Orange; sampled October 4th.	1.069	16.8	9.87	3.74
Kansas Orange; sampled October 5th.	1.059	14.5	7.11	5.05
Kansas Orange; sampled October 20th	1.050	12.4	6.79	3.60
African; sampled October 4th	1.048	11.9	4.58	4.54

Table Giving Analyses of Sorghums, 1888—Continued.

Varieties of Sorghum Cane, Season 1888—Tests of Juice.	Specific Gravity.	Degree Brix . .	Per Cent. Cane Sugar . . .	Per Ct. Glucose.
Dutchess Hybrid; sampled October 4th	1.065	15.9	9.04	4.15
White Amber; sampled October 4th	1.072	17.5	11.40	3.33
White India; sampled October 5th	1.056	13.8	6.47	4.15
White India; sampled October 5th	1.052	12.9	4.89	5.00
White India; sampled October 20th	1.043	10.7	3.30	5.04
New Sugar Cane; sampled October 6th	1.052	12.9	3.80	6.18
Old Chinese; sampled October 5th	1.062	15.2	8.84	3.65
Red Liberian; sampled October 6th.	1.056	13.8	2.52	8.76
White Mammoth; sampled October 6th	1.057	14.0	6.94	4.44
Medium Orange; sampled October 10th.	1.050	12.4	5.42	4.01
Swan's Early Golden; sampled October 20th	1.068	16.6	10.81	2.46

BULLETIN No. 1.

Do Fertilizers Affect the Quality of Tobacco?

LEXINGTON, KY., December 23, 1885.

This question being one of considerable interest and great importance, was made the subject of a series of preliminary experiments at the Experiment Station this fall. From the results obtained, we have been encouraged sufficiently far, so that we intend to make a number of additional experiments next year. No attempt was made to weigh the amount of tobacco obtained in each test, since we wished primarily to see what promised most for obtaining tobacco that would bring a good price. Naturally and incidentally we took note of the largest visual yield, but nothing more.

The soil on which these experiments were made is known as the "blue-grass soil." It is characteristically rich in phosphates.

Dr. Peter kindly furnishes us with the composition of such a soil taken from a neighboring field, showing 0.492 per cent. phosphoric acid.

The soil has been in cultivation three consecutive years with tobacco. No fertilizers were used prior to this year. For the purpose of the experiment, the ground was laid off into equal plots.

The plots were all nine feet wide and twenty-seven feet long, the tobacco being planted in the usual way. The variety was White Burley. The fertilizer was scattered broadcast when the plants were about four to five inches high. Seven plots were made, called respectively A, B, C, D, E, F, G. The tobacco resulting was graded by Mr. Jones, of the Falls City Tobacco House, Louisville, Kentucky, a gentleman who has had very large experience in the tobacco trade, and whose results are perfectly reliable.

Plots . . .	Fertilizer Used.	Pounds . .	Grade Obtained.
A	Sulphate of lime	2	
	Nitrate of potash.	1⅝	Fair red filler.
	Nitrate of Soda	½	
	Sulphate of lime or plaster . .	1	
B	Superphosphate of lime	2	
	Nitrate of potash.	1⅝	Good red leaf.
	Sulphate of lime	1⅝	
C	Nitrate of potash.	1⅝	Bright leaf; good plug filler; best grade.
	Sulphate of lime	1⅝	
D	Superphosphate of lime.	2	
	Nitrate of soda	2½	Good lugs.
	Sulphate of lime	2½	
E	Precipitated calcic phosphate . .	2⅓	
	Nitrate of potash.	⅝	Common red leaf.
	Nitrate of soda.	1⅝	
F	Nitrate of soda.	1⅝	Common red filler.
G	Nothing	. . .	Tips.

An examination of these results show us that on plot C the best grade of tobacco grew. The largest yield was on plots A and C, the smallest on plot G. We give these tentative experiments to the public to show the line we must follow next year, when we not only hope to improve the grade of the yield, but make the quantity increase in direct ratio to the quality.

These results show conclusively that the quality and quantity of tobacco can be improved by the application of fertilizer to such a soil.

By ALBERT E. MENKE,
Professor of Agriculture, Organic Chemistry and Veterinary Science.

M. A. SCOVELL, *Director.*

BULLETIN No. 2.

Corn Fodder as Food for Stock.

Corn fodder—or stover, as the fodder from which the ears have been taken is sometimes called to distinguish it from corn cut before the ears have developed—like all other fodders, contains four classes of food ingredients, each of which is essential to life. These ingredients are called food nutrients, and are classified as follows:

1. Nitrogenous organic substances, usually called albuminoids or protein compounds. A food is generally valued for the amount of digestible albuminoids it contains, as this is the flesh-producing substance.

2. Fats.

3. Carbohydrates, as starch, sugar, fiber, etc.

In an analysis the fiber is separated from the other carbohydrates.

4. Mineral matters, as potash, lime, etc.

These mineral substances are essential to life, but as they always exist in sufficient quantities, their value is not taken into consideration.

If all plants used as food for stock contained each of the ingredients in such a form as to be completely digested when fed, then an analysis of any fodder would reveal its value. But such is not the case. The examination of the solid excrements of animals invariably shows the presence of albuminoids, fats and carbohydrates. This shows that some of the food has passed through the body undigested.

This loss of food has been found to depend upon the *kind* of fodder fed, its *mechanical* condition, and upon the *proportion* existing between the classes of food ingredients. In order then to find the real value of corn fodder as a food for stock, it would be necessary—

1. To note its mechanical condition.

2. To analyze an average sample to ascertain the amount of each food ingredient it contains.

3. To ascertain from feeding experiments the amount not digested in passing through the body.

4. To find the relative proportion existing between the digested parts of the different ingredients.

This Station is not prepared to make feeding experiments for the purpose of ascertaining the digestibility of feeding stuffs. Consequently, we shall have to depend on results obtained or assumed elsewhere for the per cent. of digestibilty of the different nutrients in the sample of corn fodder under consideration.

The mechanical condition of the fodder here reported is such that only a little over one-half is readily eaten by stock, the greater portion of the stalk being left as you state.

To test the quality of the sample as a food, the leaves, husks and upper part of stalks were subjected to an analysis. In every 100 parts of the entire fodder there was found to be 47½ parts of stalks uneaten. There would be, therefore, 52½ parts of leaves, tops and husks. One hundred pounds of these leaves, tops and husks were found to contain of—

Moisture	15.44 pounds.
Protein	8.30 pounds.
Fats	1.65 pounds.
Carbohydrates	44.63 pounds.
Crude fiber	23.40 pounds.
Ash	6.58 pounds.
Total	100

Or in 100 pounds of the dry leaves, etc., there is of—

Protein	9.81 pounds.
Fats	1.96 pounds.
Carbohydrates	52.78 pounds.
Crude fiber	27.67 pounds.
Ash	7.78 pounds.
Total	100

This analysis shows it to have about the same composition as inferior hay, as reported by E. Wolff, of Germany.

As before stated, the solid matter is not all digestible. From the many experiments made on coarse fodder, and from comparison, we estimate that there is in 100 pounds of the dry matter the following amounts of digestible nutrients:

Protein	4.91 pounds.
Fats	0.58 pounds.
Carbohydrates, includiug fiber	52 48 pounds.

From this we calculate protein to be to the other nutrients as 1 to 11.

It has been found, by careful and long continued feeding experiments, that the proportion of digestible nitrogenous matter or protein to the other nutrients, should be taken into consideration in feeding stock. Wolff recommends the following: For the production of milk, the ratio to be as 1 to 5.4; for fattening cattle, 1 to 5½ to 1 to 1.6½; for keeping stock over winter, about 1 to 12.

This fodder will do, therefore, to feed to carry stock through the winter, but for milch cows and stock being fattened it should be fed along with other food richer in protein, as bran, corn, or cotton seed meal.

The value of a food depends upon its digestible nutrients. Digestible proteins and fats are more valuable than carbohydrates and fiber; feeds containing large quantities of digestible nitrogenous matter and fats sell much higher in the market as compared with other feeds rich only in carbohydrates.

In Germany they estimate the money value of digestible nutrients as follows:

Carbohydrates	9 mills per pound.
Protein	4⅓ cents per pound.
Fats	4⅓ cents per pound.

In a ton of leaves, tops and husks of this fodder, we find the following amounts of digestible nutrients:

Protein	83.00 pounds.
Fats	9.8 pounds.
Carbohydrates, including fiber	892.60 pounds.

But to find the money value per ton of the fodder, stalks and all, we shall have to include the stalk as waste matter, or 52½ of the above value.

Thus calculating, we have in one ton of corn fodder:

Digestible protein	43.68 pounds.
Fats	5.15 pounds.
Carbohydrates, including fiber	468.60 pounds.

Or, estimating the money value of each nutrient as given above, the value per ton of the corn fodder, when properly fed, would be $6.33 per ton.

Good timothy hay contains in 100 pounds:

Digestible protein	5.8 pounds.
Digestible fats	1.4 pounds.
Digestible carbohydrates and fiber	43.4 pounds.

Assuming that such hay is all eaten by stock, it would be worth, figured on the same basis, $13.80, or over twice the value of such corn fodder.

This sample of stover is superior, with one exception, to stover grown elsewhere, as shown by analyses, in most instances remarkably so.

The following table shows its comparative merits with other samples. The analysis of No. 7 is based on the separate analyses of the eaten and uneaten portions of the fodder:

Composition of Stover.

	As Reported by	Protein	Fats.	Carbohydrates . .	Crude Fats. . .	Ash . . . . . .
1	New Jersey Ex. Sta. Report, 1884.	4.43	0.91	52.10	37.22	5.34
2	New Jersey Ex. Sta. Report, 1884.	4.82	1.07	52.06	35.64	6.41
3	New Jersey Ex. Sta. Report, 1884.	4.74	1.46	52.87	35.52	5.41
4	Connecticut Ex. Sta. Report, 1879.	7.57	1.75	52.49	33.06	5.13
5	Connecticut Ex. Sta. Report, 1881.	9.36	2.14	47.41	35.44	5.65
6	Massachusetts Ex. Sta. Report, 1884	6.58	1.27	54.75	34.28	3.12
7	Sample analyzed at this Station. .	8.82	1.70	51.38	31.61	6.49

An analysis of a sample taken from a single field will not justify the assumption that the fodder owes its superior quality to our soil and climate, but the results justify further investigation. For this purpose the Station is carefully collecting samples from various fields in the blue-grass region as well as elsewhere, and will also make analyses of hay and other forage crops as you suggest.

M. A. Scovell, *Director*.

BULLETIN No. 4.

Distillery Slop.

[By Albert E. Menke, Professor of Agricultural Chemistry, and R. T. Gunn, Student in the Kentucky State College.]

Distillery slop is a substance largely used as a food for cattle in this State. A determination of its value is, therefore, a matter of considerable interest. An examination shows that it is an essentially nitrogenous food, being especially rich in digestible protein. The albuminoid substances found in animals seem to depend upon plant life for their synthetical production, although the steps by which they are ultimately formed must be many and complicated. Of their nature we have as yet but little knowledge. The herbivora derive them from the vegetables in which they are contained, and the carnivora from the animal food of which they partake. Thus, by such processes of modification as are brought about in the digestive apparatus, these albuminous principles, primarily of vegetable origin, become part of the animal body.

Analysis of the slop as it comes direct from the distillery shows the following composition:

Water	93.70 per cent.
Protein	1.85 per cent.
Carbohydrates	2.81 per cent.
Fat	.87 per cent.
Crude fiber	.58 per cent.
Ash	.19 per cent.
	100.00 per cent.

These results show a high percentage of water and protein. The large amount of water makes the addition of some dry fodder, like hay, desirable, while advantage may be taken of the high protein percentage by admixture with fodder deficient in this substance. This mixture usually causes a considerable gain of flesh. Experiments made by Kuhn and Fleischer illustrate this point well. We quote a discussion of their results by Armsby: "Two cows were fed during a first period with hay, either alone or with the addition of starch, and in a second period a nitrogenous bye fodder was added. The hay used contained an unusually small quantity of protein, and a comparatively small amount of it was consumed, so that the food in the first period was far from rich. Even the addition of the nitrogenous bye fodder in the second period did not make it particularly so, but it nevertheless caused a considerable gain of flesh which continued for some time. The experiments covered, including the preliminary feeding, from twenty-two to twenty-four days, and the gain in the last six days was fully equal to that at the beginning. The table shows the results obtained during the experiment proper, exclusive of the preliminary feeding, and also the protein consumption and the gain of protein for the last five days of the feeding with nitrogenous bye fodder:

Cow No. 1.

Date.	Fodder.	Digested per Day.		Nutrient Ratio, 1 . . .	Protein Consumption per Day, Grammes .	Gain of Protein per Day, Grammes . .
		Protein Gr'ms .	Carbohydrates Grammes . .			
Dec. 26-Jan. 6.	Hay	393	4.800	12.2	187	−5.9
Jan. 17-Feb. 1. . . . / Jan. 27-Feb. 1. . . .	Hay and rape cake . .	680	4 985	7.3	343 / 343	+124.7 / +117.8

Cow No. 2.

Date.	Fodder.	Protein Gr'ms .	Carbohydrates Grammes . .	Nutrient Ratio, 1 . . .	Protein Consumption per Day, Grammes .	Gain of Protein per Day, Grammes . .
Feb. 16-Mar 3	Hay and starch	394	5.550	14.1	156	+40
March 12-27 . . . . / March 22-27	Hay and beans	728	5.570	7.6	333 / 332	+182.2 / +181.9

The addition of protein to a ration poor in this substance caused a considerable gain of flesh by the animals. At the same time it did not fail to affect the protein consumption, approximately doubling it in each case. We conclude, then, that in the case of the herbivora protein added to a ration does not pass so promptly and completely into circulatory protein as it does in the carnivora, but may cause a considerable gain of flesh. This inclination toward the formation of organized rather than circulatory protein seems to be a characteristic of the herbivora, perhaps due in part to the large amounts of non-nitrogenous food which they consume, and in part to the considerable quantities of fat usually laid up in the bodies, and is a circumstance favorable to economy in feeding. Experiments made by stockmen show that when animals are being fed upon a food already rich in protein, if a change be made to another food containing a greater per cent. of protein, the gain is much smaller, and is accompanied by a greatly increased protein consumption.

Analysis of the Air-dried Slop.

The substance for this analysis was prepared by decanting off the water and straining. The residue was then dried in the sun for several days. The following results were obtained:

Water	6.00 per cent.
Protein	27.49 per cent.
Carbohydrates	41.99 per cent.
Fat	12.99 per cent.
Crude fiber	8.88 per cent.
Ash	2.65 per cent.
	100.00 per cent.

This result shows what would naturally be expected, that the individual percentages are higher. A food of this last description is exceedingly rich in valuable nutrients. The following table shows a comparison with other highly nitrogenous foods:

	Water	Protein	Carbohydrates	Fat	Crude Fiber	Ash
Alsike or Swedish clover	16.7	15.3	29.2	3.3	30.5	8.3
Sweet clover hay	16.7	14.9	34.3	3.5	25.6	8.5
Wheat grain	14.4	13.0	67.6	1.5	3.0	2.0
Corn	14.4	10.0	68.0	7.0	5.5	2.1
Field beans	14.5	25.5	45.5	2.0	11.5	3.5
Cotton seed cake and meal	7.0	42.9	18.6	17.3	7.4	6.8
Rape cake	15.0	28.3	33.5	9.0	15.8	7.4
Oil cake from maize chits	10.8	13 5	50.1	10.8	8.6	6.2
Distillery slop, air-dried	6.0	27.4	41.9	12.9	8.8	2.6
Distillery slop	93.7	1.85	2.81	0.87	0.58	0.19

A calculation of the money value of distillery slops, on the basis that all is digestible, would yield the following results :

Carbohydrates	At 9 mills per pound.
Protein	At 4⅓ cents per pound.
Fats	At 4⅓ cents per pound.

In a ton of distillery slops (2,000 pounds) we find the following amount of—

Protein	37 pounds.
Fats	17.4 pounds.
Carbohydrates	56.2 pounds.
Water	1874.0 pounds.

Thus calculating, we have a valuation per ton of $2.86.

A similar calculation of the air-dried slop yields the following result:

Protein	549.8 pounds.
Fats	259.8 pounds.
Carbohydrates	1017.4 pounds.
Water	120.0 pounds.

Showing a money value per ton of $44.96.

Analysis of Slop Water.

The watery part of the slop having been strained off, it was evaporated to dryness on the water bath and then heated in the water oven (to complete the drying) for some time. It was not deemed advisable to dry at a high temperature, as decomposition apparently commences at 150 degrees C. It can, however, be perfectly dried by continued heating at 120 degrees C., until a constant weight is obtained. The product was a dark brown viscous mass, almost solid, giving an acid reaction. It contained—

Fat	1.71 per cent.
Glucose	10.08 per cent.
Gum	37.60 per cent.
Protein	9.62 per cent.
Fat acids	9.52 per cent.
Water	22.61 per cent.
Ash	8.86 per cent.
	100.00

It having been found that the greater part of this portion of the slop is composed of inorganic substances, a determination of the proportion of each ingredient was deemed advisable. The following results were obtained:

Potash	17.20 per cent.
Soda	1.05 per cent.
Magnesia	9.29 per cent.
Manganese	.10 per cent.
Lime	17.18 per cent.
Phosphoric acid	28.45 per cent.
Sulphuric acid	2.44 per cent.
Silica	1.58 per cent.
Clorine	4.32 per cent.
Iron and alumina	19.21 per cent.
	100.82 per cent.

A determination of the amount of total solids in the slop water gave a result of 2.27 per cent.

A calculation of the value of the watery part of distillery slop as a manure on the following valuations, pretty generally adopted by the Experiment Stations:

Organic nitrogen in cotton seed and linseed meal and castor pomace	17 cents per lb.
Phosphoric acid, soluble in water	8 cents per lb.
Potash as sulphate	5½ cents per lb.
Potash as kainite	4¼ cents per lb.
Potash as muriate	4¼ cents per lb.

Gives as a money value per ton about twenty cents. If the water were allowed to evaporate, and the residue incinerated, the ash remaining would be worth, calculated on the foregoing basis, per ton, $64.44.

In some distilleries it is customary to use this watery part for the purpose of making fresh mash, and sometimes the same water is made to last the entire season. It has then almost the consistency of molasses, owing to the large amount of matter it contains in suspension and solution. As it is impossible just at present to obtain any of this substance for examination, it must be deferred untillater. That from which the foregoing analysis was obtained had been partly used several times, fresh water having been added to make up. The uses to which the watery part could be applied as a manure, would be particularly to grain crops. It being evident, from the high percentages of phosphoric acid it contains, that it is essentially a phosphatic manure, and hence should be applied to crops that are especially benefited by liberal applications of a manure of this description.

It is customary in this State to allow three pecks of mixed slop, *i. e.*, the solid and water, per head of cattle. A calculation of the percentage of each substance in the slop shows the following parts by weight to be found in a peck. The average weight of one peck is 17 lbs., 12 oz., 5 dwt:

	Pounds	Ounces	Pennyweights . .
Water	15	12	4
Protein	....	8	4
Fiber	....	2	6
Carbohydrates	....	6	4
Fat	....	3	16
Glucose	....	....	11
Gum	....	1	11
Ash	....	8	18
Fat acids	....	....	11
	17	12	5

The slop used in this investigation was obtained from the distilleries in the immediate neighborhood.

BULLETIN No. 5.

Analyses of Feeding-Stuffs.

The object of the following analyses of hays, grasses, fodders, etc., was—

1. To ascertain the relative value as a food of the different substances analyzed.

2. To show the effect of cutting and curing hays at different periods of growth on their nutritive value.

3. To compare the composition of feeding stuffs raised in Kentucky with those raised elsewhere.

Definition of Terms.

The following remarks are deemed essential to the ready understanding of analyses to follow:

In giving the results of an analysis we show the amount of water, protein, fat, nitrogen-free extract, fiber and ash the substance contains.

Water.—However dry feeding-stuffs may appear to be, they always contain a variable proportion of water, which, although not visible, can be driven off by heat. This amount of water in feeding-stuffs is constantly changing with the temperature and moisture of the air to which they are exposed. In order, then, to make proper comparison of different foods, the amount of water must be estimated and subtracted, and the comparison made on the dry or water-free substance.

Protein or Albuminoids.—This is the substance which the animal works over into flesh, tendons, muscles and the various tissues and membranes. It is distinguished from the other substances by containing the element nitrogen. The proportion of protein which a feeding-stuff contains is an important element in determining its value; and those fodders which contain its compounds in the largest quantity are, other things being equal, the most valuable, since the protein is the most expensive ingredient to produce.

Fat includes oil, coloring matter, wax and every thing extracted from the dry feeding-stuff by ether.

Nitrogen-free extract, or *carbohydrates,* includes starch, sugars, gums and other related bodies.

55402

Crude fiber is the insoluble portion of the plant left after boiling successively with weak acid and alkali, thoroughly washing with hot water, then with alcohol, and finally with ether. It is the essential constituent of the cell walls of plants. The amount of this substance generally increases with the age of the plant, and tends to make it *woody* and *hard*.

Ash is the residue remaining when a plant has been burned. It contains the mineral matters extracted by the growing plant from the soil, such as phosphoric acid, potash, lime, magnesia, soda, sulphuric acid, and mineral matters that are essential to animal life.

It is quite essential, in order to understand the value of an analysis of a feeding-stuff, that the above terms be thoroughly understood, and their relation to physiological functions known. The following clear exposition of the matter is taken from the annual report of the Connecticut Experiment Station, 1885:

"Protein may easily be made over by the animal into its own substance, *i. e.*, into muscles, tendons and the various working tissues and membranes which are necessary parts of the animal machine, because it is made up of the same kind of materials, is, chemically speaking, of the same composition.

"Fiber and the nitrogen free extract, on the other hand, probably can not serve at all for building up the muscles and other parts of the growing animal, and can not restore the waste and wear of those parts of mature animals, because they are of a very different nature. They contain no nitrogen, an element which enters into all the animal tissues (albuminoids) to the extent of some sixteen per cent. of their dry matter.

"Fiber and the nitrogen free extract can not restore the worn out muscles or membranes of the animal any more than coal can be made to renew the used up packing, bolts, valves, flues and gearing of a steam engine. Protein is to the ox or the man what brass and iron are to the machine—the materials of construction and repair.

"Fat, fiber and nitrogen free extract are, furthermore, to the animal very much what coal and fuel are to the steam engine. Their consumption generates the power which runs the mechanism. Their burning (oxidation) in the blood of animals produces the results of life just as the combustion of coal in the fire-box of a steam engine produces the motion and power of that machine.

20477

"There is, however, this difference between the engine and the animal. The former may be stopped for repairs; the latter may run at a lower rate, but if it be stopped it can not resume work. Hence the repairs of the animal must go on simultaneously with its wastes. Therefore the material of which it is built must admit of constant replacement, and the dust and shreds of its wear and tear must admit of escape without impeding action. The animal body is as if an engine were fed not only with coal and water, but with iron, brass and all the materials for its repair, and also is as if the engine consumed its own worn-out parts, voiding them as ashes or as gas and smoke. Protein or the blood and tissue-former is thus consumed in the animal, as well as the fat, fiber and nitrogen free extract or fuel proper. The fact that protein admits of consumption implies that when the proper fuel is insufficient, protein may itself serve as a fuel. Such is the case, in fact. But, nevertheless, the two classes of substances have distinct offices in animal nutrition."

Digestibility.

It has been found by actual feeding experiments that much of the food eaten by stock passes through the body undigested and unassimilated. This loss of food depends upon various causes, but mainly upon the kind of fodder, its mechanical condition, and the relation existing between the protein and other nutrients in the ration.

As only the digestible portion of the feeding-stuffs is of value, it is essential to know what part of the various ingredients of a feeding-stuff is actually digested by the animal. This is learned by a feeding trial upon animals. The weight and composition of the food consumed during the experiment, as well as the excreta voided, being known, it can be calculated how much protein, fiber, nitrogen-free extract, fat, etc., was eaten, and how much of each of these several materials was voided. The difference shows the amount that served as actual nourishment.

Many practical trials have been made, chiefly in Germany, to determine the digestibility of the different feeding-stuffs most commonly in use. Based on these results, and from observations and from calculations, Wolff and others have produced tables of the digestibility of feeding-stuffs. For the want of actual experiments in determining the digestibility of the hays, etc., analyzed below, we have made use of these tables in calculating their digestibility.

Comparative Valuation per Ton.

It is difficult to give a just valuation to food of different kinds wherein the value is determined from the amount of the different food nutrients. There are many things to take into consideration: the proportion existing between the protein, nitrogen-free extract, fiber and fat; the appetite of the animal; the effect on the animal system; the object of production, whether for food alone or to enrich and improve the soil as well. Clover is often raised more to improve the land than for hay. Root crops also have a beneficial effect on many soils. These have their influence on the commercial value of feeding-stuffs. But the comparison becomes valuable nevertheless, when the outside influences are taken into consideration, and especially is the comparison of great value in foods of the same general characteristics.

In calculating the money value of the feeding-stuffs below, we estimate digestible protein at four and one-third cents per pound; digestible fat at four and one-third cents, and digestible nitrogen-free extract and fiber at nine-tenths of one per cent. per pound.

Nutritive Ratio.

As stated above, the money value alone, based on the food nutrients, is not a sufficient guide for the farmers to determine the feeding value of a given hay or fodder.

The quality of the food should always be taken into consideration, and the proportion existing between the protein and other nutrients, *i. e.*, nitrogen-free extract, fiber and fat, and for what special object the food is given, whether for the production of growth, flesh, milk, or wool, or to compensate for waste of the body when at work or at rest.

Experience has demonstrated that a special ratio of digestible protein to digestible fiber, fat and nitrogen-free extract, for each special case of animal nutrition, is necessary within certain limits, and the most economical. This proportion existing is called the *nutritive ratio*. In general, the wider the ratio existing between the protein and the other nutrients, the less valuable the food.

The following table, founded on experiments, is given to show the proportion that should be maintained for economical purposes between the protein and the other nutrients of feeding-stuffs, for each special case of animal nutrition. When a given food does not come up to this standard, the ration should be composed of mixed foods, in such proportions that this standard can be reached :

	Nutrition Ratio.
Milch cows	1 to 5.4.
Horse at light work	1 to 7.
Horse at hard work	1 to 5.5.
Sheep, wool producing	1 to 8.
Sheep, fattening, first period	1 to 5.5.
Sheep, fattening, second period	1 to 4.5.
Growing cattle	......
Calves	1 to 5.
Yearlings	1 to 7.
Cattle	1 to 8.

The amount of dry substance is always to be considered in making food ratios.

Referring to the analyses of clover-hays below, we find the nutritive ratio to be from 1:4.3 to 1:7.6. Most of these hays, therefore, would be a good food for milch cows—even if fed alone—while our timothy hays should have to be fed in connection with other foods richer in protein compounds.

CORN FODDER.

1. Corn fodder or stover, raised in Fayette county, on blue-grass soil.

Leaves, tops and husks analyzed. Per cent. of leaves, tops and husks, 52½. Sample taken from experimental ground. Corn cut while green. Ears left to ripen in shock, then husked and fodder re-shocked. Leaves quite green. Corn in crib too green to keep well.

Analysis No. 1.

CONSTITUENTS.	Pounds per Hundred	Pounds per Hundred, water-free	Per Cent. Digestibility	Pounds Digestible in Ton of Fodder	Calculated Value.
Water	15.44	. . . .	. . . .	. . . .	. . . .
Ash	6.58	7.78	. . . .	. . . .	. . . .
Protein	8.30	9.81	51	84.60	$3 66½
Fat	1.65	1.96	41	13.60	59
Fiber	23.40	27.67	54	252.80	2 27½
Nitrogen-free extract	44.63	52.78	58	517.80	4 66
Total	100.00	100.00	. . . .	868.80	$11 19

Nutritive ratio, 1: 9.5.

5. Corn fodder or stover; Fayette county. Leaves, tops and husks were the parts analyzed. In every 100 pounds of the fodder there were 58 pounds of leaves, tops and husks.

The sample was fairly well preserved; leaves with a greenish cast; cut when corn was just ripe.

Analysis No. 5.

CONSTITUENTS.	Pounds per hundred	Pounds per hundred, water-free.	Per Cent. Digestibility	Pounds Digestible in one Ton. . .	Calculated Value.
Water	16.23	. . . .	. . . .	. . . .	. . . .
Ash	6.47	7.72	. . . .	. . . .	. . . .
Protein	4.85	5.79	51	49.47	$2 14
Fat	1.36	1.62	41	11.15	48
Fiber	24.91	29.74	54	269.03	2 42
Nitrogen-free extract	46.18	55.13	58	535.69	4 82
Total	100.00	100.00	. . . .	865.34	$9 86

Nutritive ratio, 1: 16.8.

7. Corn fodder or stover; Fayette county. Leaves, tops and husks were the portion analyzed. In 100 pounds of fodder there were 57 parts of leaves, tops and husks.

Fodder not so good; leaves not greenish.

Analysis No. 7.

CONSTITUENTS.	Pounds per hundred.	Pounds per hundred, water free.	Per Cent. Digestibility.	Pounds Digestible in one Ton.	Estimated Value.
Water	18.00	. .	. . . .	. . . .	. . . .
Ash	7 00	8.54	. . . .	. . . .	. . . .
Protein	4.30	5.24	51	43.86	$1 90
Fat	1.32	1.61	41	10.82	47
Fiber	25.44	31.03	54	275.75	2 48
Nitrogen-free extract	43.94	53.58	58	509.70	4 59
Total	100.00	100.00	. . . .	899.50	$9 44

Nutritive ratio, 1: 19.9.

From these analyses of corn stalks or stover, we are led to the conclusion that the leaves and tops make a very good fodder. The difficulty in estimating the true value of this fodder is the lack of feeding experiments showing the digestibility of the different ingredients. In the tables of digestibility the coefficients of digestibility of stover is given the same as that of wheat straw; but it is reasonable to suppose that stover of as good a quality as that of the leaves and tops of the samples above is far more digestible than wheat straw. The analyses show the tops and leaves to be equal to, if not better than, our timothy hays given below. We have assumed, therefore, the digestibility of the above samples to be equal to that of timothy hay, and the comparison is made from this stand-point. Early feeding experiments are very desirable to determine this matter. The great waste in corn stalks has to be taken into consideration in fixing their value. Stover has the property of absorbing a large amount of water, especially the stalks. This often amounts to over 30 per cent. of the entire fodder. Then, again, stock eat but a trifle over one-half of good stover; the rest must be calculated as waste. It is manifest, therefore, that the farmer wishing to purchase fodder must take this waste into consideration.

The values given above are for a ton of the leaves and tops, or that portion eaten by stock. When the uneaten portion is considered as making part of the weight of a ton of fodder, the value of a ton of these fodders would be reduced to the following figures:

Calculated value of No. 1 per ton	$5 97
Calculated value of No. 5 per ton	5 72
Calculated value of No. 7 per ton	5 38

No. 1 is much the richest fodder; No. 7 the poorest. We note again that No. 1 was cut while not yet ripe; No. 5 still riper, but yet the leaves still of a greenish cast; No. 7 cut ripe. Undoubtedly the better quality of No. 1 is owing to its being cut earlier in its ripening stage.

From these analyses it seems that the earliest time possible corn can be cut, and allow of the maturing of the ear, the better will be the fodder.

CLOVER HAY.

Six samples of clover hay have been sent to the Station for analysis. Nos. 9, 18 and 17 from the western part of the State; Nos. 10 and 20 are from the southern portion of the State, and No. 24 comes from the celebrated blue-grass region. All the hays were salted when stored.

The analysis of each is given below.

9. Red clover hay; grown in Jefferson county on black alluvial soil; red clay subsoil; cut in full bloom.

Analysis No. 9.

Constituents.	Pounds per Hundred	Pounds per Hundred, water-free.	Per Cent. of Digestibility . . .	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	9.80	. . . .	. . .	. . . .	. . . .
Ash	7.86	8.72	. . . .	. . . .	. . . .
Protein	14.22	15.76	62	176.33	$7 64
Fat	3.68	4.08	60	44.16	1 91
Fiber	25.53	28.30	47	237.16	2 22
Nitrogen-free extract	38.91	43.14	70	544.74	4 90
Total	100.00	100.00	. . . .	1002.39	$16 67

Nutritive ratio, 1: 5.

10. Clover hay; taken from stack; grown on rich upland; cut in bloom early in June; level, very red clay subsoil; from J. D. Clardy.

Analysis No. 10.

Constituents.	Pounds per Hundred	Pounds per Hundred, water-free.	Per Cent. of Digestibility . . .	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	9.98	. . . .	. . . .	. . . .	. . . .
Ash	7.76	8.62	. . . .	. . . .	. . . .
Protein	15.81	17.56	62	196.24	$ 8 50
Fat	2.92	3.24	60	35.04	1 52
Fiber	28.42	31.57	47	267.15	2 40
Nitrogen free-extract	35.11	39.01	70	491.54	4 42
Total	100.00	100.00	. . . .	989.97	$16 84

Nutritive ratio, 1: 4.3.

18. Red clover; grown in Jefferson county on black alluvial soil; red clay subsoil; grown by W. L. Hays; cut in full bloom.

Sample taken from barn where it had been cured.

Analysis No. 18.

Constituents.	Pounds per Hundred	Pounds per Hundred, water-free.	Per Cent. of Digestibility . . .	Pounds Digestible in one Ton Hay	Calculated Value.
Water	10.04	. . . .	. . . .	. . . .	. . . .
Ash	7.66	8.51	. . . .	. . . .	. . . .
Protein	12.08	13.43	55	132.88	$5 76
Fat	2.63	2.92	51	26.83	1 16
Fiber	28.90	32.13	45	260.10	2 34
Nitrogen-free extract	38.69	43.01	65	502.97	4 53
Total	100.00	100.00	. . . .	922.78	$13 79

Nutritive ratio, 1: 6.25.

19. Red clover; grown on wet black gravel soil; taken from stack; Jefferson county; cut in full bloom.

Analysis No. 19.

Constituents.	Pounds per Hundred. . . .	Pounds per Hundred, water-free.	Per Cent. of Digestibility . . .	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	10.70	. . . .	. .	. . . .	. . . .
Ash	6.31	7.07	. . . .	. . . .	. . . .
Protein	10.63	11.90	55	116.93	$5 07
Fat	2.62	2.93	51	26.72	1 16
Fiber	26.32	29.47	45	236.86	2 13
Nitrogen-free extract	43.42	48.63	65	564.46	5 08
Total	100.00	100.00	. . . .	944.97	$13 44

Nutritive ratio, 1: 7.4.

20. Clover hay, grown by Dr. J. D. Clardy on rich, level upland; cut in bloom early in June; fairly well cured and stored in barn.

Analysis No. 20.

Constituents.	Pounds per Hundred. . . .	Pounds per Hundred, water-free.	Per Cent. of Digestibility. . .	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	11.63	. . . .	. . . .	. . . .	. . . .
Ash	6.49	7.34	. . . .	. . . .	. . .
Protein	14.22	16.09	62	176.33	$7 64
Fat	2.42	2.74	60	29.04	1 26
Fiber	29.95	33.89	47	281.53	2 53
Nitrogen-free extract	35.29	39.94	70	494.06	4 45
Total	100.00	100.00	. . . .	980.96	$15 88

Nutritive ratio, 1: 4 8.

24. Red clover; grown by Mr. J. J. Curtis, Fayette county; blue-grass soil; cut when about one-half of bloom had turned brown; salted, adding about one-half bushel of salt to ton of hay. "Second-class hay, caused by continual damp weather after stacking." "Stock eat it well, especially cows."

Analysis No. 24.

Constituents.	Pounds per Hundred	Pounds per Hundred, water free.	Per Cent. of Digestibility . .	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	13.75	. . . .	. . . .	. . .	. . . .
Ash	7.09	8.21	. . . .	. . . .	. . .
Protein	9.89	11.49	55	108.79	$4 71
Fat	1.77	2.05	51	17.85	77
Fiber	24.07	27.90	45	216.63	1 95
Nitrogen-free extract	43.43	50.35	65	564.59	5 08
Total	100.00	100.00	. . . .	907.86	$12 51

Nutritive ratio, 1: 7.69.

Without exception these clover hays are remarkably good. In protein the most valuable nutrient, Nos 9, 10 and 20, exceed the maximum amount reported in American clover hays. The following table is given to compare each sample with the average of thirteen analyses made elsewhere in this country:

CONSTITUENTS.	Average of 13 Analyses . . .	9.	10.	18.	19.	20.	24.
Water	14.65	9.80	9.98	10.04	10.70	11.63	13.75
Ash	5.35	7.86	7.76	7.66	6.31	6.49	7.09
Protein	11.44	14.22	15.81	12.08	10.63	14.22	9.89
Fat	2.02	3.68	2.92	2.63	2.62	2.42	1.77
Fiber.	26.69	25.53	28.42	28.90	26.32	29.95	24.07
Nitrogen free extract	39.87	38.91	35.11	38.69	43.42	35.29	43.43
	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Nutritive ratio . .	1: 6.1	1: 5.1	1: 4.3	1: 6.3	1: 7.4	1: 4.8	1: 7.6
Calculated value .	$14 00	$16 67	$16 84	$13 79	$13 44	$15 88	$12 51

But little comparison can be made on these samples as to the effect of cutting at different stages of maturity. It will be noticed that all the samples, with the possible exception of No. 24, were cut at about the same stage of maturity. It was the endeavor of the writer to receive samples cut at different periods of growth, but the prevailing idea, to cut clover while in bloom, seems to be well established in our State. In No. 24 the analysis might seem to indicate that it was cut too ripe; but Mr. Curtis, the grower, seems to think the inferiority due to rains after being stacked. It does not fall much below the average, however.

TIMOTHY HAY.

Five analyses were made of timothy hay:

4. Timothy hay; taken from stack; not well cured; bleached by rains; very ripe; seeds mostly shelled out; hay coarse and stems *woody*.

Analysis No. 4.

CONSTITUENTS.	Pounds per Hundred.	Pounds per Hundred, water-free.	Per cent. of Digestibility.	Pounds Digestible in one Ton.	Calculated Value.
Water	12.27	....	....	....	....
Ash	3.03	3.45	....	....	....
Protein	4.24	4.83	51	43.25	$2 27
Fat	1.42	1.62	41	11.64	50
Fiber	33.58	38.28	54	362.66	3 26
Nitrogen-free extract	45.46	51.82	58	527.34	4 75
Total	100.00	100.00	....	944.89	10 78

Nutritive ratio, 1: 21.

13. Timothy hay; collected by Dr. J. D. Clardy, Christian county; taken from stack; nearly ripe when cut; the hay grew on bottom land; black soil; subsoil yellowish-red clay; Dr. Clardy says the hay suffered much from drouth, and is not equal to usual crops.

Analysis No. 13.

CONSTITUENTS.	Pounds per Hundred.	Pounds per Hundred, water-free.	Per Cent. of Digestibility.	Pounds Digestible in one Ton.	Calculated Value.
Water	8.05	....	....	....	....
Ash	5.10	5.55	....	....	....
Protein	6.03	6.56	57	68.74	$2 98
Fat	2.07	2.25	48	19.87	86
Fiber	29.97	32.59	58	347.65	3 13
Nitrogen free extract	48.78	53.05	62	604.87	5 44
Total	100.00	100.00	...	1041.13	$12 41

Nutritive ratio, 1: 14.

15. Timothy hay; from Jefferson county; taken from stack; stems coarse and woody; cut at ripening of seeds.

Grown on black soil; average sample from stack.

Analysis No. 15.

CONSTITUENTS.	Pounds per Hundred	Pounds per Hundred, water-free.	Per Cent. Digestibility.	Pounds Digestible in Ton Hay . . .	Calculated Value.
Water	9.17	. . . .	. . . .	. . . .	. . . .
Ash	4.33	4.77	. . . .	. . . .	. . . .
Protein	4.86	5.35	53	51.52	$2.23
Fat.	1.49	1.64	43	12.81	56
Fiber	32.33	33.59	54	349.16	3 14
Nitrogen free extract	47.82	52.65	58	554.71	4 99
Total	100.00	100.00	. . . .	968.28	$10 92

Nutritive ratio, 1: 18.22.

21. Timothy hay; grown by Mr. Curtis, Fayette, county; blue-grass region; cut in ripening stage; not as good as usual.

Analysis No. 21.

CONSTITUENTS.	Pounds per Hundred	Pounds per Hundred, water-free.	Per Cent. of Digestibility . . .	Pounds Digestible in one Ton .	Calculated Value.
Water	13.97	. . . .	. . . .	. . . .	. . . .
Ash	2.68	3.11	. . . .	. . . .	. . . .
Protein	4.73	5.50	51	48.25	$2 09
Fat	0.97	1.13	41	7.95	34
Fiber	38.46	44.71	54	415.37	3 74
Nitrogen free extract	39.19	45.55	58	454.60	4 09
Total	100.00	100.00	. . . .	926.17	$10 26

Nutritive ratio, 1: 18.

22. Timothy hay; Mr. Curtis, Fayette county; cut in ripening stage.

Analysis No. 22.

Constituents.	Pounds per Hundred	Pounds per Hundred water-free.	Per Cent. of Digestibility . . .	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	15.54	. . . .	. . . .	. . . .	. . . .
Ash	3.70	4.38	. . . .	. . . .	. . . .
Protein	4.80	5.68	51	48.96	$2 12
Fat	1.62	1.92	41	13.28	58
Fiber	35.89	42.49	54	389 61	3 51
Nitrogen-free extract	38.45	45.53	58	446.02	4 01
Totals	100.00	100.00	. . .	897.87	$10 22

Nutritive ratio, 1: 17.7.

Unlike the results from corn fodder and clover hay, we find the samples under consideration poor in quality. They do not compare favorably with timothy hay grown in other parts of this country. The following table is given for comparison:

Constituents.	Average of 32 Analyses . . .	4.	13.	15.	21.	22.
Water	11.19	12.27	8.05	9.17	13.97	15.54
Ash	3.98	3.03	5.10	4.33	2.68	3.70
Protein	6.02	4.24	6.03	4.86	4.73	4.80
Fat	2.20	1.42	2.07	1.49	0.97	1.62
Fiber	30.35	33.58	29.97	32.33	38.46	35.89
Nitrogen-free extract . . .	46.26	45.46	48.78	47.82	39 19	38 45
	100.00	100.00	100.00	100.00	100.00	100.00
Calculated value	$12.22	$10.78	$12.41	$10.92	$10.26	$10.22
Nutritive ratio	1: 14	1: 21.3	1: 14.6	1: 18.2	1: 18	1: 17.7

Undoubtedly the cause of this inferiority of the timothy sent to the Station for analysis was due to its overripeness when cut, and perhaps to the drought. The prevailing custom here seems to be, judging from the samples sent, to cut timothy hay at its ripening stage. This is too late to obtain the best quality of hay, as the above analyses show. A computation showing the loss to the farmers of Kentucky by neglecting to cut their hay at the proper stage of growth, would, without doubt, reveal astonishing results. Cut at an earlier stage, the quality, at least, would be much better, and this is what the farmer should seek in preference to quantity.

TIMOTHY AND RED TOP.

Three analyses of timothy and red top were made with the following results. Like the timothy hays, these results do not compare favorably with results obtained elsewhere, and the inferiority is due, no doubt, to the fact that the samples were too ripe when cut.

17. Timothy and red top; grown in black alluvial soil, with a red clay subsoil; Jefferson county.

Cut at ripening of the seeds.

Analysis No. 17.

Constituents.	Pounds per Hundred.	Pounds per Hundred, water-free	Per Cent. of Digestibility.	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	10.32	....	....	....	....
Ash	4.51	5.03	....	....	....
Protein	6.32	7.05	57	72.05	$3 12
Fat	1.62	1.81	48	15.55	67
Fiber	33.15	36.96	58	384.50	3 46
Nitrogen-free extract	44.08	49.15	62	546.59	4 92
Total	100.00	100.00	....	1018.69	$12 17

Nutritive ratio, 1: 13.5.

26. Timothy and red top; grown by P. W. Justice; about equal mixture of timothy and red top; stored in barn; cut when nearly ripe.

Analysis No. 26.

CONSTITUENTS.	Pounds per Hundred	Pounds per Hundred, water-free	Per Cent. of Digestibility . . .	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	11.15	. . . .	. . . .	. . . .	. . . .
Ash	5.05	5.69	. . . .	. . . .	. . . .
Protein	4.67	5.26	51	47.63	$2 06
Fat	2.34	2.63	41	19.19	83
Fiber	34.84	39.21	54	376.13	3 39
Nitrogen-free extract	41.95	47.21	58	486.62	4 38
Total	100.00	100.00	. . . .	930.57	$10 66

Nutritive ratio, 1: 14.9.

25. Timothy and red-top; grown by P. W. Justice; grown on overflowed land; cut when red-top was in full bloom; timothy ripe.

Analysis No. 25.

CONSTITUENTS.	Pounds per Hundred. . . .	Pounds per Hundred, water-free.	Per Cent. of Digestibility.	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	11.57	. . . .	. . . .	. . . .	. . . .
Ash	4.78	5.41	. . . .	. . . .	. . . .
Protein	5.21	5.89	51	53.14	$2 30
Fat	1.50	1.69	41	12.30	53
Fiber	38.41	43.44	54	415.83	3 74
Nitrogen-free extract	38.53	43.57	58	446.95	3 92
Total	100.00	100.00	. . .	928.22	$10 49

Nutritive ratio, 1: 16.76.

ANALYSES OF GERMAN MILLET.

12. German millet; grown by W. L. Hawes, Fern Creek, Ky.; grown on black alluvial soil, red-clay subsoil; cured in barn; the hay was cut immediately after full-blossom.

Analysis No. 12.

Constituents.	Pounds per Hundred.	Pounds per Hundred, water-free.	Per Cent. of Digestibility.	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	9.54	....	....	....	....
Ash	6.65	7.35	....	....	....
Protein	7.81	8.63	62	56.84	$2 46
Fat	2.37	2.62	52	24.65	1 07
Fiber	25.82	28.54	57	194.35	1 75
Nitrogen-free extract	47.81	52.86	64	611.97	5 51
Total	100.00	100.00	....	887.81	$10 79

Nutritive ratio, 1: 10.

23. German millet straw; grown by Mr. Curtis, Fayette county; cut when ripe and threshed; about one-fourth of the seed remained with the straw. "Cattle eat it with a relish." The analysis shows it to be almost worthless as a food for stock.

Analysis No. 23.

Constituents.	Pounds per Hundred.	Pounds per Hundred, water-free.	Per Cent. of Digestibility.	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	14.22	....	....	....	....
Ash	3.65	4.26	....	....	....
Protein	2.55	2.96	17	8.67	$0 38
Fat	0.94	1.10	36	6.77	29
Fiber	45.87	53 47	56	513.74	4.62
Nitrogen-free extract	32.77	38.21	39	257.61	2.32
Total	100.00	100.00	....	786.79	$7 61

Nutritive ratio, 1: 91.

ANALYSIS OF SUGAR-BEETS.

An analysis of sugar-beets is given below. The comparative value of beets and hays, as a food, must be taken with latitude. The cheapest food is not always to be considered. A change of food, mixed foods, etc., are often of great advantage and of benefit.

16. Sugar-beets; grown by Dr. R. J. Spurr; taken from a pit this spring and analyzed. The tops had begun to grow.

Analysis No. 16.

Constituents.	Pounds per Hundred.	Pounds per Hundred, water-free.	Per Cent. of Digestibility.	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	88.77	....	....	....	....
Ash	1.22	10.91	....	....	....
Protein	2.04	18.19	100	40.80	$1 77
Fat	0.09	0.76	100	1.80	08
Fiber	0.89	7.89	100	17.80	16
Nitrogen-free extract	6.99	62.25	100	139.80	1 26
Total	100.00	100.00	....	200.20	$3 27

Nutritive ratio, 1: 3.98.

ANALYSIS OF ORCHARD GRASS HAY.

14. Orchard grass; grown by Dr. J. D. Clardy; grown on rich upland, a dark-gray soil; subsoil of red clay.

"All our grasses poorer on account of a severe drought," says Dr. Clardy.

Hay taken from stack; cut about the first of June, while in bloom.

Analysis No. 14.

Constituents.	Pounds per Hundred. . . .	Pounds per Hundred, water-free.	Per Cent. of Digestibility. . .	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	11.80	. . . .	. . . .	. . . .	. . . .
Ash	5.90	6.69	. . . .	. . . .	. . . .
Protein	8.17	9.26	51	83.33	$3 61
Fat	2.26	2.56	41	18.53	80
Fiber	38.33	43.46	54	413.96	3 73
Nitrogen-free extract	33.54	38.03	58	389.06	3 50
Total	100.00	100.00	. . . .	904.88	$11 64

Nutritive ratio, 1: 10.2.

ANALYSIS OF RED-TOP HAY.

11. Red-top; taken from stack for analysis; grown on black alluvial soil; red clay subsoil; Jefferson county; cut about the time the seeds were ripening.

Analysis No. 11.

Constituents.	Pounds per Hundred	Pounds per Hundred, water-free.	Per Cent. of Digestibility . . .	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	9.84	. . . .	. . .	. . . . .	. . . .
Ash	6.99	7.75	. . .	. . . . .	. . . .
Protein	7.25	8.04	62	89.90	$3 90
Fat	1.95	2.16	52	20.28	88
Fiber	27.45	30.45	57	312.93	2 82
Nitrogen-free extract	46.52	51.60	64	595.46	5 36
Total	100.00	100.00	. . .	1,018.57	$12 96

Nutritive ratio, 1: 10.6.

ANALYSES OF BLUE-GRASS.

3. Blue-grass hay (*Poa pratensis*). This sample was taken from a stack. The hay was cut after the blue-grass had been ripe for about two weeks; it was not well cured; the stems were hard and woody; crop of 1885.

Analysis No. 3.

CONSTITUENTS.	Pounds per Hundred	Pounds per Hundred, water-free.	Per Cent. of Digestibility . . .	Pounds Digestible in one Ton Hay.	Calculated Value.
Water	16.09	. . . .	. . . .	. . . .	. . . .
Ash	4.69	5.59	. . . .	. . . .	. . . .
Protein	7.07	8.42	64	90.50	$3 92
Fat	2.02	2.40	50	20.20	88
Fiber	26.76	31.90	62	331.82	2 99
Nitrogen-free extract	43.37	51.69	68	589.83	5 31
Total	100.00	100.00	. . . .	1032.35	$13 10

Nutritive ratio, 1: 10.8.

28. Blue-grass (*Poa pratensis*); from College grounds; cut when about five inches high, before heading.

Analysis No. 28.

Constituents.	Pounds per Hundred.	Pounds per Hundred, water-free.	Pounds per Hundred, Field-cured as Hay	Pounds Digestible in one Ton of Field-cured Hay.	Pounds Digestible in one Ton of Grass. . . .
Water	82 53	. . . .	11.07	. . .	. . . .
Ash	1.59	9.12	8.11	. . .	. . . .
Protein	4.59	26.29	23.83	299.26	$58 75
Fat	1.01	5.78	5.14	51.40	10 10
Fiber	3.78	21.61	19.22	238.33	46 87
Nitrogen-free extract	6.50	37.20	33.08	451.89	88 40
Total	100.00	100.00	100.00	1040.88	$204 12

Nutritive ratio, 1: 2.7.

Calculated value: As hay, $21 41 per ton; as grass, $4 19 per ton.

29. Blue-grass (*Poa pratensis*); College grounds; cut when well headed, but before blossoming.

Analysis No. 29.

Constituents.	Pounds per Hundred.	Pounds per Hundred, water-free.	Pounds per Hundred, Field-cured as Hay.	Pounds Digestible in one Ton Field-cured Hay.	Pounds Digestible in one Ton of Grass.	Estimated value of Hay.
Water	59.85	....	8.78	....	....	....
Ash	3.66	9.12	8.32	....	....	....
Protein	7.18	17.88	16.31	208.77	91.90	$9 05
Fat	1.61	4.01	3.66	36.60	16.10	1 59
Fiber	12.80	31.89	29.09	360.72	158.72	3.25
Nitrogen-free extract	14.90	37.10	33.84	460.22	202.64	4 14
Total	100.00	100.00	100.00	1066.31	469.36	$18 30

Nutritive ratio, 1: 4.37.

Calculated value: As hay, $18 03 per ton; as grass, $7 93 per ton.

31. English blue-grass (*Festuca pratensis*); from Dr. R. J. Spurr's, near Lexington, Ky.; cut before heading.

Analysis No. 31.

CONSTITUENTS.	Pounds per Hundred as Grass. .	Pounds per Hundred, water-free.	Pounds per Hundred Field-cured as Hay	Per cent. of Digestibility . . .	Pounds Digestible in one Ton Field-cured hay. . .	Pounds Digestible in one Ton as Grass. . . . .
Water.	69.73	. . . .	9.00	. . . .	. . . .	. . . .
Ash.	3.43	11.35	10.33	. . . .	. . . .	. . . .
Protein	10.09	33.33	30.33	64	388.22	129.15
Fat	1.94	6.41	5.83	50	58.30	19.40
Fiber	5.49	18.13	16.50	62	204.60	68.08
Nitrogen-free extract . . .	9.32	30.78	28.01	68	380.94	126.75
Total	100.00	100.00	100.00	. . . .	1032.06	343.38

Nutritive ratio, 1: 88.

Calculated value per ton: field-cured, $24 62; grass, $8 19.

From these analyses we find the blue-grass of excellent quality; the over-ripe and damaged hay excelling the best of timothy hay analyzed. The hay from the young grass, both of the English and Kentucky blue-grass, giving remarkable results. The protein in the one case being 23.83 per cent, in the other 30.33 per cent. However, it is proper to remark here that in an analysis we calculate the protein compounds from the amount of nitrogen we obtain. In reality all the nitrogen is not in the form of albuminoids or protein compounds—especially is this the case in young grasses. These other compounds of nitrogen are questionable nutrients, but it is supposed that they act in some secondary manner, at least to some extent. For the want of better knowledge on this subject, and in order to make analyses of comparative value, chemists at present compute all these nitrogenous compounds as protein.

32. Corn ensilage; from Maj. P. P. Johnston, Lexington, Ky; taken from pit April 19, 1886; put in last September when the corn was in first silk.

Analysis No. 32.

Constituents.	Pounds per Hundred.	Pounds per Hundred, water-free.
Water	83.17	. . .
Ash	1.31	7.7[illegible]
Protein	2.06	12.3[illegible]
Fat	1.28	7.6[illegible]
Fiber	5.11	30.3[illegible]
Nitrogen-free extract	7.07	42.0[illegible]
Total	100.00	100.0[illegible]

27. Corn ensilage; from George W. Crum, Louisville, Kentucky

Analysis No. 27.

Constituents.	Pounds per Hundred.	Pounds per Hundred, water-free.
Water	82.78	....
Ash	1.34	7.78
Protein	1.57	9.11
Fat	0.73	4.25
Fiber	5.22	30.33
Nitrogen-free extract	8.36	48.53
Total	100.00	100.00

No definite conclusions can be made from the result of so few analyses. Many more analyses must be made before general conclusions can be reached.

There is no question about the excellent qualities of the blue-grass and the clover hay.

It is to be regretted that the timothy hays sent in were all cut at about the same stage of ripeness. Undoubtedly better results would have been obtained with hays cut when not so ripe.

Kentucky certainly produces a most excellent pasture grass—blue-grass.

From the results of analysis No. 31 we find that the English blue-grass is extremely rich in protein, and as it grows to a considerable height, it will undoubtedly make one of the richest of hays.

BULLETIN No. VI.

Clover.

[By Albert E. Menke, Professor of Agricultural Chemistry, and H. F. Hillenmeyer, Fayette county, Ky.]

Clover is one of the most important crops grown in this State; we therefore think that facts relating to its cultivation will be of interest. It is customary in Kentucky to sow clover between March 1st and April 1st. It is almost invariably sown with small grain without any preparation of the surface, save when seeding with oats. Providential conditions are relied upon to cover the seed or protect it during its period of germination and earlier growth. Experiments and close observation, covering a period of several years, favor the opinion that when the seed is sown on an unprepared surface the prevailing custom as to the time of seeding is not judicious. If sown in January, the action of rain, frost and thaw will embed the seed, entirely shielding it from the action of both frost and wind. The seed that has been exposed to severe frost will germinate perfectly, if thawed in exclusion from light. The question as to whether or no light is prejudicial to germination is unsettled. Johnston observes that "when seeds are made to germinate in a limited portion of atmospheric air, the bulk of the air undergoes no material alteration, but on examination its oxygen is found to have diminished and carbonic acid to have taken its place. Therefore, during germination, seeds absorb oxygen gas and give off carbonic acid. Hence it is easy to understand why the presence of air is necessary to germination, and why seeds refuse to sprout unless oxygen be within reach. It is a well-known fact that the leaves of plants in sunshine, evolve oxygen and absorb carbonic acid, while in the dark the reverse takes place. So it is with seeds which have begun to germinate. When exposed to the light they give off oxygen instead of carbonic acid, and thus the natural process is reversed. But it is necessary to the growth of the young germ, that oxygen should be absorbed and carbonic acid given off, and as this can take place to the required extent only in the dark, the cause of the prejudicial action of light is sufficiently apparent, as well as the propriety of covering the seed with a thin layer of soil." On the other hand, we must co sider the fact that nature does not bury the seed, but scatters them over the surface of the soil, where they are at most partly covered, and yet these seeds usually germinate satisfactorily. Hoffman has also found, in experiments made on twenty-four kinds of agricultural seeds, that light causes no appreciable bad effect in their germination. Our results would tend to show that the factor, frost, has to be taken into consideration, as it was very evident to us that seeds when frozen and thawed in the presence of light, were injured, whereas, covered seeds were comparatively, if not entirely, uninjured when exposed to the same conditions.

The conventional time of seeding is one during which high arid winds prevail, accompanied by bright sunshine. Is it not probable also that the combined action of these two conditions on the seed, before the plumule has entered the earth, is seiously detrimental to a healthy growth? The causes which, in our opinion, operate to prevent a satisfactory germination and subsequent good stand are two, viz: The loss sustained when the germinated seed is frozen and thaws in direct light, and the destructive influence of wind and bright sunshine when in the same condition. Half the seed sown in January has here invariably resulted in a better stand of plants than twice the quantity in March or early April. This is the result of experiments made with carefully counted seeds, which is also corroborated in field practice. The following is a series of experiments made this year. Commencing on February the 2d, we sowed ordinary red clover seed, covered and uncovered, at intervals of ten days. The table appended shows the daily temperature and weather conditions:

Date.	Thermom.		Bar.	Wind.	Snow, rain, etc.
	Max.	Min			
Feb. 2. .	18	12	29.48	N. N. W. Gentle	Fine snow.
" 3. .	17	2	29.32	N. Light	Snow.
" 4. .	7	—2	29.55	N. W. Brisk	
" 5. .	13	—18	29.72	S. E. Light	
" 6. .	35	4	29.29	S. W. Brisk.	Slight thaw.
" 7. .	35	9	29.35	W. Gentle	Fine day.
" 8. .	45	16	29.19	S. Gentle	Fine day.
" 9. .	50	31	29.15	S E. Gentle	Fine day.
" 10. .	51	38	29.22	E. Gentle.	Nice morning.
" 11. .	56	42	29.15	S. Gentle	Rain.
" 12. .	41	33	29.00	S. W. Brisk.	Light rain.
" 13. .	33	28	28.91	S. W. Light	Light snow.
" 14. .	49	36	28.94	S. Light.	Fine day.
" 15. .	38	17	29.27	N. W. Brisk	Snow.
" 16. .	25	10	29.60	W. Gentle	Snow 4 inches.
" 17. .	40	12	29 45	S. W. Gentle	Bright day.
" 18. .	47	26	29.28	S. Light.	Bright sunshine.
" 19. .	38	18	28.90	N. W Very High	Light snow.
" 20. .	19	9	29.42	N. W. Brisk	
" 21. .	41	26	29.06	S. W. High	Light snow.
" 22. .	40	22	29.32	S. E. Gentle	Fine day.
" 23. .	49	32	29.51	N. W. Gentle	Bright.
" 24. .	55	27	29.32	E. Light.	
" 25. .	42	22	28.71	W. Brisk.	Light rain.
" 26. .	25	10	29.40	N. W. High.	
" 27. .	27	15	29.33	N. E. Brisk	Raw.
" 28. .	33	20	29.22	E. Light	Light snow.
Mar. 1. .	32	20	29.42	N. N. E. Brisk	

Date.	Thermom. Max.	Thermom. Min.	Bar.	Wind.	Snow, Rain, etc.
Mar. 2 . .	28	14	19.52	E. Light	
" 3 . .	30	13	29.48	W. Gentle	
" 4 . .	39	18	29.41	N. E. Gentle	
" 5 . .	41	24	29.20	E. Gentle	Light snow.
" 6 . .	37	27	29.31	N. W. Gentle	
" 7 . .	38	22	29 22	W. Gentle	Light snow.
" 8 . .	37	29	29.06	W. S W. Brisk	
" 9 . .	34	23	29 11	N. W. Gentle	Snow.
" 10 .	30	27	29.39	N. W. Light	
" 11 .	48	21	39.20	S. Light	
" 12 .	44	37	28.64	S. W. High	Rain.
" 13 .	34	29	28.77	W. Brisk	Light snow.
" 14 .	62	36	29.02	S. W. Brisk	Clear.
" 15 .	63	46	29.15	S. W. Brisk	Clear.
" 16 .	61	44	29.32	N. E. Gentle	Very smoky.
" 17 .	63	53	29.27	N. E. Gentle	
" 18 .	72	49	29.19	S. W. Light	
" 19 .	72	56	28.95	S. Light	Light rain.
" 20 .	64	47	28.55	S. W. High	Rain.
" 21 .	36	30	28.56	W. High	Snow.
" 22 .	43	30	28.99	W. High	
" 23 .	40	25	29.38	W. Brisk	
" 24 .	58	28	29.27	S. Gentle	Ground frozen.
" 25 .	63	52	29.21	S. W. Brisk	
" 26 .	34	31	29.34	N. E. Gentle	Light snow.
" 27 .	33	31	29.12	N. E. Light	Rain.
" 28 .	40	29	29.26	N. E. Light	
" 29 .	57	41	29.08	E. Gentle	Rain.

Date.	Thermom. Max.	Thermom. Min.	Bar.	Wind.	Snow, Rain, etc.
Mar. 30.	55	52	28.91	S. Light	Rain.
" 31.	36	30	28.76	W. Light	Rain.
April 1.	47	29	28.97	W. High.	Snow.
" 2.	36	31	29.22	N. E. Gentle	Light rain.
" 3.	31	27	29.20	N. E. Light	Sleet, rain.
" 4.	29	28	29.24	N. E. Light	Sleet, rain.
" 5.	29	25	29.14	N. E. Light	Snow.
" 6.	29	26	28.79	N. W. Brisk	Snow.
" 7.	35	25	29.15	N. W. Light	Snow.
" 8.	48	27	29.45	S. E. Gentle	Fine day.
" 9.	61	34	29.43	S. E. Gentle	Fine day.
" 10.	64	46	29.36	S. W. Gentle	Fine day.
" 11.	63	50	29.26	S. Brisk	Rain.
" 12.	55	50	29.35	S. Gentle	Rain.
" 13.	70	51	29.39	E. Gentle	Fine day.
" 14.	76	55	29.30	S. Gentle	Fine day.
" 15.	77	59	29.29	S. Gentle	Fine day.

We found that seed sown on the surface of the ground on February 2, to be entirely embedded, continuing from that date until March 13, the number of seeds that sank out of sight diminished regularly. This was only to be expected, owing to the fact that the weather naturally improved as the season advanced. The seeds that were covered by the action of the weather almost all germinated, whilst of those left on the surface of the soil and afterward thawed by the sun, very few germinated. There was one very curious result, which may have been accidental, so we are not prepared to attach any value to it until we have repeated the experiment. It was as follows: Covered seeds sown on February 2, 12, 23, March 3 and 13, were all growing well about March 28. On March 31 the temperature fell considerably, and we had, as may be seen from the table, a cold period lasting nine days. There was considerable sleet during this time, and the plants were nearly all embedded in ice. On the tenth day a thaw set in, and after the ice disappeared we found all the plants killed except those sown on February 2 and 12. They were not much stronger looking plants than those that came from seed sown on February 22. Of course they were a little further advanced than the sowings of March 3 and March 13; more than that, we could not discern any apparent difference. Any explanation would be purely hypothetical; we therefore intend to let this portion of our results rest until we can repeat the observation. We propose repeating our experiments next year, and also intend to try the effect of exposing seeds simultaneously to light air currents and artificial low temperatures, and then thawing in the sun's rays, with a view to obtaining confirmatory evidence for our hypothesis that these conditions occurring naturally are destructive.

We also made some experiments to determine the relative value of different colored clover seeds. The seeds were divided carefully into six different shades, geenish, yellow, light brown, brown, dark brown, black. The same number of each class were sown under identical conditions to obtain a good comparative result.

The Green Seeds.—Very few of these reached the cotyledonous stage, and those that did resulted in weak plants.

The Yellow Seeds.—Almost all of these germinated and produced a good stand of healthy plants.

The Light Brown.—This class did very well, but not quite as well as the yellow seeds.

The Brown Seeds.—Again a slight decrease in value is to be noticed in the number of seeds germinating and the size of the plantlets.

The Dark Brown Seeds.—As the darkness of the seeds increased, their value evidently decreased.

The Black Seeds.—This was but a confirmation of the last result.

Haberlandt has made a number of experiments in this latter direction, and our results practically confirm his. The clover seed we used for these experiments was obtained from Henderson of New York, and was very good. We are indebted to Dr. R. J. Spurr for the meteorological observations used in the foregoing tables.

BULLETIN No. VII.

Fertilizers.

FERTILIZERS ANALYZED, 1886.

The prices given to the fertilizing ingredients as found in the tables to follow were adopted when the law went into effect. At present these prices are too high to represent the selling prices of fertilizers, and especially bone manure. About 20 per cent. should be deducted from the estimated prices on the tags. The relative value remains the same, and is of great importance to the farmer in comparing the different fertilizers.

The official analyses are tabulated in the following tables:

TABLE I.

Superphosphates and Complete Fertilizers. Analyses and Valuation, 1886.

Station No. . .	Manufacturers' Address.	Name of Brand.	Moisture, per Cent. . . .	Phosphoric Acid. Soluble, per Cent . .	Phosphoric Acid. Reverted, per Cent. . .	Phosphoric Acid. Insoluble, per Cent. . .	Nitrogen Calculated as Ammonia, per Cent.	Potash, per Cent.	Estimated value per Ton* . . .
70 . .	Amor Smith & Co., Cincinnati, O . . .	Ammoniated Superphosphate of Lime .	4.71	3.51	6.30	8.37	2.96	0.42	$39 72
71 . .	Amor Smith & Co., Cincinnati, O . . .	Ammoniated Bone Meal.	6.56	0.54	7.25	13.50	4.93	0.17	45 72
50 . .	Clark's Cove Guano Co., Boston	Eddystone Soluble Guano.	16.66	6.98	2.18	1.71	2.84	1.97	33 21
53 . .	Cleveland Dryer Co., Cleveland.	Connecticut Valley Tobacco Fertilizer .	8.10	10.98	1.03	3.20	3.99	2.58	45 40
54 . .	Cleveland Dryer Co., Cleveland.	Ohio Seed Maker.	15.79	8.29	3.56	0.35	1.79	. . .	32 33
55 . .	Cleveland Dryer Co., Cleveland	Ammoniated Dissolved Bone.	11.07	8.24	2.73	2.94	1.51	. . .	32 06
56 . .	Cleveland Dryer Co., Cleveland	White Burley Tobacco Fertilizer	8.17	9.57	1.14	3.54	3.69	3.38	42 36
57 . .	Cleveland Dryer Co., Cleveland	Buckeye Superphosphate	7.43	10.43	1.67	3.24	3.62	. . .	41 81
58 . .	Cleveland Dryer Co., Cleveland	Square Bone	6.56	2.39	5.15	10.18	4.53	. . .	41 72
63 . .	Geo. E. Currie & Co., Louisville	Falls City Superphosphate of Lime. . .	11.16	5.74	3.23	2.39	3.56	1.36	35 24
64 . .	Geo. E. Currie & Co., Louisville	Falls City Raw Bone Meal.	7.22	1.66	7.08	7.32	2.46	1.09	34 75
66 . .	Wm. A. James & Read, Richmond, Va .	Roanoke Ammoniated Superphosphate .	15.81	7.24	1.70	1.73	2.31	2.09	31 11
37a. .	Michigan Carbon Works, Detroit. . . .	Homestead Corn and Wheat Grower . .	. . .	9.07	2.57	1.27	3.01	2.03	38 83

TABLE No. I.—Continued.

No. Station . . .	Manufacturers' Address.	Name of Brand.	Moisture, per Cent.	Phosphoric Acid. Soluble, per Cent . . .	Phosphoric Acid. Reverted, per Cent . . .	Phosphoric Acid. Insoluble, per Cent . . .	Nitrogen Calculated as Ammonia, per Cent. .	Potash, per Cent.	Estimated, Value per Ton* . . .
38a. .	Michigan Carbon Works, Detroit . . .	Jarves' Tobacco Fertilizer	. . .	6.19	1.80	0.95	3.11	3.10	$31 89
39a. .	Michigan Carbon Works, Detroit . . .	Homestead Tobacco Grower	. . .	7.66	0.27	1.39	5.70	5.28	49 92
4[illegible]a .	Michigan Carbon Works, Detroit . . .	Jarves' Drill Phosphate	. . .	5.87	1.80	4.98	1 86	0.23	28 22
62 . .	Michigan Carbon Works, Detroit .	Hemp Fertilizer	9.52	7.64	0 76	0.16	6.69	8.50	49 22
52	Memphis Fertilizer Company Memphis.	Memphis Fertilizer†	10 93	3.58	4.60	3.41	2.46	4.00	33 56
67 . .	A. B. Mayer Manufac'g Co., St. Louis .	Complete Fertilizer†	5.81	2.86	3.10	3.88	2.32	2.43	27 08
68 .	A. B. Mayer Manufac'g Co., St. Louis .	Missouri Queen Fertilizer†	6.44	1.45	4.87	5.90	1 59	1.27	26 34
47a. .	North Western Fertilizing Co., Chicago.	Ralston's Bone Meal	. . .	4.34	4.87	5.65	1 64	. . .	31 32
48a. .	North Western Fertilizing Co., Chicago.	Tobacco Compound.	. . .	5.94	1.83	1.65	4.36	2.26	35 40
49a. .	North Western Fertilizing Co., Chicago.	Challenge Corn Grower	. . .	6.64	3.46	2.04	3.98	1.38	38 77
86 . .	North Western Fertilizing Co., Chicago.	National Bone Dust	12.65	5.51	2.65	5.40	2.80	. . .	32 59
87 . .	North Western Fertilizing Co., Chicago.	Prairie Phosphate.	6.86	5.92	3.73	5.05	2.11	. . .	33 23
88 . .	North Western Fertilizing Co., Chicago.	Twenty-six Dollar Phosphate	6.88	5 68	3.81	5.21	2.11	. . .	33 05
42a. .	National Fertilizer Company, Nashville.	Tennessee Superphosphate	. . .	6.65	2.69	1.78	2.84	2.77	34 47
43a. .	National Fertilizer Company Nashville.	Rock City Superphosphates	. . .	7.48	2.87	[illegible]	[illegible]	[illegible]	[illegible]

42*a*. .	National Fertilizer Company, Nashville.	Tennessee Superphosphate	. . .	6.65	2.69	1.78	2.84	2.77	34 47
43*a*. .	National Fertilizer Company Nashville.	Rock City Superphosphates	. . .	7.48	2.87	1.02	2.46	1.62	32 52
44*a*. .	National Fertilizer Company, Nashville.	Vegetable Grower	. . .	6.40	2.22	1.28	3.93	4.70	37 90
45*a*. .	National Fertilizer Company, Nashville.	Tobacco Fertilizer	. .	7.15	1.55	1.28	3.61	5.08	37 41
59 . .	Pacific Guano Company, Boston	Soluble Pacific Guano.	15.43	7.23	1.99	2.81	2.72	2.46	34 54
60 . .	Pendleton Guano Company, Atlanta . .	Phosphate, Potash and Ammonia . . .	12.09	6.37	3.17	3.04	1.23	1.15	29 23
61 . .	Pendleton Guano Company, Atlanta . .	Pendleton's Ammoniated Superph'phate.	9.69	6.24	2.00	3.04	2.98	1.73	32 73
72 . .	Thompson & Edwards' Fert. Co., Chicago.	Dissolved Bone Meal	7.76	4.06	3.23	5.32	3.52	. . .	32 97
73 . .	Thompson & Edwards' Fert. Co., Chicago.	Kentucky Sure Growth Phosphate . . .	10.46	4.43	3.22	5.53	2.45	. . .	30 45
74 . .	Thompson & Edwards' Fert. Co., Chicago.	World-of-Good Tobacco Grower	8.81	3.91	3.42	4.99	3.32	. . .	32 06

* In this estimate the following values are used for the essential ingredients: Soluble and reverted phosphoric acid, 11 cents per pound; ammonia, 16½ cents per pound; potash, 5 cents per pound; insoluble phosphoric acid, 5 cents per pound.

† These brands are not legally on sale as yet in this State, as no tags have been ordered.

TABLE II.

Raw Bone Manures. Analyses and Valuation.

Station No.	Manufacturers' Address.	Name of Brand.	Moisture per Cent.	Phosphoric Acid. In Fine Bone* per Cent. . .	Phosphoric Acid. In Medium Bone* per Cent. . . .	Phosphoric Acid. Total per Ct.	Nitrogen Calculated as Ammonia per Cent.	Estimated value per Ton †. . .
80 . .	Astroth & Miller, Louisville	Pure Raw Bone.	8.98	11.36	9.91	21.27	4.95	$39 88
78 . .	R. H. Hoskins, Louisville.	Champion Bone Meal	6.90	21.90	. . .	21.90	4.57	41 36
81 . .	J. B. Jones, Louisville.	Pure Raw Bone Meal	6.65	13.23	7.90	21.13	5.00	40 28
82 . .	J. B. Jones, Louisville.	Green River Bone Dust.	6.56	8.44	. . .	8.44	3.23	20 79
83 . .	J. B. Jones, Louisville.	Pure Ammoniated Bone Meal	6.71	16.99	. . .	16.99	4.95	36 73
69 . .	A. B. Mayer Manufac'g Co., St. Louis. . . .	Pure Buffalo Bone Meal	5.37	24.01	. . .	24.01	4.23	42 77
76 . .	P. B. Matthiason & Co., St. Louis	Raw Bone Meal (Increscent Brand). . . .	7.42	23.08	. . .	23.08	4.79	43 51
46a. .	North Western Fertilizing Co	Fine Raw Bone.	. . .	22.53	. . .	22.53	4.26	41 10
65 . .	Wm. Skene & Co., Louisville	Skene's Pure Raw Bone Dust	7.33	11.53	8.63	20.16	4.31	36 69
85 . .	J. C. Struss, Louisville	Pure Raw Bone Meal.	8.00	11.36	6.81	18.17	4.07	33 87
89 . .	National Fertilizer Co., Nashville	Rock City Bone Meal	6.90	21.56	. . .	21.56	3.89	38 71
90 . .	National Fertilizer Co., Nashville	Pure Bone Meal	7.76	21.26	. . .	21.26	4.37	39 93

* Fine bone is all that passes through a sieve with meshes 1–25 inch square. Medium bone passes through a sieve with meshes 1/6 inch square, but not through the 1–25 inch mesh sieve.

† The following are the values used: Phosphoric acid in fine bone, 6 cents per lb.; do. in medium bone, 5 cents per lb.; ammonia, 16½ cents per lb., in both grades.

Lexington, Ky., July, 1886.

BULLETIN No. VIII.

Experiments with Wheat, 1886.

Last fall, under the direction of Dr. R. J. Spurr, some experiments were undertaken in wheat culture. At the time the Experiment Station had not been organized, and as Dr. Spurr was unable to devote very much time to the experiments, he planted, with a view of confining the experiments mainly to two lines of investigation:

1. Comparative test of selected varieties.
2. Effect of cultivation.

The experiments were conducted on a piece of land used formerly as a fair ground, but now belonging to the College. The land had been in cultivation for three years. It had never received an application of manure. The soil is a typical blue-grass soil, a medium loam, two or three feet in depth, resting on a porous, reddish subsoil of the same nature as the surface soil. This subsoil rests on blue limestone, quite cavernous, producing a fine natural drainage. The subsoil varies in depth from three to ten feet. Previous to these experiments the land had been in cultivation two years in tobacco, followed by a potato crop.

Ten varieties of wheat were selected for the experiments. Each variety was planted in drills eighteen inches apart. This unusual distance between drills was given in order to cultivate the wheat in the spring, should the weather permit. Before planting the ground was ploughed and thoroughly harrowed, but not rolled. The following table gives the names of the different varieties, time of planting, area planted of each variety, and date of coming up of each variety. The amount of wheat sown was at the rate of forty pounds per acre:

No.		Area Planted	Time of Planting.	Up.
1	Martin's Amber	0.1967	Oct. 5	Oct. 9.
2	McGhee White	0.1140	Oct. 5	Oct. 9.
3	Extra Early Oakley	0.1530	Oct. 5	Oct. 9.
4	Deihl Mediterranean	0.0938	Oct. 7	Oct. 11.
5	4-rowed Sheriff Wheat from Russia	0.1424	Oct. 26	Nov. 3.
6	White Crimean	......	Oct. 5	Oct. 9.
7	Indian	......	Oct. 5	Oct. 9.
8	Genoese	0.0482	Oct. 5	Oct. 9.
9	Egyptian	......	Oct. 5	Oct 9.
10	Hick's California	0.1317	Oct. 5	....

Below are given notes made upon each variety during different periods of growth:

1. *Martin's Amber*—Fall growth, stout and vigorous; stood the winter well. Spring growth, strong and close to surface of ground; straw erect, stout. May 21, heading; May 27, in bloom; June 27, grain in hard dough; standing fairly well; straw averaging 4¼ feet in height; June 28, harvested. Heads beardless, flattened, abruptly pointed, averaging 3½ inches in length; spikelets 16-20, averaging 18; two to three grains in spikelet, generally two. Grains white, of medium size and generally plump.

2. *McGhee White.*—Fall growth very good; slightly winter-killed. Spring growth small; not very erect Straw very weak, averaging in height 4 feet. May 14, in head; May 20, in bloom. Cut June 28; very badly lodged; seed in hard dough. Heads smooth, square, or somewhat flattened, slightly tapering, averaging 2¼ inches. Spikelets compact, 12 17 in head, usually 15; grains per spikelet, 2 to 3, mostly 3; grains nearly white; good, medium size, short and plump.

3. *Extra Early Oakley.*—Fall growth very good. Stood the winter better than any variety except the Deihl Mediterranean. Although a little slow in starting, the spring growth was excellent and erect.

Straw very erect and stout, not lodging; height averaging 4 feet. In head May 5; in bloom May 13; ripe June 9. Heads smooth, averaging 2½ inches in length, tapering somewhat; spikelets 12 to 16, averaging 14; grains in spikelet 2 to 3, usually 3; red, large and mostly plump.

4. *Deihl Mediterranean.*—Fall growth very good. Spring condition the best of any of the varieties. Did not winter-kill in the least. Took a very early and vigorous spring growth. Foliage profuse; color dark green. Straw not very erect, spreading; strong, but growth so heavy that it lodged in places before ripe. Average length to straw 4½ feet. In head May 13; in bloom May 26; ripe June 21. Heads bearded, square, averaging 2½ inches in length. Spikelets compact, 18 to 22 in head, averaging 20. Grain per spikelet, in most instances, 3, sometimes only 2; red, not very plump, of average size.

5. *Four-rowed Sheriff (from Russia).*—Fall growth tender. Stood the winter well. Spring growth very backward. In head June 4; in bloom June 11. Taken by rust. Did not ripen.

6. *White Crimean.*—Fall growth good; winter-killed. No spring growth whatever.

7. *Egyptian.*—Fall growth good. Entirely winter-killed.

8. *Genoese.*—Fall growth fair. About 40 per cent. winter-killed. Spring growth erect; straw erect and very strong, averaging about 4 feet in length. In head May 14; in bloom May 22; ripe June 30. Heads somewhat rounded, beardless, loose. Spikelets per head, 14-18. Grains per spikelet, 2 to 3, usually 2. Red wheat; grains large; somewhat shriveled.

9. *Hicks.*—Fall growth good; stood the winter well. Spring growth profuse and grass-like. Straw erect and strong. Did not lodge. In head May 14; in bloom May 21; ripe June 28. Heads beardless, square, averaging 2½ inches in length. Twelve to 16 spikelets in a head, averaging 14. Grains per spikelet from 2 to 3. Grain red, hard, long and of average size.

10. *Indian.*—Fall growth good. Completely winter-killed.

Following are given the data of the time of cutting, yield per plot of grain and straw, and the estimated yield of same per acre:

Variety.	Time of Cutting.	Yield of Grain, Pounds . . .	Yield of Grain per Acre, Bus.	Weight of Grain per Bushel . .	Yield of Straw, Pounds . . .	Yield of Straw, per Acre . . .
Martin's Amber	June 28	311½	26.5	59¼	1551.5	7887
McGhee White	June 28	191½	28	62¾	817¼	7168
Extra Early Oakley	June 9	297	32½	62¾	773	5052
Deihl Mediterranean	June 21	175	31	61¼	677	7217
Genoese	June 30	77	27.3	60¾	231	4792
Hicks	June 28	186	23½	62½	765	5809

Conclusions as to Varieties.

1. The Crimean, Egyptian and Indian Wheats are valueless in this section of the country, because they are unable to stand the severity of our winters. Last winter was a fair winter on wheat, yet these three varieties were entirely winter-killed, while most of the other varieties stood the winter well, growing in adjacent plots.

2. The Genoese probably will be unable to stand the majority of winters here. Otherwise it is a good wheat. It will be tried again this year.

3. McGhee White is defective in having a weak straw, and easily lodges. Probably on uplands it would succeed well.

4. The Martin's Amber, by this year's trial, proved to be an excellent white wheat, standing the winter fairly well; fine straw and a good yielder. It deserves further trials.

5. The Four-rowed Sheriff proved valueless, as it was overtaken by rust. Unfortunately this variety was not planted at the time of planting the other varieties, but twenty days later, and the late planting undoubtedly had much to do with the fatal effects of the rust. Although a total failure, the experiment is valuable in showing the danger of very late planting.

6. The Deihl Mediterranean is a most excellent bearded wheat, and

stood the winter the best of any variety. The straw is a little too heavy for low lands in such a season as that of last, but nevertheless it is very strong. It was laid flat by several storms, but partially rose again.

7. The Extra Early Oakley proved to be a most excellent variety this year. Its early maturity prevented the attack of rust entirely. Its straw is strong and erect, not loding in the least It proved to be the best yielder of any variety, and the wheat is plump and of the best in quality.

8. It should be stated that the yield of all the varieties, with the exception of the Deihl Mediterranean, a bearded wheat, was materially lessened by the ravages of the English sparrow. An attempt was made to keep these pests off, but it was almost useless, as in some places they took every grain from the head. The Extra Early Oakley in particular suffered. It is estimated that fully one-fourth of the wheat was wasted by these birds.

Cultivation.

As before stated, all the varieties of wheat were planted in drills eighteen inches apart, for the purpose of trying the effect of spring cultivation. The season was very unfavorable for the experiment. The main object was to give the wheat a good start and a continued vigorous growth. The wet spring was very favorable for the growth of wheat, and it was in the best of condition without the application of the cultivator. Again, the ground was too wet to cultivate until the wheat was nearly knee high, and by that time the ground was already shaded. Nevertheless, one-half of each variety was cultivated twice—the first time when the wheat was nearly knee high and again ten days afterward.

No appreciable difference could be distinguished in the growth or maturity of the wheat cultivated and that of the wheat uncultivated, except the cultivated wheat at maturity was, generally speaking, about three inches the taller.

The cultivated and uncultivated portions of two varieties were harvested separately and the grain weighed separately, with the following results:

	Yield per Acre Bushels. . .	Cultivated Yield per Acre. . .	Uncultivated Yield per Acre . . .	Gain in Cultivation. . . . .
Martin Amber	27.1	27.8	21.4	1.4
Deihl Mediterranean.	31	32.2	30.9	1.3

The gain by cultivation is too small to justify the statement that it pays to cultivate wheat. These experiments must cover the various seasons before any definite conclusions can be reached in this respect. Undoubtedly in a dry spring the results would have been much more striking.

Application of Fertilizers.

The ground received no manure of any kind in the fall, but in the spring some experiments were made with fertilizers on the land not intended for future plot experiments, for the purpose of giving the wheat an early start in the spring. It was applied more as a tonic than as a food.

On a plot of wheat one-fourth was not fertilized; one-fourth received an application of nitrate of soda, at the rate of ten pounds of nitrogen per acre; one-fourth received an application of sulphate of ammonia at the rate of ten pounds of nitrogen per acre, and the last one-fourth superphosphate of lime, at the rate of 100 pounds per acre. The fertilized plots soon showed the effects of the fertilizers by a more vigorous growth, a darker green, and in every respect got an early and better start, the portion fertilized with sulphate of ammonia showing the best results.

The depredations of the birds prevented any accurate estimate of yield of each plot; but there was constantly a marked effect in starting the growth in spring. In seasons where the wheat comes through the winter in a weak condition, this tonic would certainly be worth the trial.

Smut.

This disease caused much damage to wheat this year in our State, and many inquiries have been made as to the treatment of the seed-wheat before sowing. The following interesting article on this subject, by Prof. Wm. H. Brewer, is taken from the Census Report of 1880:

"The general name *smut* is used in this country to designate a class of diseases which attack the seed, known in other countries under various names, 'bunt,' 'charbon,' 'coal,' etc. The effects are seen in the grain, which is entirely changed in its character where the disease has been complete, and in the case of wheat the kernel is changed somewhat in its appearance—is shorter, plumper and slightly darker in color, and when opened, the interior is found to be entirely filled with a black or very dark brown powder, fine as lamp-black and somewhat greasy to the feel. The starch and gluten of the interior of the grain have been entirely consumed by this parasite, and its place is occupied by the spores and *mycelium* of the fungus, which together form the black powder spoken of, only the bran of the original grain remaining.

"We have a more definite knowledge of this disease than of rust, and the whole life history of the plant is reasonably well known. It was long ago known that sowing smutty seed produced smutty grain. * * * * * * * *

"Modern experiment has proved that the disease is ordinarily communicated through the seed. Wheat moistened and rolled in smut before sowing may be so completely infected that nearly every grain of the next harvest will be diseased. All the smuts belong to the genus *ustilago*; wheat smut to the *ustilago segetum*. Its spores are rough, sticky, as if greasy, and only one twenty-eight hundredth of an inch in diameter—a minuteness one finds it difficult to appreciate. Eight millions of such pores can stand on a square inch of surface. When smutted wheat is threshed the grains burst and these spores adhere to the sound grain; and when this is sown as seed they enter the young plant and develop within during the growth of the wheat, and, like a poison, circulate with the juices, and ultimately fix themselves in the kernel, which they change in nature and fill with the black powder already spoken of, consisting mostly of spores ready to produce a new generation. The ordinary farmer first sees symptoms of this disease in the ripening grain, but the experienced observer can find its traces long before, particularly in the flower, where the *mycelium*, like minute spiders' webs, entangle the stamens and pistil. The mature seed also changes in shape and is shorter and bluer at the base; the parasite, however, comes to maturity with the maturity of the grain.

"The remedies which are efficacious are applied to the seed-grain, and, fortunately, for this disease we have several complete remedies. They all consist in soaking the seed in some solution which will kill the spore without injuring the vitality of the seed itself. Many methods have been used from time to time, but two are so much superior to all others thus far devised that there are scarcely any others now used, at least in this country. Both are effective. The most common is to wet the seed wheat before sowing in a solution of copper sulphate (called also sulphate of copper, blue vitriol and blue-stone), using at the rate of two to four ounces of the sulphate per bushel of seed wheat. * * * There are several ways of applying it. Sometimes the sulphate is dissolved in water to a saturated solution. This is then diluted with an equal volume of water and sprinkled over the wheat in a pile, which is then stirred and shoveled until all the grain is moistened. This is the least effective way of doing it. In one or two cases I have known a small stream of such solution to be run in a trough along which wheat was moved by an endless screw, which stirred it up. Another method, particularly where wheat is grown on a large scale, is to have the solution in a large quantity of about the strength of half saturation in a large tub, say a hogshead, sawed in two. The wheat, in sacks or in a basket, is lowered into this solution until entirely wet. It is then removed, the surplus allowed to drain off, and the grain thrown in a pile or left standing in the sack until the next day before sowing—this last being simply that the grain may be in a better condition to sow.

"The second process, also practically effectual, is to use a solution of strong brine instead of sulphate of copper. This method has been known for centuries, and is said to have been discovered by sowing wheat for seed which had been accidentally wet in salt water by the sinking of a vessel. To be effective, the brine needs to be strong and the grain thoroughly saturated with it. Where this process is used, it is quite common that the brined grain be thrown out upon the floor and carefully limed by sifting slaked lime over it. The process is undoubtedly a good one for the crop, but so far as the smut is concerned the lime is unnecessary."

Dr. Spurr recommends the following method for the application of the sulphate of copper:

Five pounds of blue-stone in lumps are placed in a tub or half-barrel; water is added until the tub is about two thirds full; the mixture is stirred with a stick and allowed to stand for a while. The seed-wheat to be treated is placed in a basket, and basket and wheat are lowered into the solution, allowed to stand for a few moments, then raised, drained and the wheat emptied on a floor. Should sowing be delayed, the wheat can be spread and dried and sowed at any time.

BULLETIN No. IX.

Experiments with Potatoes, 1886.

The work of the Station last year in field experiments with potatoes was limited, for want of sufficient land in proper condition, to the following experiments:

1. Test of varieties.
2. Preparation of seed.
3. Application of fertilizers.

The ground for all the work was prepared the same. The land had been in cultivation for three years. It had never received an application of manure. The soil is a typical blue grass soil, a medium loam, two to three feet in depth, resting on a porous, reddish subsoil of the same nature as the surface soil. This subsoil rests on blue limestone, quite cavernous, producing a fine natural drainage. The subsoil varies in depth from three to ten feet. Previous to these experiments the land had been in cultivation two years in tobacco, followed by a potato crop. The plot had been plowed the previous fall, and was re-plowed, harrowed and dragged just before planting. In all the experiments the potatoes were planted in rows three feet apart by fourteen inches in the row and four inches deep. The cultivation was shallow, but in the third cultivation the dirt was thrown toward the row. The bugs were picked off of all plots at the same time, and great care was taken to have all conditions alike.

Test of Varieties.

Our endeavors were put forth to give each variety an impartial test. They were all planted the same day. All seeds cut to two eyes a few days before planting, and planted, cut-side down, exactly fourteen inches apart in the row and covered to the depth of four inches. The different sorts were so planted that any errors arising from the contour of the land were obviated as much as possible, and all plots were cultivated the same day each time. All the varieties were planted April 18th.

Description of Varieties Tested.

Charter Oak.—Obtained from Peter Henderson & Co., New York. Tuber large, irregular oval, and typical ones slightly flattened; skin smooth and white, eyes large, shallow and pink. Vines, large, stout, erect, very vigorous and fully two feet high.

Burbank.—Tubers long and flattened, smooth, light color, medium size. Vines strong and erect growth, about 20 inches high.

White Star. — (Henderson.) Tubers resembling Burbank, very white, smooth, medium size. Vines strong, erect, about 20 inches high.

Clarke's No. 1.—(Henderson.) Tubers resembling Early Rose, but lighter in color; somewhat flattened, smooth, medium size, tending to large. Vines strong growth, vigorous, slightly drooping.

Vanguard.—(Henderson.) Tubers long, medium size, color resembling Early Rose; eyes few and shallow. Vines not very strong, about 18 inches high.

Early Rose.—(Ohio grown.) Tubers of medium size, smooth, longish, reddish-brown. Vines not very vigorous and of medium growth

Rochester Favorite.—(Henderson.) Tubers oval, tending to long; light, smooth and medium size. Vines vigorous, and about 22 inches high.

Empire State.—(Henderson.) Tubers large, white and smooth. Vines vigorous.

Pearl of Savoy.—(Henderson.) Tubers oblong, large, smooth; light rose tint.

Perfect Peachblow.—(Henderson.) Tubers globular form, large, uniform, rough; eyes pink, small, slightly indented. Vines of medium growth, compact.

Dakota Red.—(Henderson.) Tubers small to medium size; reddish, irregular. Vines medium.

Early Ohio.—(Ohio grown.) Tubers nearly round, smooth to rough; reddish-brown, medium size. Vines vigorous and erect.

St. Patrick—(Henderson.) Tubers long, smooth, white, resembling Burbank; large. Vines vigorous.

Jumbo.—(Henderson.) Tubers globular, somewhat flattened, rough, light color, some very large. Vines vigorous, spreading.

White Elephant.—(Henderson.) Tubers long, large, white, and resembling the Burbank. Vines not very vigorous, about 18 inches high.

Extra Early Vermont.—(Henderson.) Tubers medium in size, smooth, longish, rose colored; resembling the Early Rose. Vines of medium growth.

Beauty of Hebron.—(Henderson.) Tubers medium in size, smooth, shallow eyes, rose color, resembling Early Rose. Vines vigorous and of medium height.

Early Sunrise.—(Henderson.) Tubers long, brownish red, smooth, medium in size. Vines of medium growth.

Triumph.—(Henderson.) Tubers long and somewhat flattened, smooth, light colored, medium in size; eyes numerous and pinkish.

Of these varieties the Vanguard, Early Vermont, Beauty of Hebron, Early Rose, Early Ohio, Early Sunrise, Pearl of Savoy, St. Patrick and Clarke's No. 1 are early sorts; the Burbank, Rochester Favorite, White Star, White Elephant, Charter Oak, are medium, and the Perfect Peachblow, Jumbo, Dakota Red, and Empire State are late in coming to maturity.

Yield of the Varieties.

The following table shows the yield of the different varieties calculated on the basis of an acre. The varieties are named in order of their yield:

Name of Variety.	Yield Per Acre in Bushels.		Total Yield.
	Large Tubers.	Small Tubers.	
Charter Oak	271½	27½	299
Burbank	230½	32	262½
White Star	209	30½	239½
Clar' e's No. 1	193½	36½	230
Vanguard	17[illegible]	44½	216½
Early Rose (Ohio grown)	153½	20½	174
Rochester Favorite	146½	34½	181
Empire State	140½	11½	152
Pearl of Savoy	132	43	175
Perfect Peachblow	114	25½	139½
Dakota Red	98	21	119
Early Ohio	90½	29½	120
St. Patrick	90	20½	110½
Early Rose (Henderson)	88½	14½	103
Jumbo	85½	26½	111½
White Elephant	75	8½	83½
Extra Early Vermont	55	21½	76½
Beauty of Hebron	55	12½	67½
Early Sunrise	32½	5½	38
Triumph	31½	18	49½

The results show that the new potato, *Charter Oak*, ranks first as to yield, exceeding by 41 bushels the Burbank, which ranks second.

The fact that a variety shows a yield a few bushels greater or less than another one year, is not conclusive that it will do so year after year. Such experiments, to be of much value, should extend over a series of years. In this table the yield of early and late potatoes is compared. The Vanguard is very early, while the Charter Oak is considered a late potato. The difference in the growing season of the two potatoes might have caused the difference in yield, although to appearances the season was favorable to the early potato. Again, the variation in size of the seed, and the cuttings, might have caused a difference in the yield, as will be seen further on. The endeavor was to so cut the potatoes that the comparisons would be alike. Two eyes were left to each piece, yet the pieces were not all of the same size; and in some instances the want or proper food might have greatly retarded the young plant, and thereby injured its yield.

The last four varieties are hardly comparable with the others, as but very small quantities of each were planted.

The Quality of the Different Varieties.

The yield, while it has its influence, is not so much sought after in a potato as its quality. A good yielder may be worthless on account of its poor quality. It is essential, therefore, to test the eating as well as its producing qualities.

The quality of a potato is supposed to depend on the amount of starch it contains, or as the *dry substance* of a potato is mostly starch, this is often taken as a standard of quality in ripe and well preserved potatoes.

To determine the dry substance, well selected potatoes were cut in two and a slice cut from either half until one pound of slices was obtained. These were dried in a current of warm air, then ground, and the last traces of water driven off by heating at the boiling temperature of water.

The following table shows the relative quality of the different varieties of potatoes September, 1886, as depending upon the dry substance found:

Name of Variety.	Dry Substance in 100 Parts	Water in 100 Parts . .
Charter Oak	22.87	77.13
Perfect Peachblow	22.63	77.37
Early Rose (Ohio grown)	22.57	77.43
Early Rose (Henderson)	22.05	77.95
Rochester Favorite	21.98	78.02
Beauty of Hebron	21.85	78.15
Clarke's No. 1	21.75	78.25
Extra Early Vermont	21.74	78.26
Burbank (Ohio grown)	21.66	78.34
Empire State	21.40	78.60
Triumph	21.38	78.62
Early Rose (home grown)	21.32	78.68
White Elephant	21.25	78.75
Early Ohio	20.85	79.15
Vanguard	20.70	79.30
Pearl of Savoy	20.66	79.34
St. Patrick	20.30	79.70
Early Sunrise	19.97	80.03
Shaker Russet	19 93	80.07
White Star	19.66	80.34
Jumbo	19.64	80 36
Dakota Red	18.97	81.03

From this table it appears that the Charter Oak ranks first in quality, being superior to the Perfect Peachblow and the Early Rose, while the Dakota Red is at the foot of the list.

Taken as a whole, the table shows that the quality of potatoes produced here this year is not of the best. A good potato should contain 25 per cent. of dry substance.

The season here was not favorable to the production of the best quality of potatoes. At the ripening season dry weather was prevailing, and probably did not allow of proper maturity. Especially can this be said of the late varieties, including the Charter Oak. The vines dried up rather than ripened.

The Keeping Qualities of the Different Varieties.

To ascertain the keeping qualities of the different varieties of potatoes, one-half bushel of each sort was placed on a ground floor of a good warm cellar and left there until early in February, when they were taken to the laboratory for analysis. Two days before they were taken from their winter quarters a severe rain storm flooded the cellar, and the potatoes were completely submerged for that length of time.

In the laboratory the specific gravity of each variety was noted, and the amount of solid matter ascertained, as had been done in the fall. As was anticipated, this had not changed to any great extent in any of the varieties. In the fall of the year, while the potatoes are in perfect condition, it may do to judge of their quality by the amount of dry substance they contain; but in the spring, especially when the potatoes are sprouting, the starch is being changed without material effect on the amount of solid matter. As this change takes place more rapidly in some varieties than others, it becomes necessary to test the quality by the amount of starch found, rather than by the amount of dry substance.

The following table shows the amount of starch, sugar and dry substance found in the different varieties of potatoes February, 1887. The varieties are named in order of the amount of starch found:

Name of Variety.	Per Cent. of Starch. . . .	Per Cent. of Sugar	Per Cent. of Dry Substance. . .	Per Cent. of Water.
1. Empire State	15.48	0.88	22.40	77.60
2. Charter Oak	15.33	1.49	22.91	77.09
3. Clarke's No. 1	15.29	1.06	22.35	77.65
4. Perfect Peachblow	15.12	1.32	22 22	77.78
5. White Star	15.11	0.81	21.82	78.18
6. Triumph	15.09	0.76	21 80	78.20
7. Pearl of Savoy	15.07	1.06	21.86	78.14
8. Burbank	14 98	0 74	21.46	78.54
9. Vanguard	14.76	0.87	21.03	78.97
10. Early Rose	14.57	0.97	21.72	78.28
11. Beauty of Hebron	14.56	0.94	21.29	78.71
12. Early Ohio	14.35	0.77	21.10	78.90
13. St. Patrick	14.29	0.74	20.20	79 80
14. Jumbo	14.20	0.84	20.45	79.55
15. Shaker Russet	13.91	0.84	20.42	79 58
16. Dakota Red	12.05	1.10	19.21	80.79

In all probability the results would have been more striking if the potatoes could have been kept until later in the spring before making the tests. As it is, the table indicates that the first nine varieties would be good for spring use; that the next six varieties are poor in quality, and that the last might be said to be unfit for use.

Preparation of Seed.

Only three experiments were undertaken in this line. The Burbank potato was the variety used. The seed was taken from home-grown potatoes. The three plots received exactly the same treatment as to preparation, planting and cultivation.

The first experiment was made with whole potatoes too small for eating purposes. The second with marketable potatoes cut to two eyes. The third with whole potatoes of large size.

The plots were 1-10 acre in size. The potatoes were planted in rows 3 feet apart by 14 inches in a row, and covered to the depth of 4 inches.

The following table shows the yield calculated per acre:

SEED.	Yield of Large Tubers. . .	Yield of Small Tubers. . .	Total Yield .
Small, whole seed	145	48	193
Cut to two eyes	120	30	150
Large, whole seed	210	50	260

The results show the advantage of planting whole potatoes of large size. Even small whole potatoes are to be preferred as seed to cut potatoes.

Application of Fertilizers.

The soil for these experiments is similar to that for varieties. The plots were 1-10 acre each. The method of planting was identical to that described under varieties, and the previous treatment of the soil was the same.

The fertilizers were applied to each plot separately—one-half broadcast, and the other half distributed equally in the furrows. The Burbanks were used as seed, cut to two eyes, the seed end not being used.

The following table gives the fertilizers used per acre and the yield of potatoes:

Plot Number, . . .	How Treated.	Yield per Acre in Bushels.		Total . . . . . .
		Large. . .	Small . . .	
56	None	120	30	150
58	Nitrate of soda, 300 . . . . Superphosphate of lime, 600 . . . . Sulphate of potash, 200	170	43	213
59	Nitrate of soda, 300 . . . . Superphosphate of lime, 600 . . . . Chloride of potassium, 200	198	48	245
60	Superphosphate of lime, 600 . . . . Sulphate of potash, 200	203	35	238
61	Superphosphate of lime, 600 . . . . Nitrate of soda, 300	213	35	248
62	Nitrate of soda, 300. . . . . Sulphate of potash, 200	198	35	233
63	Mapes complete potato manure, 600.	195	45	240
64	None	138	53	191
65	Stable manure, about 1½ tons	170	30	200
66	Homestead tobacco grower, 600	183	33	216
67	Limestone dust, 1,000	135	35	170

The essential ingredients of fertilizers are *nitrogen*, *phosphoric acid* and *potash*. In these experiments the fertilizer applied to furnish nitrogen was nitrate of soda, which contained 15 per cent. of nitrogen; superphosphate of lime, containing 18 per cent. of phosphoric acid, to supply phosphoric acid, and sulphate of potash, containing 40 per cent. of potash, to supply that substance. Some soils are deficient in all three of these elements, while others are lacking in only one or two. In our experiments, plots Nos. 58 and 59 received all three of these essential ingredients, or what is called a complete fertilizer. On plot No. 59 the muriate of potash was substituted for sulphate of potash simply to find out which potash compound could be used to best advantage. In plot No. 60 the nitrogenous fertilizer (nitrate of soda) was left out, with no appreciable effect on production. In plot No. 61 the potash was left out with apparent advantage, but the variation in the soil was probably the cause of the small increase in yield.

From the above it would seem that as neither the nitrogenous fertilizer nor the potash increased the yield, the phosphoric acid was the element lacking, but in plot No. 62, with this element left out and potash and nitrogen applied, the yield was about the same as in any of the fertilized plots. While the results show conclusively that the application of fertilizers greatly increased the yield, they fail to show which of the ingredients was the most effective. The Mapes fertilizer, presented for trial by the Mapes Formula and Peruvian Guano Company, New York, and the Homestead Tobacco Grower, presented by the Michigan Carbon Works, Detroit, answer the purpose as well, considering the amount applied, as the other mixtures. The stable manure fell short of the artificial fertilizers, and the limestone dust had no appreciable effect.

It must be borne in mind that these experiments were made on comparatively new and very rich ground, having been in cultivation only three years. In a soil long in cultivation, or of poor quality, the results would have undoubtedly been more striking. Again, as shown by plots Nos. 56, 64 and 67, the field varied in fertility, and makes conclusions more difficult. But this variation happens in all soils, and often makes the most carefully carried-out plot experiment of little value. Well weighed and accumulative evidence is needed before general conclusions can be reached with safety. The judicious application of commercial fertilizers for nearly all crops would, with scarcely a doubt, be a paying investment to the farmer. Certain it is that this subject neads careful consideration and attention.

The Effect of Fertilizers on the Quality of Potatoes.

The following table shows the effect of the different fertilizers on the quality of the potato—the potato having the most starch being considered the best:

Plot Number.	Fertilizer Used.	Per Ct. Starch.	Per Ct. Sugars.	Per Cent. Dry Substance.	Per Ct. Water.
56	None	15.34	0.63	21.31	78.69
58	Nitrogen; Phosphoric acid; Sulphate potash	15.28	0.68	21.50	78.50
59	Nitrogen; Phosphoric acid; Muriate potash	15.20	0.75	21.04	78.96
60	Phosphoric acid; Potash	15.97	0.95	21.75	78.25
61	Phosphoric acid; Nitrogen	15.13	0.65	21.60	78.40
62	Potash; Nitrogen	15.80	0.93	22.38	77.62
63	Mapes potato manure	15.56	0.74	22.15	77.85
64	None	15.98	0.88	22.74	77.26
65	Stable manure	14.65	0.88	21.33	78.67
66	Homestead Tobacco Grower	14.69	0.92	21.58	78.42
67	Limestone dust	15.43	0.96	21.85	78.15

The following conclusions seem warrantable from the results as shown in the table:

1. That the application of stable manure greatly injures the quality of the potato.

2. That the application of nitrate of soda is injurious to the quality of the potato. This will probably hold good to the application of

any nitrogenous fertilizer. The Homestead Tobacco Grower probably contains too much nitrogen for the production of the best quality of potatoes.

3. The inference is, based upon one trial, that the result in the quality of the potato is the same, whether sulphate or muriate of potash is used at least in combination with nitrate of soda and superphosphates.

BULLETIN No. 10.

Fertilizer Analyses.---Fertilizers Analyzed, 1887.

The following tables give the names of all the manufacturers who have complied with the law for 1887, and the names of the brands legally on sale; also the analysis and valuation of each brand.

The following are the values used for the essential ingredients:—Phosphoric acid soluble in water, 10 cents; insoluble phosphoric acid, 4 cents; phosphoric acid in fine bone, 4½ cents; in medium bone, 4 cents per lb.; potash, 5 cents, and nitrogen, 18 cents per lb.

Fine bone is all that passes through a sieve with meshes 1-25 inch square. Medium bone passes through a sieve with meshes 1·6 inch square, but does not include fine bone.

TABLE I.

Raw Bone Manures—Analysis and Valuation.

Station Number	Name and Address of Manufacturer.	Name of Brand.	Pounds in the Hundred. Moisture	Phosphoric Acid. In Fine Bone	Phosphoric Acid. In Medium Bone	Phosphoric Acid. Total	Phosphoric Acid. Equivalent to Bone Phosphate	Nitrogen	Equivalent to Ammonia	Potash	Estimated Value per Ton.
207	Cincinnati Desiccating Co., Cincinnati, O	Pure Raw Bone Meal	4.58	19.18	4.79	23.97	52.36	4.43	5.38	. .	$37 04
210	Cincinnati Desiccating Co., Cincinnati, O	Pure Bone Flour	6.43	23.90	. . .	23.90	52.19	4.11	4.99	. .	36 31
196	Currie Fertilizer Co., Louisville, Ky.	Currie's Raw Bone Meal	7.68	10.81	10.81	21.62	47.22	4.22	5.12	. .	33 55
177	Michigan Carbon Works, Detroit, Mich.	Homestead Bone Meal with Potash	6.49	17.72	. . .	17.72	38.70	2.93	3.56	2.90	29 40
218	Michigan Carbon Works, Detroit, Mich.	Homestead Desiccated Bone	7.77	17 74	1.19	18.93	41.35	3.69	4.48	. .	30 20
183	Miller Fertilizer Works, Louisville, Ky.	Pure Raw Bone Superphosphate	10.87	14.62	3.65	18.27	39.90	4.11	4.99	0.59	31 47
188	Miller Fertilizer Works, Louisville, Ky.	Pure Raw Bone Meal	7.23	15.01	8.45	23.46	51.24	3.89	4.72	. .	34 27
169	North Western Fertilizing Co., Chicago Ill	Fine Raw Bone	8.93	23.00	. . .	23 00	50.24	3.52	4.27	. .	33 37

TABLE II.

Complete Fertilizers, Superphosphates, etc.—Analysis and Valuation.

Station Number	Name and Address of Manufacturer.	Name of Brand.	Pounds in the Hundred.							Estimated Value
			Moisture	Phosphoric Acid.			Nitrogen	Equivalent to Ammonia	Potash	
				Soluble	Reverted	Insoluble				
219	Amor Smith & Co., Cincinnati, O.	Ammoniated Superphosphate of Lime.	17.97	0.61	6.99	15.08	2.38	2.89	..	$35 83
208	Cincinnati Dessiccating Co, Cincinnati, O	Pure Acidulated Bone	7.51	2.89	8.35	8 97	4.23	5.14	..	44 89
209	Cincinnati Dessiccating Co. Cincinnati, O.	Gilead Phosphate	7.40	2.84	4.36	3.07	3.63	4.41	1.35	31 28
212	Cleveland Dryer Company, Cleveland, O.	White Burley Tobacco Fertilizer	6.88	10.39	0.78	3.39	3.15	3.82	2.84	39 23
213	Cleveland Dryer Company, Cleveland, O.	Connecticut Valley Tobacco Fertilizer.	6.90	10.21	0.68	2.94	3.29	3.99	4.79	40 76
214	Cleveland Dryer Company, Cleveland, O.	Buckeye Phosphate	4.50	11.05	1.30	3.53	3.19	3.87	..	39 00
215	Cleveland Dryer Company, Cleveland, O.	Ammoniated Dissolved Bone	10.22	6.67	2 57	3.43	1.68	2.04	..	27 27
216	Cleveland Dryer Company, Cleveland, O.	Square Bone	5.14	4.06	4.25	9 27	4.55	5.52	..	40 42
217	Cleveland Dryer Company, Cleveland, O.	Ohio Seed Maker	9.97	6.96	2.47	3.08	1.83	2.22	..	27 91
171	Currie Fertilizer Co., Louisville, Ky	Falls City Tobacco Grower	9.36	4.38	5.03	2.47	2.62	3.11	6.07	36 30
191	Currie Fertilizer Co., Louisville, Ky	Falls City Corn Grower	12.91	6.75	3.38	2.87	1.79	2.17	1.08	30 08

TABLE II.---Continued.

Station Number	Name and Address of Manufacturer.	Name of Brand.	Pounds in the Hundred.							Estimated Value.
			Moisture	Phosphoric Acid.			Nitrogen	Equivalent to Ammonia	Potash	
				Soluble	Reverted	Insoluble				
192	Currie Fertilizer Co., Louisville, Ky.	Falls City Ammoniated Dissolved Bone	11.15	7.36	2.06	2.35	1.14	1.38	2.11	$26 93
194	Currie Fertilizer Co., Louisville, Ky.	Falls City Wheat Grower	6.26	4.32	5.46	4.96	2.45	2.97	1.08	33 43
195	Currie Fertilizer Co., Louisville, Ky.	Falls City Phosphate	12.44	6.65	3.25	3.08	1.89	2.29	1.10	30 16
197	Currie Fertilizer Co., Louisville, Ky.	Falls City Raw Bone Meal	6.25	4.20	5.32	5.65	2.27	2.76	1.05	32 78
198	Currie Fertilizer Co., Louisville, Ky.	Falls City Bone Flour	7.24	3.77	4.03	5.95	1.44	1.75	2.08	27 62
193	Currie Fertilizer Co, Louisville, Ky.	Currie's Raw Bone Superphosphate	13.42	1.62	6.73	5.33	4.33	5.26	1.40	37 95
202	D. Duckwall & Co., Louisville, Ky.	Bromophyte	4.70	0.23	1.90	0.34	1.08	1.31	0.38	8 80
220	Wm. A. James & Read, Richmond, Va.	"Regular Roanoke" Ammo'd Super'te.	13.92	8.09	1.79	1.84	1.86	2.26	3.12	31 05
179	Michigan Carbon Works, Detroit, Mich.	Homestead Tobacco Grower	11.49	9.63	0.75	0.47	3.83	4.65	4.90	39 83
180	Michigan Carbon Works, Detroit, Mich.	Homestead Corn and Wheat Grower	14.88	7.89	2.20	0.91	2.37	2.88	1.64	31 08
181	Michigan Carbon Works, Detroit, Mich.	Jarves' Drill Phosphate	11.78	7.87	1.70	4.02	1.29	1.57	..	27 00
185	Michigan Carbon Works, Detroit, Mich.	Jarves' Tobacco Grower	12.17	5.37	1.93	1.07	1.83	2.22	2.59	24 64

180	Michigan Carbon Works, Detroit, Mich. .	Homestead Corn and Wheat Grower .	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
181	Michigan Carbon Works, Detroit, Mich. .	Jarves' Drill Phosphate.	11.78	7.87	1.70	4.02	1.29	1.57	. .	27 00
185	Michigan Carbon Works, Detroit, Mich. .	Jarves' Tobacco Grower.	12.17	5.37	1.93	1.07	1.83	2.22	2.59	24 64
170	P. B. Mathiason & Co., St. Louis, Mo . .	St. Louis Fertilizer	13.50	2.74	2.65	5.18	2.14	2.60	0.39	23 02
184	P. B. Mathiason & Co , St. Louis, Mo . .	Ammoniated Bone Superphosphate. .	9.90	8.09	2.06	2.43	3 66	4.44	1.53	36 95
221	Memphis Fertilizer Co., Memphis, Tenn .	Memphis Fertilizer	8.81	5.74	3.15	2.56	2.14	2.60	2.88	30 41
163	Northwestern Fertilizing Co., Chicago, Ill.	Tobacco Compound.	11.01	6.06	2.08	4.78	2.75	3.34	1.64	31 64
164	Northwestern Fertilizing Co., Chicago, Ill.	Challenge Corn Grower	12.51	6.96	2.09	5.14	2.31	2.81	3.26	33 79
165	Northwestern Fertilizing Co., Chicago, Ill.	National Bone Dust.	12.56	7.46	2.04	4.96	2.14	2.60	3.29	33 96
166	Northwestern Fertilizing Co., Chicago, Ill.	Ralston's Bone Meal	13.81	3.61	3.75	5.87	2.04	2.48	. .	26 76
167	Northwestern Fertilizing Co., Chicago, Ill.	Prairie Phosphate	15.13	5.25	1.71	8.28	1.29	1.57	. .	25 18
168	Northwestern Fertilizing Co., Chicago, Ill.	Twenty-six Dollar Phosphate	14.96	5.21	1.78	8.34	1.29	1.57	. .	25 29
206	National Fertilizer Co., Nashville, Tenn .	Tobacco Fertilizer	8.42	2.84	8.37	5.05	3.19	3.87	4.56	42 50
204	National Fertilizer Co , Nashville, Tenn .	Corn Grower	8.34	8.01	2.83	0 55	1.65	2.00	4.17	32 23
205	National Fertilizer Co., Nashville, Tenn .	Rock City Superphosphate	12.04	7.38	1.80	1.54	2.75	3.34	3.00	32 49
203	National Fertilizer Co., Nashville, Tenn .	Tennessee Superphosphate	15.50	6.40	2.18	1.54	2.67	3.24	5.02	33 02
175	Pacific Guano Company, Boston, Mass. . . (John S. Reese & Co., Baltimore, Md.)	Dissolved Bone Phosphate and Potash.	2.30	9.69	4.23	2,46	0.19	0.23	2.01	32 50
176	Pacific Guano Company, Boston, Mass. . . (John S. Reese & Co., Baltimore, Md.)	Soluble Pacific Guano	13.28	7.14	1.87	2.47	2.60	3.16	3.04	32 40
186	Wm. Skene & Co., Louisville, Ky.	Skene's Imp'd Louisville Superphos. .	5.96	0.52	6.08	8.16	1.66	2.02	6.70	32 41
187	Wm. Skene & Co., Louisville, Ky.	Kentucky Bone Meal with Potash . .	4.86	1.23	7.51	5.46	1.21	1.47	3.76	29 97
172	Thompson & Edwards, Chicago, Ill . . .	Sure Growth Phosphate	6.59	5.85	3.55	6.86	1.37	1.66	. .	29 22
173	Thompson & Edwards, Chicago, Ill. . . .	World of Good Tobacco Grower . . .	5.39	5.21	3 38	6.58	2.82	3.44	. .	32 59
174	Thompson & Edwards, Chicago, Ill . . .	Dissolved Bone Meal	8.38	4.75	3.36	8.76	1.79	2.17	. .	29 67

TABLE II.—Continued.

Station Number	Name and Address of Manufacturer.	Name of Brand.	Pounds in the Hundred.							Estimated Value
			Moisture	Phosphoric Acid.			Nitrogen	Equivalent to Ammonia	Potash	
				Soluble.	Reverted.	Insoluble.				
199	Walton & Whann Co., Wilmington, Del.	Diamond Soluble Bone	11.05	7 36	5.29	3.56	0.33	0.40	..	$29 34
200	Zell Guano Company, Baltimore, Md.	Zell's Ammo. Bone Superphosphate	10.20	6.42	1.28	4.91	1.91	2.32	1.63	27 84
201	Zell Guano Company, Baltimore, Md.	Zell's Calvert Guano	10.30	7.94	2.45	1.83	0.71	0.86	1.47	26 27
211	Zell Guano Company, Baltimore, Md.	Zell's Dissolved Bone Phosphate	11.26	10.86	1.89	2.70	...	...	..	27 66

BULLETIN No. XI.

Experiments With Wheat, 1887.

During the year 1886–1887 the experiments undertaken in wheat culture were confined mainly to the following investigation:

1. Comparative test of selected varieties.
2. Method of seeding.
3. Effect of cultivation.
4. Effect of fertilizers.
5. Application of various substances on the wheat to prevent smutting.

The experiments were conducted on a piece of land used formerly as a fair ground, but now belonging to the College. The soil is a typical blue-grass soil, a medium loam two to three feet in depth, resting on a porous reddish subsoil of the same nature as the surface soil. This subsoil rests on blue limestone, quite cavernous, producing a fine natural drainage. The subsoil varies in depth from three to ten feet. Previous to these experiments the land had been in cultivation four years—two years in tobacco, one in potatoes, and the last year in wheat.

Test of Varieties.

Fifteen varieties of wheat were selected for the experiments. Before planting the ground was plowed and thoroughly harrowed, but not rolled. Each variety was planted in drills 7 inches apart, by use of the Buckeye wheat drill. One-twentieth of an acre was planted of each variety. The following table gives the names of the different varieties, time of planting, amount of seed-wheat planted, and the date of coming up of each variety:

Number.	Variety.	Amount Seed per Acre.	Time of Planting.	When up
1	Martin's Amber	50 lbs	Oct. 5	October 10
2	McGhee White	55 lbs	Oct. 5	October 10
3	Extra Early Oakley	50 lbs	Oct. 6	October 11
4	Diehl Mediterranean	52½ lbs	Oct. 6	October 11
5	Genoese	52½ lbs	Oct. 6	October 11
6	Hicks	60 lbs	Oct. 6	October 11
7	Fulcaster	60 lbs	Oct. 6*	October 27
8	German Emperor	55 lbs	Oct. 6	October 11
9	Finley	57½ lbs	Oct. 6	October 10
10	Fultz	50 lbs	Oct. 6	October 10
11	German Amber	50 lbs	Oct. 6	October 10
12	Blue Stem	67½ lbs	Oct. 8	October 14
13	Mediterranean Hybrid	65 lbs	Oct. 9	October 15
14	Longberry	62½ lbs	Oct 9	October 15
15	Hickman	65 lbs	Oct. 9	October 15

* Re-planted October 20.

The following notes made on the different varieties during different periods of growth are given:

No. 1. *Martin's Amber.*—(From United States Department Agriculture, 1885). Fall growth, vigorous; early spring growth, backward, strong and close to surface of ground; straw, erect, stout, stooling March 4; jointing March 19; in head May 23; in bloom May 30; ripe June 28; straw standing well, averaging 4 feet in height; heads beardless, flattened, abruptly pointed, averaging 3¼ inches in length; spikelets, 11 to 20, averaging 18; two grains in a spikelet; grains white, small, thin.

2. *McGee White* (From U. S. Dep't Ag'l, 1885).—Fall growth prime; winter-killed to small extent; spring growth small, not very erect; straw weak, averaging 3¾ feet in height; stooling March 4; jointing March 16; in head May 9; in bloom May 18; ripe June 21; heads smooth, square, tapering, averaging 3 inches in length; spike-

lets, 14 to 21, averaging 19; grains, 2 to 3 in spikelet, medium to large.

3. *Extra Early Oakley* (From U. S. Dep't Ag'l, 1885).—Fall growth prime; spring stand perfect; spring growth, erect, but not stooling to a very great extent; straw very erect and stout, not lodging; height averaging 3⅔ feet; stooling March 4; jointing March 16; heading May 9; in bloom May 17; ripe June 15; heads smooth, square, tapering, not compact, averaging 3 inches in length; spikelets, 9 to 18, averaging 17; grains in spikelet, 2 to 3, usually 2; red, medium, plump.

4. *Diehl Mediterranean* (From U. S. Dep't Ag'l, 1885).—Fall growth excellent; spring condition perfect; took a very early and vigorous growth; foliage, profuse; color, dark green; straw not very erect, spreading; strong, but lodging in places; average length of straw, 3¾ feet; jointing March 19; heading May 11; in bloom May 18; ripe June 21; heads bearded, square, tapering from the middle, short, compact, averaging 2½ inches in length; spikelets compact, 13 to 20 in head, averaging 17; grains in spikelet, 2; red, average size, plump.

5. *Genoese* (From U. S. Dep't Ag'l, 1885)—Fall growth fair; affected by the winter very much; growth yellow, as seen after snow melted; spring growth erect; straw erect and very strong, averaging 3⅔ feet in length; stooling March 8; jointing March 19; in head May 20; in bloom May 27; ripe June 28; heads smooth, nearly square, tapering, not compact; grains red, plump, medium to large.

6. *Hicks* (From U. S. Dep't of Ag'l, 1885).—Fall growth fair; stood the winter well. Spring growth profuse, grass-like; straw erect and strong; did not lodge; stooling March 4; jointing March 16; in head May 14; in bloom May 21; ripe June 20. Heads beardless, flattened, tapering, averaging 2½ inches in length; 10 to 14 spikelets in a head, averaging 13; grains in each spikelet, from 2 to 3; grain red, hard, medium to large, plump.

7. *Fulcaster* (U. S. Dep't of Ag'l, 1886).—It was impossible to get a perfect stand of this variety, the first planting producing but a few scattering spears of wheat. October 20 the plot was replanted, putting on at the rate of nearly 4 bushels per acre, and not a full stand was obtained even then. The wheat had evidently been heated.

The following description of the wheat accompanied the packages sent us by the Department of Agriculture:

Fulcaster.

"This hardy and prolific variety of wheat is believed to be a hybrid of two of our most celebrated, time-tested and hardy wheats, viz: Fultz and Lancaster, as it has the straw, chaff and peculiar eight-row head of the Fultz, with the hardiness, long berry and beards of the Lancaster, really possessing all of the good qualities of both. This wheat has a stiff white straw that will stand up well under almost any circumstances; a white bearded chaff that clings to the grain, not shattering easily; heads long and massive; filled with the large, plump, flinty, long berry grains. It ripens from three to six days earlier than most other varieties, and the yield is said to be fully equal to that of the Fultz. The originator also claims for it superior milling qualities. This wheat was originated in the Cumberland and Shenandoah Valley region, one of the finest winter wheat regions in the United States."

Our observations were: Fall growth weak and slow; spring growth better; straw stiff and strong; not falling; average length, 4 feet; stooling March 10; jointing March 20; in head May 20; in bloom May 27; ripe June 28; heads bearded, flattened, tapering, averaging 3¼ inches; spikelets 14 to 24, averaging 19; grains 2 to 3, mostly 3; large, red.

8. *German Emperor.*—This is a new variety, sent last fall by the United States Department of Agriculture, with the following description:

German Emperor.

Imported from Germany by the grower, and thoroughly tested in Northwestern Ohio. It is a smooth wheat, having large, compact heads, somewhat resembling the Clawson. It is highly recommended as being exceptionally hardy and well adapted for culture on low lands where the soil is of a black and mucky character. It tillers or "stools" out remarkably, and the straw is long and strong and stands up well. It ripens early, and is said to yield from one-fourth to one-third more than other varieties in the same locality.

Fall and spring growth good; straw strong, averaging 4 feet in length; heading May 10; ripe June 21; heads beardless, flattened, slightly tapering; average, 3 inches in length; spikelets, 14 to 19, average, 17; grains, 2 to 3 in spikelet, rather long, not plump, red.

9. *Finley* (From W. S. McChesney, Lexington, Ky.)—Made a strong, healthy fall growth; grew well in spring, but not stooling to a very great extent; straw 4 feet; stooling March 4; jointing 16; heading May 14; in bloom May 21; ripe June 21; heads smooth, flattened, tapering, 3 inches long; spikelets, 12 to 19, average 17; grains, 2 to 3 in spikelet, medium size, plump.

10. *Fultz.*—Fall growth fair; perfect stand in spring; straw 4 feet, standing well; stooling March 4; jointing March 16; in head May 16; in bloom May 22; ripe June 28; heads smooth, flattened, tapering slightly, 3¼ inches long; spikelets, 12 to 23, average 17; grains, 2 to 3 in spikelet, mostly 3; small to medium size, plump.

11. *German Amber* (United States Department of Agriculture, 1886).—Fall growth, fair; not winter-killed in the least; spring growth vigorous; straw 4⅓ feet long; jointing March 16; heading May 17; ripe June 28; heads beardless, flattened, tapering; spikelets, 12 to 23, averaging 18; grains, 2 to 3, mostly 2, in spikelet; medium size, plump.

12. *Blue Stem.*—Made a good fall growth; not injured by the winter; grew thriftily in the spring; straw strong, 4 feet long; jointing March 19; in head May 10; ripe May 20; heads beardless, square, tapering, 2¾ inches long; spikelets 10 to 20, averaging 17; 2 to 3 grains in spikelet, mostly 2; medium size, long.

13. *Mediterranean Hybrid* (From C. S. Brent, Lexington).—Said to be a cross between the Diehl and Red Mediterranean. Made a rank fall growth; marked perfect in spring; spring growth profuse; stooling remarkably; straw heavy and strong, but lodging somewhat on low land; heading May 16; ripe June 21; straw averaging 4¼ feet long; heads bearded, square, compact, some abrupt, some tapering, 2½ inches long; spikelets 15 to 24, averaging 19; grains 2 to 3 in spikelet, mostly 2; large, plump, red.

14. *Longberry* (*Nigger*).—From J. Q. A. Hayman, Lexington.—Made a fair growth in fall; did not winter-kill. Spring growth fair; straw strong, measuring 4 feet 2 inches in length; heading May 17; ripe June 22; heads bearded, loose, flattened, tapering, averaging 3¼ inches long; spikelets 11 to 17, averaging 15; grains 2 to spikelet; medium to large, and plump kernel.

15. *Hickman* (From D. D. Laudeman, Lexington).—Fall and

spring growth grass-like; stood well; straw 3 feet 9 inches long; heads beardless, flattened, tapering, 2½ inches long; spikelets 10 to 16, average 13; grains 2 to 3 per spikelet, mostly 2; medium to large; red.

The following table gives the time of ripening, yield of grain and straw, estimated per acre, weight of wheat per bushel, and other data:

Number	Variety.	Ripe June	Yield of Wheat per Acre	Yield Straw per Acre	Weight of Wheat per Bushel	Remarks.
1	Martin's Amber	28	8.8 bu.	2,100 lbs	56 lbs.	White, beardless.
2	McGhee White	21	12.7 bu.	3,840 lbs	58¾ lbs.	White, beardless.
3	Extra Early Oakley	15	20.3 bu.	3,120 lbs	61 lbs.	Red, beardless
4	Diehl Mediterranean	21	26.1 bu.	3,015 lbs	60¼ lbs.	Red, bearded.
5	Genoese	28	11.9 bu.	1,975 lbs	56¾ lbs.	Red, beardless.
6	Hicks	20	21.7 bu.	3,320 lbs	60 lbs.	Red, beardless.
7	Fulcaster	28	10.7 bu.	3,895 lbs	59½ lbs.	Red, bearded.
8	German Emperor	21	23. bu.	2,570 lbs	59½ lbs.	Red, beardless.
9	Finley	21	17. bu.	3,310 lbs	59¾ lbs.	Red, beardless.
10	Fultz	28	19.2 bu.	3,080 lbs	59¾ lbs.	Red, beardless.
11	German Amber	23	11.9 bu.	2,765 lbs	60 lbs.	Red, beardless.
12	Blue Stem	20	18. bu.	3,282 lbs	60½ lbs.	White, beardless.
13	Mediterranean Hybrid.	23	29. bu.	3,838 lbs	60¾ lbs.	Red, bearded.
14	Longberry (Nigger).	21	25.3 bu.	3,980 lbs	58¾ lbs.	Red, bearded.
15	Hickman	20	17.7 bu.	3,203 lbs	60½ lbs.	Red, beardless.

Conclusions as to Varieties.

1. Last year we stated that the Crimean, Egyptian and Indian wheats were valueless in this section of the country, being unable to withstand our winters. After two years' trial we must add to this list the Genoese. Perhaps in the southern part of the State it might be raised to advantage.

2. The McGhee White is defective in having a weak straw.

3. The Martin's Amber made almost a failure with us this year. Last year it did much better, yielding 26.5 bushels per acre.

4. The Diehl Mediterranean, as last year, proved to be an excellent variety. Two years' observations indicate that the straw is too heavy for low lands. This wheat certainly deserves attention by the farmers of the State.

5. Of the three varieties sent out by the United States Department of Agriculture, the German Emperor is a promising variety. The Fulcaster, as before stated, failed to make a stand, and nothing can be said as to the yield. The wheat is prime.

6. The Mediterranean Hybrid yielded the most of any variety. It certainly is very promising, and the best wheat we had this year. The straw lodged a little with us, and in rank soils it should be sown with some caution.

7. The Extra Early Oakley with us has proven itself a most excellent wheat. Last year it was the best yielder we had. This year, although falling below some other varieties in this respect, it nevertheless was above the average, ranking above the Fultz. It is to be recommended for its early maturity—a great benefit in seasons of rust—its upright and strong growth of straw, and for the fine quality of grain. This wheat was so promising last year that some samples were sent out to try it on a farming scale.

Dr. J. D. Clardy, of Christian county, Dr. R. J. Spurr and B. D. Peter, of Fayette county, send in reports.

Dr. Clardy writes:

"Cut the acre of Early Oakley wheat June 11th. It suffered, with all the other smooth head varieties, from rust and an unfavorable season. It did not ripen more than two days earlier than the Odessa or Fultz. The yield was 18 bushels of fair but not extra wheat. I shall try it another year before I can recommend it as superior to our other wheats here."

Dr. R. J. Spurr sends the following report:

GREENDALE, FAYETTE COUNTY, KY., September 12, 1887.

Professor Scovell:

DEAR SIR: The Extra Early Oakley wheat which I got of you last fall has given me much satisfaction. It is an iron-clad wheat in hardiness, thrift, starting to grow earlier in the spring than any variety I have raised; stands up well, ripens early (was cut one week earlier than any other), consequently escaping rust; has a fine, plump grain of fine quality for milling, and the yield equal to any of the several varieties raised by me. I have noticed this wheat on the State College grounds for the past three years, and was impressed by its characteristics, and feel free to say that no greater boon could be conferred upon the farmers of this State than a general distribution of it throughout our territory. I shall sow all that I raised, about 16 bushels. * * * * * * * *

Very respectfully, R. J. SPURR.

Mr. B. D. Peter reports a yield of 13.28 bushels from 65-100 acre sown with Oakley wheat. This is at the rate of 20 to 21 bushels per acre. The rest of the field was sown with Fultz wheat, and yielded at the rate of 24 to 25 bushels per acre.

Methods of Seeding.

A series of experiments was undertaken in different methods of seeding. The variety of wheat used was the Extra Early Oakley. No fertilizers were used, and the experiment plat was selected with care, that the fertility should be as even as possible.

The following table gives the results obtained, based on acre plats:

Number		Amount Sown.	Yield in Bush. per Acre	Yield of Straw, Pounds
1	Broadcast	1½	7.8	1,175
2	Drills seven inch	1⅛	18⅔	2,020
3	Drills fourteen inch	9/16	15½	1,370
4	Usual depth	1⅛	20.3	. . .
5	Deep planting	1⅛	17.7	2,960
6	Thick seeding	1½	16.1	3,575
7	Thin seeding	⅔	13⅓	2,000
8	Drills seven inches	1⅛	17⅔	2,515
9	Drills fourteen inches	9/10	16½	2,300

From these results the following conclusions are drawn, applying at least for this dry season and for the Extra Early Oakley wheat:

1. The method of drilling in wheat is much superior to sowing broadcast.

2. That drills 14 inches apart produce nearly the same amount of wheat as 7-inch drills. The probabilities are that had the same amount of wheat been sown on each plat the 14-inch drills would have produced fully as much per acre.

3. That putting the seed deep in the ground not only retards early fall growth but lessens the yield at harvest.

4 That about one and one-eighth bushels of Extra Early Oakley wheat, drilled in, produce better results than thicker or thinner seeding. It should be stated here, however, that in all experiments the seed wheat was thoroughly cleaned and all light kernels floated off.

Cultivation.

Last year we began a series of experiments to test the effect of spring cultivation. We reported the season unfavorable for the test. This year we continued the experiments. The plots for these experiments were 1-40 acre each. The wheat was put in drills 14 inches apart. This was done by plugging every alternate hole in the drill. The variety experimented upon was Extra Early Oakley. The alternate plots were cultivated twice—the first time March 24, just after commencing to joint; the last May 4, before heading. For this purpose a small cultivator was used, running between the rows. The early season was favorable to the growth of wheat, and the ground was in prime condition without being cultivated. The cultivated rows could easily be distinguished during the latter stages of growth. The results, after harvesting, showed a little difference in favor of the cultivated plots, as may be seen from the following table:

Plot Number.	Yield of Wheat per Acre in Bushels.		Yield of Straw per Acre in Pounds.	
	Cultivated.	Uncultivated.	Cultivated.	Uncultivated.
22	17	15	1,740	1,500
24	18.4	18.7	3,420	2,660
26	13.4	13.4	2,450	1,820
28	24	23.4	3,340	3,070
30	14.7	16.7	3,220	2,980
32	18	15	3,840	1,840
34	18.7	14	3,690	2,200
38	18.4	14	3,840	2,566
40	23.4	18	4,380	2,600
Average	18.5	16.5	3,324	2,359

Application of Fertilizers.

For this purpose ten plots were selected of 1-20 acre each. The plots were adjacent to each other. The tract was as level as could be had on our experiment grounds, although inclining slightly from plot No. 21 to plot 31. The plots were separated from each other by a space of three feet. Our trials last year without the use of fertilizers indicated that the plots were nearly equal in fertility. The wheat experimented upon was Extra Early Oakley, planted in drills October 9, at the rate of 1 1-8 bushels per acre. The fertilizer was applied broadcast to each plot separately after planting.

The following table gives the fertilizers used, the amount applied per acre, and the yield of wheat and straw calculated per acre:

Plot.	How Treated.	Yield of Wheat.	Yield of Straw.
21	No fertilizer used	16.7	2,195
22	Superphosphate of lime, 300 pounds; Sulphate of potash, 150 pounds; Sulphate of ammonia, 150 pounds	17.2	2,240
23	Superphosphate of lime, 300 pounds; Sulphate of potash, 150 pounds	16.2	1,928
24	Superphosphate of lime, 300 pounds; Sulphate of ammonia, 150 pounds	18.1	1,995
25	Sulphate of potash, 150 pounds; Sulphate of ammonia, 150 pounds	16.3	2,230
26	No fertilizer used	17	2,407
27	Homestead Corn and Wheat Grower, 400 pounds	16	2,135
28	No fertilizer used	18	2,230
29	No fertilizer used	15.9	2,240
30	Muriate of potash, 100 pounds	19.2	2,445

From the above results it is readily seen that the application of the various fertilizers had no effect upon the yield of wheat this year. During the fall and spring growth a marked difference could be seen between the fertilized and unfertilized plots. The very dry weather at the time when the heads were filling might have been the cause of equalizing the yield of the various plots. It must be remembered, also, that the soil on which these experiments were made has been in cultivation but four years, and that it is a very rich blue-grass soil, probably having all the elements in an available form necessary for the full development of a wheat crop. In these experiments the superphosphate of lime was applied to supply phosphoric acid, the sulphate of potash to give available potash, and the sulphate of ammonia, nitrogen.

Smut.

This disease was in all our wheat last year, consequently our seed-wheat contained smut grains. To prevent its recurrence this year all our varieties of wheat were treated with a solution of blue vitriol (blue stone) before sowing. The method of applying the solution of blue vitriol was as follows: Ten pounds of blue vitriol were dissolved in eight gallons of water, and the solution placed in a tub. The seed-wheat was put into the solution and well stirred—care being taken not to put enough wheat in to come to the top of the solution. After skimming off floating wheat and particles, the solution was poured off into a second tub, the wheat drained and spread on boards to dry. The solution was re-used as often as we had wheat to treat in this manner.

This treatment proved entirely successful, not the least smut appearing in any of the plots where the seed had been treated in this way, while the plot planted for comparison, without treating the seed-wheat, contained about the same amount of smut as last year.

It was thought that by having the solution cover the wheat, the smut grains would float, and in this way all but the adhering spores would be removed, and these would be easily killed by the copper sulphate solution.

Other experiments were made in this line substituting lime, salt and water in place of copper sulphate; but the effect of each was inferior to copper sulphate, as all the plots so treated were affected with smut this year to a greater or less extent.

Addendum.

By request, Messrs. Hayman & Co., millers, of Lexington, kindly give us the milling qualities of the following wheats, as judged from samples submitted to them by number:

German Amber	Best milling wheat.
Mediterranean Hybrid	Good milling wheat.
Diehl Mediterranean	Good milling wheat.
Fultz	Good milling wheat.
Extra Early Oakley	Good milling wheat.
Nigger	Best sample of Longberry.
Blue Stem	Best white wheat for milling

They were unable to judge the other varieties by sample.

BULLETIN No. XII.

Additional Fertilizer Analyses, 1887.

The following official analyses have been made since the publication of Bulletin No. 10:

TABLE I.

Raw Bone Manure—Analysis and Valuation.

Station Number	Name and Address of Manufacturer.	Name of Brand.	Pounds in the Hundred.							Estimated Value per Ton
			Moisture	Phosphoric Acid.				Nitrogen	Equivalent to Ammonia	
				In Fine Bone.	In Med. Bone.	Total	Equivalent to Bone Phosphate			
244	P. B. Mathiason & Co., St. Louis, Mo.	Increscent brand pure raw bone ml.	5.60	23.59	. . .	23.59	51.52	4.04	4.90	$35 77
245	P. B. Mathiason & Co., St. Louis, Mo.	Increscent brand pure bone meal	5.13	21.45	. . .	21.45	46.86	4.42	5.37	35 22
255	Globe Fertilizer Co., Louisville, Ky.	Pure raw bone meal	7.59	10.75	11.56	22.31	48.73	3.96	4.81	33 19
256	J. B. Jones, Louisville, Ky.	Pure raw bone meal	7.87	10.40	12.21	22.61	49.37	4.02	4.88	33 60
257	J. B. Jones, Louisville, Ky.	Pure ammoniated bone meal	5.71	18.50	3.82	22.32	48.76	2.96	3.59	30 37
262	Thompson & Edwards Fer. Co., Chicago.	Fine ground bone	4.39	23.32	1.78	25.10	54.82	3.16	3.84	33 79
265	Wm. Skene & Co., Louisville, Ky.	Pure raw bone dust	7.55	13.35	8.87	22.22	48.53	3.31	4.02	31 04
263	C. & F. Singer, Nashville, Tenn.	Pure raw bone meal	6.70	11.97	8.88	20.85	45.54	4.20	5.11	33 00

TABLE II.

National Dissolved Bone, manufactured by the National Fertilizer Company, Nashville, Tenn., Station No. 267. Analysis:

Moisture			13.28 per cent.
Phosphoric acid:	Soluble	8.17 per cent.	
	Reverted	2.65 per cent.	
	Insoluble	1.32 per cent.	
	Total	12.14 per cent.	
Nitrogen			1.72 per cent.
Equivalent to ammonia			2.09 per cent.
Potash			1.92 per cent.

Estimated value per ton, $30.81.

Values used: Phosphoric acid in fine bone, 4½ cents per pound; phosphoric acid in medium bone, 4 cents per pound; nitrogen, 18 cents per pound.

Fine bone is all that is fine enough to pass through a sieve with meshes 1-25 inch square. Medium bone passes through a sieve with meshes 1-6 inch square, but does not include fine bone.

BULLETIN No. XIV.

Artificial or Commercial Fertilizers.

Under whatever name sold, the value of a commercial fertilizer depends upon the nitrogen, phosphoric acid and potash it contains, for it is to supply the plants with these ingredients that the fertilizer is mainly applied to the soil. The value of a fertilizer, however, does not depend wholly upon the quantity of nitrogen, phosphoric acid or potash it contains, but upon their form and condition as well. It is evident that these elements should be in such condition in the fertilizer that the plant can readily use them as a food.

Nitrogen.

If the free nitrogen, which is found in nature in immense quantities, could be appropriated by plants as food, there would be no need of seeking this element in commercial fertilizers; but all careful experiments indicate that none of the free nitrogen of the atmosphere can be directly used by the plant. Before it is available it must be combined with other elements, as oxygen, with which it forms nitric acid, or hydrogen to form ammonia.

Nitric acid is formed in small quantities by the direct union of the nitrogen and oxygen in the air during electrical storms, and is carried by the rain into the soil, where it combines with mineral matter, forming nitrates; but by far the larger quantity of nitrates is formed in the soil by the oxidation of ammonia compounds and of organic matter in the soil. This nitrification, as it is called, is brought about by the action of a very small organism which lives in the soil, but how it does it is as yet unknown. It is favored by warmth and moisture. In new soils, where vegetation is allowed to decay in place, the loss of nitrogen only takes place by drainage, and a little set free by oxidation. In cultivated fields the great loss is by the removal of crops. Tillage also increases the loss by drainage.

Under the conditions of cultivation the losses exceed the supply, and after a time the available nitrogen is so reduced that crops can not be grown without the use of nitrogenous manures derived from some other source than the soils themselves. In artificial fertilizers the forms in which nitrogen is usually supplied, are:

Nitrate of soda.

Sulphate of ammonia.

The organic nitrogen of dried blood, waste from slaughter-houses, bones, fish scrap, cotton-seed meal, castor pomace and other vegetable products rich in nitrogen.

Guanos.

Nitrogen, in the form that can be taken up as food by plants, is the most valuable element of plant-life. It is also the element usually soonest exhausted in the soil.

Phosphates.

Next in importance to nitrogen as a plant-food comes phosphoric acid. This acid usually combines in the soil with lime, magnesia and iron. In these forms it is insoluble in water, so that practically there is no loss by drainage. The source of loss is that carried off by the crops. The loss can be supplied only by the use of fertilizers

Phosphate of lime is the general source of phosphoric acid in fertilizers. There are many sources from which the phosphoric acid is obtained for commercial fertilizers, such as—

Bone meal.
Bone ash.
Bone black.
Superphosphate of lime, or acid phosphate.
Phosphate rock.
Thomas slag and guano.

Bone Meal.

Bone meal is valuable, not only for the phosphoric acid which it contains, but also for its nitrogen. "Bones are composed of two distinct substances which interpenetrate one another." There is, as it were, a skeleton of earthy matter, which is called phosphate of lime or bone phosphate, and a flesh of organic matter, which is called ossein. Ossein is a highly nitrogenized substance.

The fineness to which bones are ground is an important consideration as to their value. The finer the meal, so much the more readily will it putrefy and dissolve in the soil, and so much sooner will the crops be fed. There is some difficulty in grinding fresh raw bones. To obviate this difficulty they are generally steamed, or carried through some process whereby the fat is extracted. Steamed or desiccated bones, if not very strongly steamed, are better for fertilizers than raw bones. This is contrary to the general belief, but raw bones contain the fat, which is not only useless to the plant, but adds weight and clogs the meal, and hinders decomposition of the bone in the soil. Of course the steaming process must not be carried on to such an extent as to extract the nitrogenous portion of the bone. It is true that some of the nitrogen is lost, nevertheless the meal from steamed bones has proved itself to be better than from ordinary raw bone.

Bone ash is sometimes used as a fertilizer. It is shipped from South America. It is generally used to make other forms of phosphates, as superphosphates.

Bone Black.

The spent black from sugar refineries is sold to manufacturers of fertilizers. When bones are heated in iron cylinders into which air it not allowed to enter, gas, water, oily matters and other products are driven off, while bone charcoal is left in the cylinders. This product is used to take the coloring matter out of raw sugars After a time it becomes worthless for this purpose, when it is sold for fertilizing purposes, as all the lime phosphate still remains. The decomposition of bone black in the soil goes on slowly, and, therefore, it is not generally applied as such, but after treatment with sulphuric acid.

South Carolina Rock, Apatite, etc.

These mineral sources of phosphates are, with great difficulty, decomposed in the soil, and so slowly that in general it does not pay to put these ground rocks on the soil before putting them through a process which will make the most of the phosphoric acid readily available to the plant. This leads us to the consideration of

Superphosphates.

In order to make these various phosphates more rapid in their action they are treated with sulphuric acid, commonly called oil of vitriol. This treatment converts the insoluble phosphate into a soluble phosphate of lime, called *superphosphate of lime*, sulphate of lime or gypsum being formed at the same time. For the purpose of making these superphosphates, very impure and cheap sulphuric acid may be used. Some manufacturers make their superphosphates with acid that has already been used for purifying petroleum or coal oil. In purifying the oil the acid takes down with it tar-like matters, and settles below the oil in a mass-like substance. If water is added to this mixture after the oil is taken off, the tarry compounds are decomposed and the sulphuric acid liberated greatly diluted, and having strongly the odor of petroleum. The use of this acid in making superphosphates imparts to them a strong odor of petroleum products. Such an odor is probably a benefit to the fertilizer, as it will undoubtedly keep insects away whenever used. It is worthy of note that where a superphosphate made with such acid was used on a plot of corn last year no cut worms appeared, while in an adjacent plot they destroyed a small portion of the corn.

When bone, bone ash, bone black, or mineral phosphates are treated with sulphuric acid in sufficient quantity, the superphosphate formed contains the phosphoric acid in a form soluble in water. After standing, or when the superphosphate is applied to the soil, the phosphoric acid is in the reverted form, as it has gone back to a form insoluble in water. This reverting of the phosphoric acid does not materially change its value as a fertilizer, for experiments have shown that plants can take up the phosphoric acid in this state as readily as in the soluble form.

When the sulphuric acid is added in insufficient quantities to dissolve all the phosphates, some of the phosphoric acid remains in the insoluble form. This insoluble phosphoric acid is not as available to the plant, and it is much cheaper in the markets. In making an analysis of a fertilizer, therefore, we separate the phosphoric acid into three divisions of *soluble*, *reverted* and *insoluble phosphoric* acid, giving to each its value.

The "soluble" and "reverted" forms of phosphoric acid are both readily assimilable by plants, and hence are sometimes included under the common name "available phosphoric acid." The "available phosphoric acid" in an analysis is equal to the sum of the "soluble" and the "reverted" phosphoric acid.

Potassium.

Potassium ranks next to phosphorus as a valuable food for plants. Plants consume this element in comparatively large quantities, and some soils are unable to supply the demand; especially is this the case with light, sandy soils.

Primarily the plants obtain potash from the decomposition of minerals or rocks containing potash. Thus feldspar contains from 10 to 16 per cent. of potash. It is potash combined with silica and alumina. As such it is insoluble and not available to the plant. In the decomposition of this rock clay is formed and a soluble potash salt, which then becomes available. This decomposition goes on gradually, and thus in most clay soils available potash salts are being continually liberated for the use of the plant. Stirring the soil accelerates this decomposition, and the presence of lime or gypsum increases decomposition. In such soils, therefore, the application of lime has another use besides that of plant-food.

Plants vary largely as to the amount of potash they require. For example, an acre of wheat yielding 20 bushels requires about 28 pounds of potash; while an average crop of potatoes requires 100 pounds of potash per acre, and an acre of tobacco yielding 3,800 pounds of leaves and stalks, assimilates over 200 pounds of potash. It is evident, therefore, that the continual cropping of soils with potatoes or tobacco will, in time, exhaust the potash supply. Light and sandy soils require this element almost from the start.

Sources.

Wood ashes contain potash, and are, therefore, sometimes used to supply this element to the soil. Sulphate of potash and muriate of potash are also used in fertilizers to supply potash.

Usually commercial fertilizers contain two or all of the *essential ingredients*, viz: nitrogen, phosphoric acid and potash, but sometimes only one. Plain superphosphates contain only *phosphoric acid.* Ammoniated superphosphates contain nitrogen and phosphoric acid. Bone contains, and is valuable for its nitrogen and its phosphoric acid. Potash salts, of course, are valuable for their potash only. A complete fertilizer is one containing *nitrogen, phosphoric acid* and *potash.*

Explanations in Regard to the Tables.

The farmers should study carefully the tables of analyses in this bulletin before purchasing commercial fertilizers.

It will be noticed that besides moisture, which is noted simply to compare the different analyses of the same brand, there is given in the tables the amount of phosphoric acid, in its soluble, reverted and insoluble form, nitrogen and its equivalent in ammonia, and potash for each brand. Now, the selling value of a commercial fertilizer should depend upon the amount of the various forms of phosphoric acid, the nitrogen and the potash it contains—for, as has been said, it is to supply the plants with *phosphoric acid, nitrogen and potash,* that the fertilizer is mainly applied to the soil. As regards phosphoric acid, the *soluble and reverted* forms should be particularly noted. They are the forms capable of being readily taken up as food for the plant, while the *insoluble phosphoric acid* does not, in all probability, serve as food to the plant at once, and probably not for a year or more. For this reason this form of phosphoric acid is not as valuable to the farmer as the other forms. It is also the cheapest form of phosphoric acid in the market. Nitrogen is another element of great importance and value in a fertilizer, and is needed in most every soil where fertilizers are applied with benefit. Potash is the cheapest essential ingredient of a commercial fertilizer, but in some crops, and especially tobacco and potatoes, it is a very important element.

The Estimated Value.

In the last column of each table is given the value in dollars and cents of the different fertilizers. These values are estimated from the essential ingredients contained in the fertilizers, and the forms in which they exist. In other words, they express the *commercial value*, or about the price the ingredients could be bought for on the open market, mixed and put upon the market as fertilizers. These values are not intended to express the *agricultural value* of the fertilizers, or the profit they will give the farmer by their use. They are intended rather to notify him, if he intends to purchase fertilizers, that from quotations this year of the essential ingredients of these fertilizers, he should be able to purchase them for about the estimated price given in the table. Another, and perhaps the most important use of these estimated values, is to assist the farmer is determining which is the cheapest fertilizer for him to purchase. In choosing between several fertilizers of the same kind, that is, containing the same essential ingredients in about the same proportion, the one that has the highest "estimated value per ton" in the table of analyses would be prefera-ble at the same cost. Or, if the "estimated value per ton" is about the same in all, the one that costs the least is to be preferred. Take for example a supposable case: A farmer desires to purchase ten tons of some commercial fertilizer for his tobacco crop. His land is poor, and he concludes to purchase a fertilizer containing all three of the essential ingredients, namely, phosphoric acid, potash and nitrogen. He goes to his merchant and finds that he has two brands for sale. No. 1 is priced at $40 per ton, and No. 2 at $30. The farmer refers to the tables in this bulletin, and finds the two brands relatively alike as to the essential ingredients. No. 1 is estimated at $40, and No. 2 at $25. It is evident, from the estimated values, that he should purchase the higher priced fertilizer, for if he paid $40 for this brand, he should pay but $25 instead of $30 for the cheaper one. But the analysis given on the tags, signed by the Director, attached to each sack or package of fertilizer, or in the tables of this bulletin, should be carefully considered, as well as the estimated value, for the estimated value is not a sufficient guide to determine which of two or more fertilizers to purchase, except in those cases where the proportions of phosphoric acid, potash and nitrogen are relatively the same. To illustrate the importance of considering the analysis as well as the estimated value, let us take an example: Suppose a farmer desires to purchase a fertilizer for his tobacco crop. He goes to his merchant and is offered either of two brands at the same price. The price, fortunately, does not help him to decide in this case. He next looks at the tags attached to the sacks, and finds that the Director has estimated each fertilizer at $30 per ton. He next looks at the analysis and finds fertilizer No. 1 to contain:

Soluble phosphoric acid	8 per cent.
Reverted phosphoric acid	7 per cent.
Potash	None.
Nitrogen	None.

And fertilizer No. 2 to contain:

Soluble phosphoric acid, Reverted phosphoric acid	7.5 per cent.
Nitrogen	3.0 per cent.
Potash	4.2 per cent.

He is able now to judge quickly which of the two fertilizers to purchase. If his soil needs phosphoric acid he will quickly decide on No. 1, for he will get twice as much for the same money, while did he purchase No. 2 he would have paid $15 for the phosphoric acid which he needed, and $15 for the nitrogen and potash which he did not need. But should he be in doubt whether his land *needed* one or all the elements of a fertilizer, he would be wise in purchasing No. 2. For should his soil need potash or nitrogen, or all three of the essential elements to produce a large tobacco crop, and should he have purchased No. 1, it is doubtful whether he would have received any benefit from it.

On account of the difference in soils no rule can be given by which to tell what fertilizer is the best for any particular crop, and this question must be decided by actual trial, systematically and carefully made. Some such trials are made at the station each year, and the Director will be glad to furnish a plan for similar experiments to any one who desires to test the effect of fertilizers on his land.

In regard to the manner of applying fertilizers, it is generally best to sow broadcast or by drill, and work well into the soil before planting. When a small quantity of fertilizer is applied to each hill or row at planting time, it acts mainly as a stimulant to produce an early and vigorous start, which is considered necessary for the tobacco crop, but often renders the crop more sensitive to drouth. In any case care should be taken to mix the fertilizer with the soil, so that it will not come in contact with the seeds or plants. Most fertilizers, and especially those containing much nitrogen, soluble phosphoric acid or potash, will injure or destroy young plants if brought directly in contact with them.

Fertilizers Analyzed.

The following tables give the names of all the manufacturers who have complied with the law for 1888, and the names of the brands legally on sale; also the analysis and valution of each brand.

The following are the values used for the essential ingredients: Phosphoric acid soluble in water, 10 cents; "reverted" phosphoric acid, 10 cents; insoluble phosphoric acid, 4 cents; phosphoric acid in fine bone, 4½ cents; in medium bone, 4 cents per pound; potash, 5 cents, and nitrogen, 18 cents per pound.

Fine bone is all that passes through a sieve with meshes 1-25 inch square. Medium bone passes through a sieve with meshes 1-6 inch square, but does not include fine bone.

TABLE I.—Raw Bone Manures—Analysis and Valuation.

Station Number.	Name and Address of Manufacturer.	Name of Brand.	Pounds in the Hundred.								Estimated Value per Ton.
			Moiturse.	Phosphoric Acid.			Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia.		
				In Fine Bone.	In Med. Bone.	Total.					
289	Crocker Fer. and Chem. Co., Buffalo, N Y	Crocker's Pure Ground Bone. . . .	6.81	16.72	6.73	23.45	51.21	4.31	5.23		$35 95
310	North-western Fer. Co., Chicago, Ill. .	Fine Raw Bone	9.24	22.07	0.92	22.99	50.21	3.94	4.78		34 78
326	The Cincinnati Desicca. Co., Cincinnati.	Pure Raw Bone Meal	7.33	21.17	2.75	23.92	52.25	4.26	5.17		36 59
341	Miller Fertilizer Works, Louisville . . .	Pure Raw Bone Meal	8.10	14.26	7.71	21.97	47.97	3.82	4.64		32 75
349	J. B. Jones, Louisville	Pure Raw Bone Meal	6.80	12.93	8.59	21.52	47.00	3.98	4.83		32 84
350	J. B. Jones, Louisville	Pure Ammoniated Bone Meal . . .	4.89	11.24	6.30	17.54	38.31	4.54	5.51		31 49
352	The Globe Fertilizer Co., Louisville . .	Pure Raw Bone Meal	7.25	13.89	8.63	22.52	49.17	4.07	4.94		34 05
353	The Globe Fertilizer Co., Louisville . .	Kentucky Standard Bone Meal. . .	6.92	13.24	8.79	22.03	48.08	4.02	4.88		33 42
355	Thompson & Edwards' Fert. Co.,Chicago.	Pure Raw Bone	7.45	6.17	15.71	21.88	47.78	4.39	5.33		33 92
356	Thompson & Edwards' Fert. Co., Chicago.	Pigs' Foot Brand Chicago Bone Ml.	5.02	16.91	. .	16 91	36.94	3.60	*4.37		30 28
357	Thompson & Edwards' Fert. Co., Chicago.	Durham Brand Animal Guano . . .	4.34	10.11	. . .	10.11	22.07	5.08	†6.16		31 86
363	P. B. Mathiason & Co., St. Louis, Mo. .	Increscent Bd. Pure Raw Bone Ml .	6.20	22.82	. . .	22.82	49.84	4.24	5.15		35 80
381	The Currie Fertilizer Co , Louisville . .	Currie Raw Bone Meal	7 55	8.09	13.56	21.65	47.27	4.04	4.90		32 67

* Potash (from sulphate), 2.10 per cent. † Potash (from sulphate), 4.47 per cent.

TABLE II.
Complete Fertilizers, Superphosphates, Etc.—Analysis and Valuation.

Station Number	Name and Address of Manufacturer.	Name of Brand.	Pounds in the Hundred.							Estimated Value per Ton.
			Moisture	Phosphoric Acid.			Nitrogen	Equivalent to Ammonia	Potash	
				Soluble	Reverted	Insoluble				
290	Crocker Fer. and Chem. Co., Buffalo, N.Y	Crocker's Am'ed Bone Super'phate.	11.51	7.38	1.40	1.19	3.20	3.88	1.54	$31 57
291	Crocker Fer. and Chem. Co, Buffalo, N Y	Crocker's Pot°to, Hop and Tob. Ph.	12.92	8.39	1 55	0.77	2.50	3.04	4.50	34 00
292	Crocker Fer. and Chem. Co., Buffa o, N.Y	Crocker's Wheat and Corn Phos'te.	16.58	7.52	3.39	0.86	2.00	2.[illegible]3	2.62	32 33
293	Crocker Fer. and Chem. Co., Buffalo, N.Y	Crocker's South'n Tob. Phosphate .	11.81	5 62	4.01	1.33	3.49	4.24	3 55	36 35
295	Mich. Carbon Works, Detroit, Mich . .	Jarves' Tobacco Fertilizer.	14.60	5.64	1.36	0.68	1.92	2.33	2.28	23 75
298	Globe Fertilizer Co., Louisville, Ky. .	Globe Tobacco Grower	7.75	6.74	4.53	1.14	5.06	6 14	4.22	45 89
299	Globe Fertilizer Co., Louisville Ky . .	Globe Superphos'e and Corn Gr'wer	7.77	5.53	5.31	1.85	4.45	5.40	1.57	40 75
300	Globe Fertilizer Co, Louisville, Ky . .	Globe Potato Grower	6.60	6.77	5.44	1.27	4.28	5.20	4.78	45 73
301	Globe Fertilizer Co., Louisville, Ky . .	Eagle Fertilizer	6.99	4.45	3.91	3.61	3.08	3 74	1.57	32 27
302	Globe Fertilizer Co., Louisville, Ky .	Kentucky Standard Tobacco Grower	6.27	5.69	5.39	1 98	4.19	5.09	3.72	42 54
303	Thompson & Edwards' Fer. Co., Chicago	World-of-Good Tobacco Grower . .	5.43	2.85	3.08	4.59	3.86	4.69	5.74	35 17
304	North-western Fer. Co., Chicago . . .	Prairie Phosphate	15.00	5.14	3.59	5.05	1.95	2.37	. . .	28 52
305	North-western Fert Co., Chicago, Ill. .	Twenty-six Dollar Phosphate . . .	14.87	5.08	3.89	5.14	1.94	2.36	. . .	29 03

303	Thompson & Edwards' Fer. Co., Chicago	World-of-Good Tobacco Grower . .	5.43	2.85	3.08	4.59	3.86	4.69	5.74	35 17
304	North-western Fer. Co., Chicago . . .	Prairie Phosphate	15.00	5.14	3.59	5.05	1.95	2.37	. . .	28 52
305	North-western Fert. Co., Chicago, Ill. .	Twenty-six Dollar Phosphate . . .	14.87	5.08	3.89	5.14	1.94	2.36	. . .	29 03
306	North-western Fert. Co., Chicago, Ill. .	Horse-shoe B'd Chal. Corn Grower .	13.38	4.54	4.32	5.05	2.69	3.27	1.51	32 95
307	North-western Fert. Co., Chicago, Ill .	Horse-shoe Brand Tobacco Grower .	10.42	3.59	5.03	4.38	3.61	4.38	2.31	36 05
308	North western Fert. Co., Chicago, Ill. .	Horse-shoe Brand Potato Grower .	11.46	4.63	5.11	4.86	2.62	3.18	1.60	34 40
309	North western Fert. Co., Chicago, Ill. .	Ralston's Bone Meal	7.36	0.31	5.37	8.44	2.20	2.67	. . .	27 23
311	North-western Fert. Co., Chicago, Ill .	Kentucky Tobacco Grower	12.14	5.25	3.32	6.01	1.49	1.81	. . .	26 71
312	North-western Fert. Co., Chicago, Ill. .	Kentucky Corn Grower	11.96	5.35	4.50	4.64	1.55	1.88	. . .	28 79
314	Michigan Carbon Works, Detroit, Mich.	Jarves' Drill Phosphate	10.61	6.52	1.35	3.43	1.21	1.47	. . .	22 84
315	Michigan Carbon Works, Detroit, Mich.	Homestead Tobacco Grower. . . .	11.45	6.98	4.04	2.53	3.27	3.97	3.22	39 05
316	Michigan Carbon Works, Detroit, Mich.	Home. Corn and Wheat Grower . .	10.99	7.94	0.90	1.11	2.28	2.77	1.55	28 33
322	The Currie Fertilizer Co., Louisville .	Falls City Phosphate	10.35	5.95	4.29	3.13	1.97	2.39	1.09	31 16
323	The Currie Fertilizer Co., Louisville .	Falls City Corn Grower	10.21	3.70	3.85	3.08	3.00	3.64	1.80	30 16
324	The Currie Fertilizer Co., Louisville .	Falls City Tobacco Grower	9.28	3.63	3.24	3.43	2.01	2.44	6.90	30 62
325	The Currie Fertilizer Co., Louisville .	Guano	8.17	5.50	3.02	1.48	1.98	2.40	3.47	28 82
327	The Cincinnati Desic. Co., Cincinnati, O.	Pure Acidulated Bone.	7.27	3.40	9.82	7.33	3.79	4.60	. . .	45 94
328	The Cincinnati Desic. Co., Cincinnati, O.	Gilead Phosphate.	9.82	2.48	6.50	2.93	2.76	3.35	1.91	32 35
332	National Fertilizer Co., Nashville, Tenn.	Tobacco Grower	10.79	6.05	4.16	2.17	3.29	3.99	3.93	37 93
340	Miller Fertilizer Works, Louisville . .	Bone Superphosphate	3.75	5.18	6.31	3.59	3.88	4.71	0.36	40 18
342	Cleveland Dryer Co., Cleveland, O. . .	Kentucky Tobacco Grower	10.24	6.32	2.23	4.82	1.64	1.99	1.34	28 20
343	Cleveland Dryer Co., Cleveland, O. . .	Ammoniated Dissolved Bone . . .	11.61	6.35	2.15	5.09	1.58	1.92	. . .	26 76

TABLE II.—Continued.

Complete Fertilizers, Superphosphates, Etc.—Analysis and Valuation.

Station Number	Name and Address of Manufacturer.	Name of Brand.	Pounds in the Hundred.							Estimated Value per Ton
			Moisture	Phosphoric Acid.			Nitrogen	Equivalent to Ammonia	Potash	
				Soluble.	Reverted.	Insoluble.				
344	Cleveland Dryer Co., Cleveland, Ohio	Buckeye Phosphate	3.90	10.49	1.55	2.44	2.96	3.59	0.33	$37 02
345	Cleveland Dryer Co., Cleveland, Ohio	White Burley Tobacco Fertilizer	5.74	10.85	0.39	3.25	3.26	3.96	2.61	39 43
346	Cleveland Dryer Co., Cleveland, Ohio	Ohio Seed Maker	10.14	5.99	2.52	5.31	1.57	1.91	...	26 82
347	Cleveland Dryer Co., Cleveland, Ohio	Connecticut Valley Tob. Fertilizer	6.38	10.35	1.06	2.94	3.29	3.99	4.73	41 74
348	Cleveland Dryer Co., Cleveland, Ohio	Square Bone	7.45	6.59	3.81	6.33	2.24	2.72	...	33 92
354	Globe Fertilizer Co., Louisville, Ky	Globe Wheat Grower	5.44	3.88	4.96	3.84	3.82	4.64	2.44	36 94
359	National Fertilizer Co., Nashville, Tenn.	National Corn Grower	10.03	7.77	1.94	3.04	1.66	2.02	4.13	31 96
360	National Fertilizer Co., Nashville, Tenn.	National Dissolved Bone	10.28	8.47	2.26	2.52	1.54	1.87	1.86	30 88
361	National Fertilizer Co., Nashville, Tenn.	Rock City Superphosphate	9.71	6.81	2.54	3.19	2.23	2.71	2.31	31 59
362	National Fertilizer Co., Nashville, Tenn.	Tennessee Superphosphate	10.38	6.04	4.07	5.05	1.72	2.09	2.10	32 55
364	The Cincinnati Dessicating Co., Cin., O.	Ohio Valley Phosphate	10.07	1.05	7.50	1.77	1.75	2.12	1.70	26 52
365	The Cincinnati Dessicating Co., Cin., O.	Tobacco Fertilizer	7.16	5.51	5.43	1.97	3.63	4.41	5.87	42 40

366	Northwest'n Fertilizing Co., Chicago	National Bone Dust	4.82	0.36	7.43	2.52	2.77	3.36	...	$27 57

364	The Cincinnati Dessicating Co., Cin., O.	Ohio Valley Phosphate	10.07	1.05	7.50	1.77	1.75	2.12	1.70	26 52
365	The Cincinnati Dessicating Co., Cin., O.	Tobacco Fertilizer	7.16	5.51	5.43	1.97	3.63	4.41	5.87	42 40
366	Northwest'n Fertilizing Co., Chicago . .	National Bone Dust.	4.82	0.36	7.43	2.52	2.77	3.36	. . .	$27 57
367	National Fertilizer Co., Nashville, Tenn.	Tobacco Fertilizer	8.84	6.40	4.04	2.99	3.39	4.12	4.82	40 29
368	Pacific Guano Co., Boston, Mass . . . (John S. Reese & Co., Baltimore.)	Dissolved Bone Phos. and Potash. .	3.03	9.26	3 07	4.63	0.30	0 36	2.66	32 10
369	Pacific Guano Co., Boston, Mass . . . (John S. Reese & Co., Baltimore.)	Soluble Pacific Guano.	4.82	6.81	2.76	4.63	2.60	3.16	2.45	34 65
379	The Currie Fertilizer Co., Louisville, Ky.	Falls City Wheat Grower.	10.19	5.48	4.51	3.11	1.98	2.42	1.49	31 58
380	The Currie Fertilizer Co., Louisville, Ky.	Falls City Raw Bone Meal.	4.91	3.91	6.94	7.42	1.99	2.44	1.50	36 29

BULLETIN No. XV.

Experiments with Wheat.

The main object in our wheat experiments the past year was to test the different varieties, and to note what effect commercial fertilizers might have on wheat. Incidentally to this we continued the experiments on the effect of cultivation, and made some experiments showing the effect of the application of various substances on the wheat to prevent smutting.

As in former years, these experiments were conducted on a piece of land used formerly as a fair ground, and now a part of the College inclosure.

The soil is a typical blue-grass soil, a medium loam two to three feet in depth, resting on a porous, reddish subsoil of the same nature as the surface soil. This subsoil rests on blue limestone, quite cavernous, producing a fine natural drainage. The subsoil varies in depth from 3 to 10 feet.

Test of Varieties.

Previous to these experiments the land had been in cultivation five years—two years in tobacco, two in corn, and last year in potatoes.

For making a comparative test, 27 varieties were selected. Each variety was planted in drills 7 inches apart. One-fortieth acre was planted of each variety. The wheat was planted October 8.

Below is given a description of most of the varieties:

Description of Varieties.

German Emperor (From U. S. Dep't Agl., 1886).—Imported from Germany. It is a smooth wheat, having large compact heads, hardy; straw long and strong and stands up well. It tillers out remarkably. Fall and spring growth good; stooling March 2; jointing March 17; in head May 10; in bloom May 18; ripe June 22; grains 2 to 3 in spikelet; red, large, rather plump.

Genoese.—This variety is worthless here.

Lancaster (From Dr. J. D. Clardy, Christian county).—Fall growth rank; slightly winter-killed; made a free spring growth; straw not very strong, lodging in low places; resembles Mediterrenean; jointing March 17; in head May 17; in bloom May 24; ripe June 22; grain large, red, rather plump.

Diehl Mediterranean (U. S. Dep't Ag'l., 1885).—Fall growth fine; spring condition perfect; foliage profuse, color dark green; straw spreading, lodging in low places; length of straw about four feet; heads bearded, square, short and compact; grains in spikelet, 2; red; jointing March 17; in head May 18; in bloom May 26; ripe June 27; grain large, red and very plump.

Hickman.—Fall and spring growth grass-like; stands up well; heads beardless, flattened; grain medium to large, red, very plump; jointing March 17; in head May 16; in bloom May 24; ripe June 22.

Hicks.—Fall growth not very vigorous; stood the winter well; spring growth abundant and grass-like; straw erect, strong, and does not lodge; heads beardless, flattened, tapering, averaging 2½ inches in length; jointing March 17; in head May 16; in bloom May 24; ripe June 22; grain large, red, plump.

Extra Early Oakley.—Fall growth medium; slightly winter-killed; spring growth erect; not stooling or tillering very much; straw very erect and stout, no tendency to lodge; height averaging 3½ feet; stooling March 2; jointing March 17; heading May 11; in bloom May 19; ripe June 20; heads smooth, square, not compact, averaging 3 inches in length; grain red, rather large, plump.

Canadian Finley.—Fall growth strong; not winter-killed. Spring growth good, not stooling to a great extent; straw stout, not lodging; stooling March 2; jointing March 17; heading May 16; in bloom May 24; ripe June 27; heads smooth, flattened, tapering, 3½ inches long; grains medium, plump, red.

McGhee White (From U. S. Dept. Agl, 1885)—Fall growth fair; stood the winter well; spring growth medium, not very erect; straw somewhat weak, 3½ feet high; stooling March 2; jointing March 17; heading May 10; in bloom May 18; ripe June 27; heads square, smooth, tapering; grain white, medium size, short and plump.

German Amber (U. S. Dep't Agl, 1886).—Fall growth fair; did not winter kill; spring growth quite vigorous; straw about four feet long, strong; heads smooth; stooling March 2; jointing March 17; heading May 18; blooming May 27; ripe June 27; grain medium to large, plump, red.

Blue Stem.—Fall growth fair, not injured by the winter; spring growth vigorous; straw strong and about four feet long; heads beardless; stooling March 4; jointing March 19; heading May 20; blooming May 27; ripe June 27; grain medim size, plump, white.

Nigger.—Fall growth fair, stood the winter well; spring growth only fair; straw strong, four feet long; heads bearded; stooling March 4; jointing March 19; heading May 18; in bloom May 24; ripe June 27; grain long, not very plump, red.

Fulcaster.—Fall growth hardy; spring growth strong; straw stiff and strong, and stands up well; heads bearded; injured a little by frost; stooling March 3; jointing March 19; heading May 18; blooming May 24; ripe June 25; grain large and plump, red.

Penquite's Velvet Chaff (From Mr. John Curtis, Greendale).—Originated by Mr. Abram Penquite, Ohio. It has a golden, velvety chaff; grain rather long, plump, red; one year's trial showed it to be a hardy wheat; straw stiff, standing well; stooling March 2; jointing March 17; in head May 18; in bloom May 24; ripe June 27.

The following table gives the names of the varieties tested, and a summary of their characteristics:

SUMMARY OF CHARACTERISTICS.

Number	Name of Variety.	Fall growth	Stood the Winter	Character Straw.	Heading	Ripe	Head	Grain.	
								Color	Quality
1	German Emperor	Good	Well	Strong	May 17.	June 22	Smooth	Red	Fine milling.
2	Genoese	Fair	Badly	Strong	May 17.	June 27	Smooth	White	Poor.
3	Lancaster	Rank	Fairly well	Not very strong	May 17.	June 22	Bearded	Red	Fair milling.
4	The Good	Fair	Fairly well	Strong	May 10	June 22	Smooth	Red	Fine milling.
5	Red Sea	Rank	Well	Strong	May 17.	June 27	Bearded	Red	Fair milling.
6	Diehl Mediterranean	Profuse	Well	Inclined to lodge.	May 18.	June 27	Bearded	Red	Fair milling.
7	Shelby's New Golden	Good	Well	Strong	May 16.	June 27	Bearded	Red	Good milling.
8	Hickman	Grass-like	Well	Strong	May 16.	June 22	Smooth	Red	Fine flouring.
9	Hicks	Grass-like	Well	Strong	May 16.	June 22	Smooth	Red	Fine milling.
10	Extra Early Oakley	Medium	Fairly well	Very strong	May 11.	June 22	Smooth	Red	Fine milling
11	Canadian Finley	Strong	Well	Strong	May 16.	June 27	Smooth	Red	Fine milling.
12	McGhee White	Fair	Well	Somewhat weak	May 10	June 27	Smooth	White	Fine milling.
13	German Amber	Fair	Well	Strong	May 18.	June 27	Smooth	Red	Good milling.
14	Blue Stem	Fair	Well	Strong	May 20.	June 27	Smooth	White	Fine milling.

SUMMARY OF CHARACTERISTICS—Continued.

Number	Name of Variety.	Fall Growth	Stood the Winter	Character Straw.	Heading	Ripe	Head	Grain.	
								Color	Quality
15	Mediterranean Hybrid	Profuse	Well	Inclined to lodge.	May 18.	June 27	Bearded	Red	Good milling.
16	Longberry (Nigger)	Fair	Well	Strong	May 18.	June 27	Bearded	Red	Good milling.
17	Fulcaster	Strong	Fairly well	Strong	May 18	June 27	Bearded	Red	....
18	Penquite's Velvet Chaff	Strong	Well	Strong	May 18.	June 27	Bearded	Red	Fine milling.
19	Fultz	Good	Well	Strong	May 18.	June 27	Smooth	Red	Fine milling.
20	Golden Drop	Fair	Winter-killed	....	....	....	.....	....	....
21	Square Head	Fair	Winter-killed.	....	....	....	.....	....	....
22	Hunter's White	Fair	Winter-killed.	....	....	....	.....	....	....
23	Browrick Red	Fair	Winter-killed.	....	....	....	.....	....	....
24	African Wheat 4 varieties	Fair	Winter-killed.	....	....	....	.....	....	....

Milling Qualities.

We are under obligations to Messrs. Hayman & Co. for the following report on the milling qualities of the different varieties.

Samples of the different varieties were submitted to them for their opinion as to their milling quality. The samples were designated by numbers, no names being given. Below is given Messrs. Hayman & Co.'s report in full, to which we have added the names of the varieties corresponding to the numbers :

LEXINGTON, KY., Sept. 7, 1888.

M. A. SCOVELL, *Director:*

By request of your Mr. Murray, we make the following report of milling qualities of samples of wheat left by him with us this day:

1. (German Emperor).—Firm milling wheat.
2. (Genoese).—Badly rusted or winter-killed.
3. (Lancaster).—Species of Longberry ; fair milling wheat.
4. (The Good).—Amber ; hard and fine milling wheat.
5. (Red Sea).—Species Longberry ; fair milling wheat.
6. (Diehl Mediterranean).—Longberry ; fair milling wheat.
7. (Shelby's New Golden).—Amber ; fine specimen and good milling.
8. (Hickman).—Amber ; hard, flinty and fine flouring.
9. (Hicks).—Longberry ; amber ; hard, flinty and fine milling.
10. (Extra Early Oakley).—Species of Fultz ; beautiful amber ; splendid milling wheat.
11. (Canadian Finley).—Species of Fultz ; northern amber ; hard and splendid milling wheat.
12. (McGhee White).—White, round berry ; fine and splendid milling wheat.
13. (German Amber).—Light amber ; round berry ; firm and good milling wheat.
14. (Blue Stem).—White mixed color ; fine milling.
15. (Mediterranean Hybrid).—Species Longberry ; good milling ; weather damaged.
16. (Nigger).—Fair Longberry ; flour qualities known to be good by all millers.
17. (Fulcaster).—Large amber ; milling qualities not known.
18. (Velvet Chaff).—Amber ; firm and fine milling.
19. ultz).—Light amber ; fine milling.

Some of the samples have been damaged by the weather, otherwise their milling qualities would have been more favorable.

Yours respectfully, HAYMAN & CO.

Table Showing the Yield of the Varieties That Have Been Tested at the Station for the Past Three Seasons.

Name of Variety.	1887–8 — Bushels per Acre. . . .	1886–7 — Bushels per Acre. . . .	1885–6 — Bushels per Acre. . . .	Average of Two Years.	Average of Three Years. . . . .
Canadian Finley	37.3	17.0	. . .	27.2	. . .
Red Sea	36.7	. . .	. . .	. . .	. . .
McGhee White	35 7	12.7	28.0	. . .	25.1
Hickman	35.3	17.7	. . .	26.5	. . .
Hicks	34.0	21.7	23.5	. . .	26.4
German Amber	32.3	11.9	. . .	22.1	. . .
Fulcaster	32.3	10.7	. . .	21.5	. . .
Longberry (Nigger)	31.3	25.3	. . .	28.3	. . .
Extra Early Oakley	31 0	20.3	32.5	. . .	27.9
Blue Stem	30.7	18.0	. . .	24.4	. . .
Mediterranean Hybrid	30.7	29.0	. . .	29.9	. . .
Penquite's Velvet Chaff	30.3	. . .	. . .	. . .	. . .
German Emperor	28.7	23.0	. . .	25.9	. . .
Lancaster	26.7	. . .	. . .	. . .	. . .
Diehl Mediterranean	26.7	26.1	31.0	. . .	27.9
Shelby's New Golden	23.3	. . .	. . .	. . .	. . .
Genoese	15.3	11.9	27.3	. . .	18.2
Fultz	15.0	19.2	. . .	17.1	. . .
The Good	13 7	. . .	. . .	. . .	. . .
Martin's Amber	. . .	8.8	26.5	17.7	. . .

Table Showing Yield of Wheat and Straw per Acre, and Weight of Wheat per Measured Bushel.

Number	Name of Variety.	Yield of Wheat per Acre	Yield of Straw per Acre	Weight of One Bushel of Wheat.
1	German Emperor	28.7 bus.	3,880 lbs.	63½ lbs.
2	Genoese	†15.3 "	3,080 "	55¼ "
3	Lancaster	26.7 "	4,600 "	62 "
4	The Good	*13.7 "	2,620 "	65¼ "
5	Red Sea	36.7 "	6,280 "	61¾ "
6	Diehl Mediterranean	26.7 "	4,200 "	61¼ "
7	Shelby's New Golden	23.3 "	3,880 "	60¾ "
8	Hickman	35.3 "	4,300 "	65¾ "
9	Hicks	34.0 "	2,120 "	66 "
10	Extra Early Oakley	31.0 "	3,700 "	66¼ "
11	Canadian Finley	37.3 "	4,080 "	65¾ "
12	McGhee White	35.7 "	4,180 "	65 "
13	German Amber	32.3 "	4,660 "	65¼ "
14	Blue Stem	30.7 "	3,460 "	66½ "
15	Mediterranean Hybrid	30.7 "	2,220 "	60½ "
16	Longberry (Nigger)	31.3 "	4,400 "	61½ "
17	Fulcaster	†32.3 "	4,180 "	61¼ "
18	Penquite's Velvet Chaff	*30.3 "	3,460 "	62½ "
19	Fultz	*15.0 "	2,040 "	61¼ "

* Partly destroyed by birds. † Injured by frost.

Conclusions as to Varieties.

1. The following-named varieties were unable to withstand the winter, and therefore prove themselves valueless for this section:

1. Golden Drop.
2. Square Head.
3. Hunter's White.
4. Browrick Red.
5. Four varieties from Algeria, Africa.
6. Genoese.

2. The Diehl Mediterranean, for three years with us, has made a good average yield each year, the yield varying but little with the different seasons. The straw is heavy but weak, and the wheat should not be sown on low ground. The Mediterranean Hybrid, said to be a cross between the Diehl and the Red Mediterranean, resembles the Diehl in every particular, and is also to be recommended.

3. The Hicks, a California wheat, has done well with us for three years. It is a fine red wheat, and I believe it worthy of trial by the farmers. The Hickman wheat seems to be identical with the Hicks

4. The Extra Early Oakley on our land has been a success. The average yield for three years has been 27.9 bushels, and ranking all our other wheats except the Diehl Mediterranean, the average yield of which is the same.

Reports coming in from farmers who have been sent samples for trial, are not generally so favorable. In the southern part of the State it does not appear to yield well, as reported by Dr. Clardy. It winter-kills to some extent on low ground, according to Dr. Spurr, and its lack of capacity for tillering is another objection. Dr. Spurr says he believes these objections might be overcome to a great extent by planting it thicker than most wheats, say two bushels per acre:

Dr. J. D. Clardy reports:

"The Extra Early Oakley wheat only did moderately well the past season, only yielding about 16 bushels per acre, and ripening only two days ahead of the Fultz. It is an excellent berry, but does not produce enough per acre to be desirable, and we shall cease to grow it. Possibly it might do better sowed very thickly."

Major Phil. Bird, of Shelby county, received 46 pounds of the Extra Early Oakley wheat last fall for seed. He reports as follows:

"The Extra Early Oakley wheat sent me last fall was planted. It made the best yield in bushels of any wheat I ever grew. I got 34 bushels from the quantity you sent me. It did well through the winter. Did not winter-kill; was free from rust; grew a stiff straw; ripened about five days before the Diehl Mediterranean, which grew alongside of it, sowed on same day, on same kind of land, and prepared in same way; in fact there was no difference in soil or treatment, but the yield of the Oakley was one-third more."

Dr. R. J. Spurr reports that he got about 25 bushels of the Extra Early Oakley per acre. Was winter-killed on low land and stood thin on the ground. It did not do as well as the Velvet Chaff. Two bushels per acre would be about the quantity of the Oakley to sow.

5. The Red Sea, from Dr. Clardy, and the Canadian Finley were heavy yielders this year, and are promising varieties.

6. The Fulcaster did well this year. Last year, the first year with us, it did poorly.

7. The Velvet Chaff (from Mr. Curtis), all things considered, is one of the most promising wheats. It stood the winter perfectly; tillered well; straw stiff and strong. The wheat was ripe June 27. It yielded a little over 30 bushels to the acre. It proved the hardiest wheat we had.

Effect of Cultivation.

Last year we made some experiments to test the effect of spring cultivation. This year we made a continuation of these experiments. The plots for these experiments were 1.40 acre each. The wheat was planted in drills 14 inches apart. This was done by plugging every alternate hole in the drill. The Extra Early Oakley was the wheat selected for the experiments.

In this field alternate plots were cultivated twice—the first time before the wheat began stooling, and the last time just before heading. The cultivated rows made the best appearance, but the yield failed to substantiate the appearance.

The following report on the Extra Early Oakley wheat comes too late to be inserted in the body of this bulletin:

Mr. B. D. Peter, of Fayette county, reports a yield of 230¼ bushels from 6½ acres Extra Early Oakley, making 35.4 bushels per acre. The thresher-man of much experience pronounced it the best wheat he had ever threshed. The Oakley had the red rust very badly, and did not ripen as much in advance of the Fultz as it did last year.

The following table shows the yield of wheat and straw, calculated per acre:

Effect of Cultivation.

No. of Plat.	Yield of Wheat in Bushels per Acre.		Yield of Straw in Pounds Per Acre.	
	Cultivated.	Uncultivated.	Cultivated.	Uncultivated.
22	18.3	21.0	1,800	1,800
24	28.0	25.3	2,980	2,740
26	21.7	24.7	1,860	2,380
30	22.7	22.3	2,440	2,820
32	20.7	22.3	2,280	2,160
36	24.3	26.7	2,640	2,740
38	18.0	19.7	2,120	1,760
Average .	22.0	23.1	2,303	2,343

Application of Fertilizers.

For the purpose of testing the effect of the application of commercial fertilizers, the same plots were used this year as last, each plot receiving the same treatment this year as last. The soil is of the same nature as that described under the head of varieties. The field had been in cultivation five years—two in tobacco, one in potatoes, and the last two in wheat. The field inclined slightly from No. 21 to 40. Each plot was separated from those adjacent by a path of three feet.

Extra Early Oakley wheat was planted in drills October 3, at the rate of one bushel per acre.

The fertilizer was applied broadcast to each plot separately after planting. The following table gives the fertilizers used, the amount applied per acre, and the yield of wheat and straw calculated per acre:

Effect of the Fertilizer.

No. of Plot . . .	Fertilizers Applied and Amount per Acre.	Yield of Wheat per Acre . . .	Yield of Straw per Acre . . .
21–2	No Fertilizer used	19.9 bu.	1,940 lbs
23–4	Superphosphate of Lime, 600 pounds . . . . Sulphate of Potash, 200 pounds. . . . . Sulphate of Ammonia, 300 pounds	30.1 bu.	2,970 lbs
25–6	Superphosphate of Lime, 600 pounds . . . . Sulphate of Potash, 200 pounds	26.9 bu.	2,605 lbs
27–8	Superphosphate of Lime, 600 pounds . . . . Sulphate of Ammonia, 300 pounds	27.4 bu.	2,635 lbs
29–30	Sulphate of Potash, 200 pounds . . . . Sulphate of Ammonia, 300 pounds	26.7 bu.	2,775 lbs
31–32	No Fertilizer used	26.3 bu.	2,480 lbs
33–34	Homestead Corn and Wheat Grower, 600 pounds.	25.7 bu.	2,400 lbs
35–36	Bone Meal	29.7 bu	2,930 lbs
37–38	No Fertilizer used	23.3 bu.	2,390 lbs
39–40	Muriate of Potash, 200 pounds.	20.9 bu.	2,380 lbs

It should be stated that the English sparrows did considerable damage to this field this year, and especially to the outside plots. Had it not been for the ravages of these pests I believe plots 21–22 and 39–40 would have shown better results. From these results it appears that this soil is not in need of fertilizers yet to produce a good wheat crop. The soil is a very rich blue-grass soil, and has been in cultivation but five years, and it probably has all the elements in an available form necessary for the full development of a wheat crop.

The experiments on the prevention of smut were of no avail this year, as no smut appeared in any of the wheat.

BULLETIN No. XVI.

Experiments with Potatoes.

The experiments in potato culture the past year were conducted on the farm recently purchased by the College for the use of the Experiment Station.

Soil.—The soil of the blue-grass region is derived from the gray and blue limestones of the upper portions of the Trenton group of the Lower Silurian. These beds are fossiliferous, varying in character from thin bedded blue limestone, with rich phosphatic layers, to thick bedded, semi-crystalline gray limestone. The soil varies in its relation to the rocks by the interposition of a retentive clay, thin, or having a depth increasing to many feet. At least two different soils are known in this region, one having a red clay subsoil, porous and producing fine natural drainage; the other with a light clay subsoil, retentive and often deficient in natural drainage. The soil of the Experiment Station farm is of the latter class, and although on a ridge, from lack of proper drainage, is quite wet in the spring, and, therefore, may be called a cold and backward soil. It has been in cultivation for a long time, the exact length is not definitely known. At least three crops of hemp were grown on it prior to 1860. In 1863 it was planted to corn, in 1870 and 1871 in wheat; in 1872 it was in meadow; in 1879 a crop of potatoes was taken off of it; in 1881 it seems to have been in clover, in 1882 in millet, in 1887 in rye.

In the field where the experiments with potatoes were conducted it is believed that no stable manure or other fertilizers were ever applied.

The Season.—The season was not a favorable one for potatoes. Wet weather in early spring, together with the water-holding character of the soil, prevented very early planting. Dry weather during June and up to the 9th of July caused a blight, and the vines to die prematurely. The potatoes in consequence were small and of poor quality. The heavy rains of July 8 and 9 were too late to benefit the early potatoes, and even the late ones had suffered so that they were benefited but little from these rains. The very wet August and September caused the potatoes to take a second growth before they could be gathered, assisting undoubtedly in deteriorating the quality of the potatoes.

The total rain-fall for June was 2.97 inches; for July, 3.77 inches.

The tests were made under the following heads:

1. Test of varieties.
2. Methods of cutting and planting.
3. Test of fertilizers.

Test of Varieties.

The field on which the varieties were grown sloped gently to the East. The soil received no fertilizer whatever. Seed was prepared by cutting selected medium size to large potatoes in pieces containing from two to three eyes each, a few days before planting. These were planted, cut-side down, fourteen inches apart, in rows three feet wide. All the varieties were planted April 18 and 19, at a depth of four inches. All plots were cultivated the same day each time. The third time the field was cultivated the soil was thrown to the rows. Most of the plots contained 1-40 acre each; a few 1-20 acre. As before stated, the vines died prematurely, and therefore but little difference could be distinguished between the early and late varieties, the first to succumb being the *Perfection*; the *Perfect Peach Blow* and the *New Champion* showing the greatest resistance to the drought. On account of the wet weather the potatoes were not dug until September 28. In all varieties the potatoes were small to medium, and no attempt was made to select the large from the small.

The following table shows the yield of 65 of the 83 varieties planted, calculated in bushels to the acre. The varieties are named in the order of their yield:

Varieties.	Bushels per Acre . . .	Varieties.	Bushels per Acre . . .
Rands 42	104	White Elephant	45
Putnam	83	Great Eastern	45
Stanton	78	Crandall's Beauty	44
Alexander's Prolific	75	Steuben Chief	44
Early Rose	72	Lee's Favorite	43
Dictator	70	Paragon	43
Churchill's Seedling	67	White Chief	41
Nevada White	67	Sunlit Star	41
White Star	67	Brownell's 55	41
The Thorburn	65	Perfect Gem	40
Garfield (Burroughs)	64	Pride of Palestine	39
American Giant	62	Nott's Victor	38
Seneca Red Jacket	52	Banana	38
Green Mountain	51	New Champion	37
Burbank	51	Pearl of Savoy	36
Early Maine	50	Early Pearl	34
Crane's June Eating	49	Vanguard	34
Jumbo	48	Sylvan	34
Early Essex	47	Princess	34
Queen of Roses	47	Ricker's Graft	33
Tunix	33	Beauty of Hebron	28
Cream of the Field	32	Brownell's 31	27
New York State	31	Steuben's Beauty	26
Farina	31	Clark's No. 1	26
Chas. Downing	30	Rochester Favorite	25

Yield of Varieties.—Continued.

Varieties.	Bushels per Acre . . .	Varieties.	Bushels per Acre . . .
Early Sunrise	30	Big Benefit	24
Lake Ontario	29	Early Rose (home grown)	23
Crane's Keeper	29	Nott's Victor	23
Perfection	29	Rhode Island	21
Early Ohio	29	Dakota Red	21
Astonisher	28	Perfect Peach Blow	21
Newton's Seedling	28	Eno's Seedling	21
White Flower	28		

Quality of the Different Varieties.

The following table shows the relative quality of some of these varieties, as indicated by the amounts of *dry substance* and *water* found in each, and also by the average weight of one potato. The amounts of dry substance and water were calculated from the specific gravity, and the average weight of one potato is the average of both large and small potatoes:

Name of Variety.	Dry Substance in 100 Parts	Water in 100 Parts	Average Weight of One Potato
Farina	24.5	75.5	1¼ ounces.
Alexander's Prolific	22.1	77.9	2½ "
Pride of Palestine	21.1	78.9	2 "
Green Mountain	21.1	78.9	2¼ "
Astonisher	20.7	79.3	2½ "
Stanton	20.4	79.6	1½ "
Rands 42	20.4	79.6	3 "
Rhode Island	20.4	79.6	1¾ "
Perfection	20.4	79.6	1½ "
Charter Oak	20.2	79.8	2½ "
Sylvan	20.2	79.8	1½ "
White Flower	20.2	79.8	1¾ "
Newton's Seedling	20.2	79.8	1¾ "
Brownell's 31	20.0	80.0	1¾ "
Ricker's Graft	20.0	80.0	1½ "
Pearl of Savoy	19.7	80.3	1 "
New Champion	19.7	80.3	2¼ "
Brownell's 55	19.7	80.3	1¼ "
Crane's June Eating	19.7	80.3	1½ "

Quality of the Different Varieties.—Continued.

Name of Variety.	Dry Substance in 100 Parts	Water in 100 Parts	Average Weight of One Potato	
Crane's Keeper	19.7	80.3	1¾	ounces.
Seneca Red Jacket	19.7	80.3	1¾	"
Tunix	19.7	80.3	2	"
Perfect Peach Blow	19.5	80.5	1½	"
Empire State	19.5	80.5	2½	"
Paragon	19.3	80.7	2½	"
Boston Market	19.3	80.7	1¾	"
White Star	19.3	80.7	2	"
Rochester Favorite	19.3	80.7	2	"
Dictator	19.0	81.0	2	"
Triumph	19.0	81.0	2¼	"
Garfield (Burroughs)	19.0	81.0	1¾	"
American Giant	19.0	81.0	1¾	"
Lake Ontario	19.0	81.0	1¾	"
Junkis	18.8	81.2	2¼	"
White Chief	18.8	81.2	3½	"
Early Pearl	18.8	81.2	1¼	"
Great Eastern	18.8	81.2	2¼	"
Burbank	18.8	81.2	2	"
Spaulding	18.8	81.2	2	"
Clark's No. 1	18.6	81.4	2	"
Nevada White	18.6	81.4	2¼	"
Sunlit Star	18.6	81.4	1½	"
Perfect Gem	18.6	81.4	2½	"
Putnam	18.6	81.4	2	"

Quality of the Different Varieties.—Continued.

Name of Variety.	Dry Substance in 100 Parts	Water in 100 Parts . .	Average Weight of One Potato . . .
Early Rose (home grown)	18.1	81.9	1½ ounces.
Jumbo	18.1	81.9	1¾ "
Banana	17.9	82.1	2 "
General Logan	17.9	82.1	1¾ "
Princess	17.9	82.1	1 "
Churchill's Seedling	17.9	82.1	2¼ "
Big Benefit	17.6	82.4	2¼ "
New York State	17.6	82.4	2¼ "
Dakota Red	17.4	82.6	2 "
Steuben Chief	17.2	82.8	3 "
White Elephant	17.2	82.8	2 "
Weld's Jumbo	17.0	83.0	2½ "
Cream of the Field	17.0	83.0	1½ "
Steuben's Beauty	16.5	83.5	2 "
White Seedling	16.3	83.7	1½ "
Steuben's Beauty	15.8	84.2	2 "
Crandall's Beauty	15.6	84.4	3¼ "

It is proper to remark that the above results were obtained under rather unfavorable circumstances, as the vines were destroyed or seriously injured by blight and drouth at the time that the tubers were maturing, and for this reason the quality of the potatoes was below the average.

Methods of Cutting and Planting.

Six plots were used in these experiments, This field proved to be the poorest piece of land we had. It was supposed to be rich enough to raise a fair crop of potatoes, and as we did not wish to fertilize it until we had tested its productiveness, no manure of any kind was used.

The Early Rose potato was the variety used. The "seed" was obtained from Ohio. Each plot received exactly the same treatment as to preparation and cultivation. In all plots the potatoes were planted 14 inches apart in rows 3 feet wide, except that in plot No. 6 they were put 24 inches apart in the row.

The plots were 1-10 acre each in size.

Plot No. 1 was planted with the average run of potatoes as they came from the barrel, cut to two eyes.

Plot No. 2 was planted with large, selected potatoes planted whole.

Plot No. 3, very small potatoes planted entire.

Plot No. 4, selected large potatoes cut to two eyes.

Plot No. 5, small potatoes cut in pieces containing two eyes each.

Plot No. 6, seed same as plot No. 1. Potatoes planted in hills two feet apart.

The following table shows the yield calculated per acre:

Number of Plot.	FORM OF SEED POTATOES PLANTED.	Yield—Bushels Large Potatoes.	Yield—Bushels Small Potatoes.	Total Yield of Potatoes in Bushels.	Bushels of Potatoes Planted per Acre.
1	Average potatoes cut to 2 eyes	27	15.5	42.5	7
2	Large whole potatoes	51	25.6	76.6	47
3	Small whole potatoes.	30	31.6	61.6	11
4	Large potatoes cut to 2 eyes	25.3	19.6	44.9	7
5	Small potatoes cut to 2 eyes.	20.3	20.3	40.6	5
6	Average potatoes cut to 2 eyes, planted 24 inches apart	20.6	8.3	28.9	4

These results add to the evidence obtained heretofore at this Station, and to the many results obtained elsewhere, that by using whole potatoes of large size for seed in place of small potatoes or "cut seed," *there follows an increased yield in the crop.*

But the results this year do not warrant the statement *that it pays to plant large whole potatoes.* This year, with us, it did not pay, as the following table clearly demonstrates:

Form of Seed Potatoes Planted.	Value Merchantable Potatoes per Acre	Value Small Potatoes per Acre . .	Total Value Crop per Acre	Cost of Seed per Acre	Value Less Cost Seed . . . . .
Average potato cut to 2 eyes	$16 20	$3 10	$19 33	$7 70	$11 60
Large, whole potato	30 60	5 12	35 72	51 70	*. . .
Small, whole potato	18 00	6 32	24 32	12 10	12 22
Large potato cut to 2 eyes	15 18	3 92	19 10	7 70	11 40
Small potato cut to 2 eyes	12 18	4 06	16 24	5 50	10 74
Average potato cut to 2 eyes, planted 24 inches apart.	12 36	1 66	14 02	4 40	9 62

* Loss, $15.98.

The season and soil were unfavorable to such a test. *When the season is favorable and the soil is rich, the evidence from many experiments tends to show that the value of the increased yield produced by planting large size potatoes more than compensates for the increased outlay for seed.*

Experiments made at this Station, in a rich soil and in a fair season, in the year 1886, gave the following results per acre:

Form of Seed Potatoes Planted.	Yield of Large Potatoes . .	Yield of Small Potatoes . .	Total Yield .
Small, whole seed	145 bu.	48 bu.	193 bu.
Cut to two eyes	120 bu.	30 bu	150 bu.
Large, whole seed	210 bu.	50 bu.	260 bu.

Computing the quantity of seed potatoes required for planting an acre, the same as was required this year, and noting the fact that the seed potatoes cost that year 60 cents per bushel, and that the product of large potatoes was sold at 45 cents per bushel, and the small potatoes at 15 cents, we find that it was profitable to use large whole potatoes, as the following table shows:

Experiments of 1886.

Form of Seed Potatoes Planted.	Value of Large Potatoes . . .	Value of Small Potatoes . . .	Total Value of Crop per Acre	Cost of Seed .	Value Less Cost of Seed . . .
Small, whole seed	$65 25	$7 20	$72 45	$4 40	$68 05
Cut to two eyes.	54 00	4 50	58 50	4 20	54 30
Large, whole seed	94 50	7 50	102 00	28 20	73 80

Similar experiments made under the direction of Professor Henry E. Alvord, Director of the Maryland Agricultural Experiment Station this year, emphasize the fact that, with an average crop, it is economical to use whole potatoes of medium or large size for seed.

The following tables from Bulletin No. 2, of the Maryland Agricultural Experiment Station, are given to show the results obtained by Major Alvord:

1. Average result from forty varieties of potatoes:

Product per Acre.—Five Different Methods of Seeding,

Row.	Form of Seed Potatoes Planted	Total Yield.	Merchantable.	Unmerchantable.
		Bus per Acre	Bus. per Acre	Bus. per Acre
A	A large whole potato	268.95	172.12	96.83
B.	A whole potato, size of egg. . . .	174.36	106.70	67.66
C.	Usual cutting, one piece	134 24	82.75	51.48
D.	A single eye on good sized piece.	90.53	58.86	31.65
E.	A single eye on very mall piece.	57.98	33.10	24 87

whole potatoes of large size for seed in place of small potatoes or "cut seed," *there follows an increased yield in the crop.*

But the results this year do not warrant the statement *that it pays to plant large whole potatoes.* This year, with us, it did not pay, as the following table clearly demonstrates:

FORM OF SEED POTATOES PLANTED.	Value Merchantable Potatoes per Acre	Value Small Potatoes per Acre . .	Total Value Crop per Acre . . .	Cost of Seed per Acre	Value Less Cost Seed . . . . .
Average potato cut to 2 eyes	$16 20	$3 10	$19 33	$7 70	$11 60
Large, whole potato	30 60	5 12	35 72	51 70	* . . .
Small, whole potato	18 00	6 32	24 32	12 10	12 22
Large potato cut to 2 eyes	15 18	3 92	19 10	7 70	11 40
Small potato cut to 2 eyes	12 18	4 06	16 24	5 50	10 74
Average potato cut to 2 eyes, planted 24 inches apart.	12 36	1 66	14 02	4 40	9 62

* Loss, $15.98.

The season and soil were unfavorable to such a test. *When the season is favorable and the soil is rich, the evidence from many experiments tends to show that the value of the increased yield produced by planting large size potatoes more than compensates for the increased outlay for seed.*

Experiments made at this Station, in a rich soil and in a fair season, in the year 1886, gave the following results per acre:

FORM OF SEED POTATOES PLANTED.	Yield of Large Potatoes . .	Yield of Small Potatoes . .	Total Yield .
Small, whole seed	145 bu.	48 bu.	193 bu.
Cut to two eyes	120 bu.	30 bu	150 bu.
Large, whole seed	210 bu.	50 bu.	260 bu.

Computing the quantity of seed potatoes required for planting an acre, the same as was required this year, and noting the fact that the seed potatoes cost that year 60 cents per bushel, and that the product of large potatoes was sold at 45 cents per bushel, and the small potatoes at 15 cents, we find that it was profitable to use large whole potatoes, as the following table shows:

Experiments of 1886.

Form of Seed Potatoes Planted.	Value of Large Potatoes. . .	Value of Small Potatoes. . .	Total Value of Crop per Acre	Cost of Seed	Value Less Cost of Seed. . .
Small, whole seed.	$65 25	$7 20	$72 45	$4 40	$68 05
Cut to two eyes.	54 00	4 50	58 50	4 20	54 30
Large, whole seed	94 50	7 50	102 00	28 20	73 80

Similar experiments made under the direction of Professor Henry E. Alvord, Director of the Maryland Agricultural Experiment Station this year, emphasize the fact that, with an average crop, it is economical to use whole potatoes of medium or large size for seed.

The following tables from Bulletin No. 2, of the Maryland Agricultural Experiment Station, are given to show the results obtained by Major Alvord:

1. Average result from forty varieties of potatoes:

Product per Acre.—Five Different Methods of Seeding,

Row.	Form of Seed Potatoes Planted	Total Yield.	Merchantable.	Unmerchantable.
		Bus per Acre	Bus. per Acre	Bus. per Acre
A.	A large whole potato	268.95	172.12	96.83
B.	A whole potato, size of egg. . . .	174.36	106.70	67.66
C.	Usual cutting, one piece	134 24	82.75	51.48
D.	A single eye on good sized piece.	90.53	58.86	31.65
E.	A single eye on very mall piece.	57.98	33.10	24 87

"The constant decrease of product in all three columns, corresponding to the decrease in the quantity of seed potato planted, is too manifest to need comment. By quantity of seed is meant the bulk and weight of the tuber, or portion of tuber, used in every hill. The crop as a whole, in this instance, was a very fair one, all considered, the general average, total yield, being at the rate of 145¼ bushels per acre."

3. Cost of seed potatoes in relation to crop.

a. Experiment of 1888.

Row.	Value of Merchantable, per Acre.	Value of Unmerchantable per Acre.	Total Value of Crop per Acre . . .	Cost of Seed Potatoes per Acre	Value Crop Less Cost of Seed . . . .
A	$103 20	$24 00	$127 20	$60 00	$67 20
B	63 90	16 75	80 65	14 40	66 25
C	49 50	12 75	62 25	4 80	57 45
D	35 30	7 90	43 20	2 40	40 80
E	19 80	6 20	26 00	2 40	23 60

From the above results, and from others made under his direction while at Houghton Farm, Professor Alvord says: "The general result is thus emphasized: *The more seed potato planted, the more and better the crop.*"

Test of Fertilizers.

The field on which these experiments were made is quite level. The soil is of the general character before described. The plots were each 1-10 acre in size, and were separated from each other by a path of three feet. The method of planting was identical to that described under varieties, and the preparation of the soil and the cultivation was the same. The variety of potato planted in these experiments was Northern grown Early Rose, cut to two eyes, planted fourteen inches apart in the row, the rows being three feet wide.

After the ground was well prepared by plowing and harrowing, the rows were marked out by a small mold-board plow. The fertilizers were scattered in these rows by hand, and afterwards slightly covered with dirt. The potatoes were planted in the rows thus prepared.

The fertilizers were applied and the potatoes were all planted April 19.

The following plan shows the arrangement of the plots, and the kind and amount of fertilizer used:

1	Blank.	
2	Acid Phosphate, 60 lbs.	
3	Sulphate of potash, 20 lbs.	
4	Muriate of potash, 20 lbs.	
5	Sulphate of Ammonia, 30 lbs.	
6	Blank.	
7	Acid Phosphate, Sulphate of Potash,	60 lbs. 20 lbs.
8	Acid Phosphate, Sulphate of Ammonia.	60 lbs. 30 lbs
9	Sulphate of Potash, Sulphate of Ammonia	20 lbs. 30 lbs.
10	Sulphate of Potash, Sulphate of Ammonia, Acid Phosphate,	20 lbs. 30 lbs. 60 lbs.

NOTE—The manure plot was 14 feet to the left of plot No. 2. It had 8 loads of manure applied.

When a soil becomes less productive or exhausted from long continued cropping, it is generally caused by the loss of potash, phosphoric acid or nitrogen, or any two of them or all three. Of all the elements furnished by the soil, these three are generally the soonest exhausted. Commercial fertilizers are made and sold for the purpose of furnishing one or more of these elements to the soil. Some fertilizers, as simple superphosphates, contain only one of these ingredients, while others contain all three, and they are then called complete fertilizers.

To test the agricultural value of all the various *brands* made would be an endless task, and even if this should be undertaken the results would be of little value, as the composition of the various fertilizers varies from year to year. It is an easy task, however, to find out whether a soil needs potash, phosphoric acid, or nitrogen, or whether it needs a combination of any two or all of these elements. This found out, it is an easy matter to judge which of the various brands of fertilizers is wanted for such soil, by noting their composition.

These experiments were planned with this object in view: To learn what essential ingredient or ingredients of commercial fertilizers would be beneficial to the production of potatoes on our soil. If potash was needed alone, plots 3 and 4 would show it. If phosphoric acid only was needed, plot No. 2 would show it; if nitrogen, plot No. 5; if the soil needed a combination of two of these ingredients, then plots No. 7, 8 or 9 would show which combination was needed; or, if it needed all these applied, No. 10 would show it. Plots Nos. 1 and 6 were left blank for comparision, and plots Nos. 2 and 3 were designed to show which form of potash was best for potatoes, taking into consideration the quality as well as any increased yield

In these experiments we applied ammonium sulphate, which contained 20.21 per cent. of nitrogen, to furnish nitrogen; acid phosphate, to furnish phosphoric acid, containing 15 per cent. of this ingredient, and sulphate of potash, containing 51 per cent. of potash, to furnish the potash, except in plot No. 4, where muriate of potash was used, containing 50 per cent. of potash.

The following table gives the yield of potatoes on the plots, calculated per acre:

Effect of Fertilizers on Potatoes.

Number of Plot.	Fertilizers Used.	Amount per Acre, Pounds.	Yield in Bushels per Acre.		
			Large Potatoes.	Small Potatoes.	Total.
1	None	....	57	15	72
2	Acid Phosphate	600	61	25.1	86.1
3	Sulphate of Potash	200	101.6	28.1	129.7
4	Muriate of Potash	200	96.3	28.1	124 4
5	Sulphate of Ammonia	300	64.5	17.4	81.9
6	None	.....	63.5	25	88.5
7	Acid Phosphate Sulphate of Potash	600 200	110.7	22.5	133.2
8	Acid Phosphate Sulphate of Ammonia	600 300	52.3	21.1	73.4
9	Sulphate of Potash Sulphate of Ammonia	200 300	98.3	18.7	117.0
10	Acid Phosphate Sulphate of Potash Sulphate of Ammonia	600 200 300	108.0	18.3	126.3
11	Stable manure	80 loads.	94.7	27.7	122.4

These results show:

1. That the yield of merchantable potatoes, and also the total yield, was largely increased on those plots containing potash.

2. That potash sulphate when applied alone produced as large a yield of potatoes as when combined with acid phosphate or ammonia sulphate, or both.

3. That the acid phosphate when applied alone or in combination with ammonia sulphate, produced no material increase in the yield of potatoes.

4. That the yield of potatoes was not increased by the application of ammonia sulphate.

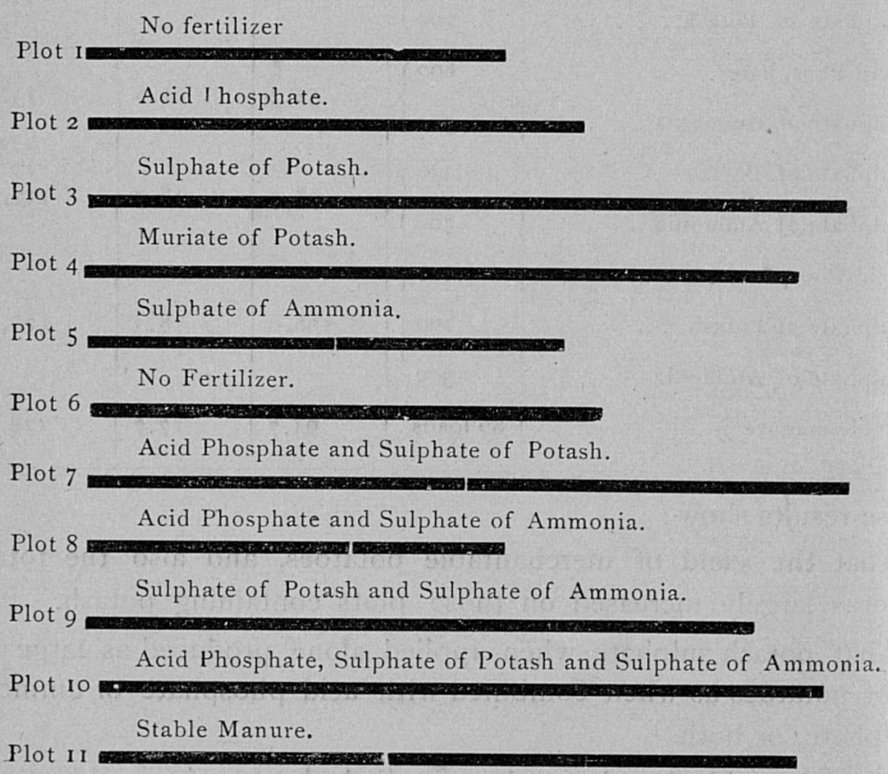
5. That 200 pounds of sulphate of potash produced an increased yield slightly exceeding that produced by the application of 80 loads of stable manure.

6. That the results were the same, as to the yield, whether muriate or sulphate of potash was used.

7. To sum up: "Potash is what is needed on our soil for the potato crop."

The effect of the potash was shown upon the growth of the potatoes as well as the yield. The vines were much more thrifty and stood the drouth better. The potatoes on plots containing potash were larger and more even in size than those on other plots.

The effect of using potash upon the yield of potatoes may, perhaps, be better shown in graphic form, as below, where the heavy black lines show, by their relative lengths, the comparative yield of the different plots:



Was There a Profit in the Use of These Fertilizers?

The question of economy in the use of fertilizers is one always to be considered. It is evident that if the cost of the fertilizer applied is greater than the increase in value of the crop, there will be loss instead of gain by its use, unless its recuperative powers extend through more than one year.

Generally speaking, the effect of commercial fertilizers upon land the second year after applying, should not be considered in calculating the profits by their use.

The following table has been compiled to show the profit or loss in the use of various fertilizers applied:

No. of Plot.	Fertilizers Used	Cost of Fertilizers Used.	Value of Merchantable Potatoes.	Value of Small Potatoes.	Total Value of Crop.	Value of increased Yield.	Value of Increased Yield Over Cost of Fertilizer.
1	Blank	. . .	$34 20	$3 00	$37 20	. . .	. . . .
2	Acid Phosphate	$5 4	36 60	5 02	41 6	$1 47	*. . . .
3	Potash Sulphate	5 00	60 96	5 62	66 58	26 43	$21 43
4	Potash Muriate	4 00	57 75	5 6	63 37	23 22	19 22
5	Ammonia Sulphate	9 00	38 70	3 48	42 18	2 03	†. . .
6	Blank	.	38 10	5 00	43 10	. . . .	. . . .
7	Acid Phosphate Potash Sulphate	10 40	66 42	4 50	70 92	30 77	20 37
8	Acid Phosphate Ammonia Sulphate	14 40	31 38	4 22	35 60	. . . .	‡. . . .
9	Potash Sulphate Ammonia Sulphate	14 00	58 98	3 74	62 72	22 57	8 57
10	Potash Sulphate Ammonia Sulphate Acid Phosphate	19 40	64 80	3 65	68 45	28 30	8 90
11	Manure		56 82	5 54	62 36	22 21	. . . .

*Loss, $3.93. †Loss, $6.97. ‡Loss, $14.40

It should be remembered that dry weather does not produce very favorable results in the use of fertilizers. It is believed that had we had timely rains in the growing season the results would have been still more marked. But the results show decidedly that there was a profit in the use of potash compounds, and that the money expended in ammonia sulphate and superphosphates was entirely lost. Plot No. 11, which received 80 loads of barnyard manure, probably did not produce an increase enough to pay for the expense of hauling out the manure It is likely, however, that the manure will show good effects longer than the other fertilizers.

Thus we find by these experiments that it is potash compounds that are needed to enrich the soil of the Experiment Station farm for the production of potatoes. They indicate, also, that impoverished soils of the above class, in the blue-grass region, would be improved by the application of potash compounds; but, whether this be true or not of the various farms, can only be determined positively by similar experiments. The conclusions reached show no indications for the soils of other geological formations of the State. It would be erroneous to conclude, from these experiments, that potash is the element needed on all soils for the potato crop. It is wrong to suppose that a certain crop needs the same kind of fertilizer on any and all soil. It is true that some crops need more of a given constituent of fertilizers than any others, yet if a soil lacks an element for any given crop, the indications are that it needs this element applied for nearly all crops.

The preceding experiments teach an important lesson as to the intelligent use of commercial fertilizers. To be able to use them intelligently, we must know beforehand what our soil requires, and then we may select that fertilizer which we know, from its analysis, will furnish the desired element or elements. If the soil does not need all of the fertilizing elements for the production of a particular crop, it is useless and wasteful to spend money in buying material containing those elements. Take, for instance, our soil: We spent $5 on plot No. 3 for fertilizer; on plot No. 10, $19.40. The results show that potash is what we want. We bought the same amount of potash in No. 3 as in No. 10, but in plot No. 10 we bought two other fertilizer ingredients, also, viz: nitrogen and phosphoric acid, which made the difference in the cost of the two fertilizers. We, therefore, threw $14.40 away, at least as far as the present crop is concerned, in the purchase of these two extra elements not needed.

A fertilizer containing all these three ingredients has this advantage, however—where it is not known what the soil really needs—it will supply the soil with the elements needed, while the fertilizer containing only one or two may not. To illustrate: On plot No. 2 we put superphosphate, and on plot No. 10 a complete fertilizer. Not knowing what our soil needed, we lost by putting on an incomplete, but gained by putting on a complete fertilizer. This, however, is not always economical. It is far better for the farmer to study the requirements of his soil. How can this be done? The answer is, by making just such experiments as are described in this bulletin.

Any farmer who applies commercial fertilizers to his land, should take pains to carefully carry out such experiments, and to those who do not use fertilizers such experiments would probably be more useful than to those who do, as they might find, by such experiments, that there was economy in the proper use of commercial fertilizers. The Station will gladly co-operate with any farmers undertaking such experiments.

Effect of Fertilizers on the Quality of Potatoes.

Number of Plot.	Fertilizers Applied.	Dry Substance in 100 Parts . .	Water in 100 Parts . . . .
1	None	17.4	82.6
2	Acid Phosphate	Not tried.	Not tried.
3	Sulphate of Potash	19.3	80.7
4	Muriate of Potash	18.2	81.8
5	Sulphate of Ammonia	18.2	81.8
6	None	19.5	80.5
7	Acid Phosphate Sulphate of Potash	20.3	79.7
8	Acid Phosphate Sulphate of Ammonia	18.5	81.5
9	Sulphate of Potash Sulphate of Ammonia	19.5	80.5
10	Acid Phosphate Sulphate of Potash Sulphate of Ammonia	18.5	81 5
11	Stable Manure	19.2	80.8

The results show that on all the plots the potatoes were of an inferior quality, owing probably to incomplete development, caused by the dry weather. A good potato should contain from 22 to 25 per cent. of dry matter.

On the Use of London Purple to Destroy the Potato Bug.

Some experiments were made in the use of "London Purple" by "spraying," to prevent the ravages of the potato bug, and they were so successful that it is deemed worth while to report them here. Six ounces of London Purple were made into a paste with water, and then added to forty gallons of water. This mixture was applied to the vines by means of a force pump, with short hose and spraying nozzle attached. The pump was attached to a barrel containing the mixture, and the whole was carried through the field on a cart, driven between the rows. It required two hands—one to work the pump, the other to direct the spray, and a boy to drive, and four rows were sprinkled at a time. The pump was a spraying pump, manufactured by the Field Force Pump Co., Lockport, N. Y., and was so constructed as to keep the contents of the barrel always agitated, which is necessary to prevent the London Purple from settling.

The effect of the application was to kill or drive the bugs away immediately, and the vines receiving the sprinkling were not attacked for over a week, after which time the vines received a second spraying. This was sufficient to protect them for the rest of the season, as they were not further molested. It is probable, however, that, in rainy weather, more frequent applications would be necessary. On a part of the field that was left without spraying, for comparison, it required daily hand pickings to save the vines from destruction. In view of the effectiveness of this method of applying the poison, and its convenience, it is believed that it should come into more general use in this section. Care should be taken in using London Purple, however, as it is very poisonous.

M. A. SCOVELL, Director.
A. M. PETER, Ass't Chemist.

Exchanges.

Our list of exchanges at this date is as follows:

Farm and Home, Springfield, Mass.
Mirror and Farmer, Manchester, N. H.
Holstein-Friesian Register, Brattleboro, Vt.
American Agriculturist, New York.
Country Gentleman, Albany, N. Y.
Farmers' Club Journal, Hornellsville, N. Y.
Popular Gardening, Buffalo, N. Y.
Rural and Poultry World, Syracuse, N. Y.
Sugar Beet, Philadelphia, Pa.
The Farmers' Call, Quincy, Ill.
National Live Stock Journal, Chicago, Ill.
Industrialist, Manhattan, Kas.
Western Resources, Lincoln, Neb.
American Swineherd, Alexandria, Dak.
American Grange Bulletin, Cincinnati, O.
Ohio Farmer, Cleveland, O.
Prairie Farmer, Chicago, Ill.
Dairy World, Chicago, Ill.
Orange Judd Farmer, Chicago, Ill.
American Sheep Breeder and Wool Grower, Chicago, Ill.
Home and Farm, Louisville, Ky.
Farmers' Home Journal, Louisville, Ky.
Baltimore Sun, Baltimore, Md.
Hoard's Dairyman, Fort Atkinson, Wis.
The Maritime Agriculturist, Sackville, N. B.
Kentucky Telephone, Cadiz, Ky.
Stock Grower and Farmer, Las Vegas, N. M.
Farmers' Home, Dayton, O.
American Bee Journal, Chicago, Ill.
Progressive Age, Hopkinsville, Ky.
Agricultural Epitomist, Indianapolis, Ind.
Columbus Record, Columbus, O.

LAWS.

THE HATCH ACT.

AN ACT to establish agricultural experiment stations in connection with the colleges established in the several States under the provisions of an act approved July 2, 1862, and of the acts supplementary thereto.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress Assembled, That in order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science, there shall be established under direction of the college or colleges, or agricultural departments of colleges, in each State or Territory established, or which may hereafter be established, in accordance with the provisions of an act approved July 2, 1862, entitled, "An act donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts," or any of the supplements to said act, a department to be known and designated as an "agricultural experiment station: *Provided,* That in any State or Territory in which two such colleges have been or may be so established, the appropriation hereinafter made to such State or Territory shall be equally divided between such colleges, unless the Legislature of such State or Territory shall otherwise direct.

§ 2. That it shall be the object and duty of said experiment stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping, as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective States or Territories.

§ 3. That in order to secure, as far as practicable, uniformity of methods and results of the work of said stations, it shall be the duty of the United States Commissioner of Agriculture to furnish forms, as far as practicable, for the tabulation of results of investigation or experiments; to indicate, from time to time, such lines of inquiry as to him shall seem most important; and, in general, to furnish such advice and assistance as will best promote the purposes of this act. It shall be the duty of each of said stations, annually, on or before the 1st day of February, to make to the Governor of the State or Territory in which it is located, a full and detailed report of its operations, including a statement of receipts and expenditures, a copy of which report shall be sent to each of said stations, to the said Commissioner of Agriculture, and to the Secretary of the Treasury of the United States.

§ 4. That bulletins or reports of progress shall be published at said stations at least once in three months, one copy of which shall be sent to each newspaper in the States or Territories in which they are respectively located, and to such individuals actually engaged in farming as may request the same, and as far as the means of the station will permit. Such bulletins or reports and the annual reports of said stations shall be transmitted in the mails of the United States, free of charge for postage, under such regulations as the Postmaster-General may, from time to time, prescribe.

§ 5. That for the purpose of paying the necessary expenses of conducting investigations and experiments and printing and distributing the results as hereinbefore prescribed, the sum of $15,000 per annum is hereby appropriated to each State, to be specially provided for by Congress in the appropriation from year to year, and to each Territory, entitled under the provisions of section eight of this act, out of any money in the Treasury proceeding from the sales of public lands, to be paid in equal quarterly payments, on the first day of January, April, July and October in each year, to the Treasurer or other officer duly appointed by the governing boards of said colleges to receive the same; the first payment to be made on the first day of October, 1887: *Provided, however*, That out of the first annual appropriation so received by any station, an amount not exceeding one-fifth, may be expended in the erection, enlargement, or repair of a building or buildings necessary for carrying on the work of such station; and thereafter an amount not exceeding five per centum of such annual appropriation may be so expended.

§ 6. That whenever it shall appear to the Secretary of the Treasury, from the annual statement of receipts and expenditures of any of said stations, that a portion of the preceding annual appropriation remains unexpended, such amount shall be deducted from the next succeeding annual appropriation to such station, in order that the amount of money appropriated to any station shall not exceed the amount actually and necessarily required for its maintenance and support.

§ 7. That nothing in this act shall be construed to impair or modify the legal relation existing between any of the said colleges and the government of the States or Territories in which they are respectively located.

§ 8. That in States having colleges entitled under this section to the benefits of this act, and having also agricultural experiment stations established by law separate from said colleges, such States shall be authorized to apply such benefits to experiments at stations so established by such States; and in case any State shall have established, under the provisions of said act of July 2d aforesaid, an agricultural department or experimental station, in connection with any university, collge or institution not distinctively an agricultural college or school, and such State shall have established or shall hereafter establish a separate agricultural college or school, which shall have connected therewith an experimental farm or station, the Legislature of such State may apply, in whole or in part, the appropriation by this act made, to such separate agricultural college or school, and no Legislature shall by contract, express or implied, disable itself from so doing.

§ 9. That the grants of moneys authorized by this act are made subject to the legislative assent of the several States and Territories to the purpose of said grants: *Provided*, That payment of such installments of the appropriation herein made as shall become due to any State before the adjournment of the regular session of its Legislature meeting next after the passage of this act, shall be made upon the assent of the Governor thereof, duly certified to the Secretary of the Treasury.

§ 10. Nothing in this act shall be held or construed as binding the United States to continue any payments from the Treasury to any or all the States or institutions mentioned in this act, but Congress may, at any time, amend, suspend or repeal any or all the provisions of this act.

Approved March 2, 1887.

THE LAW ACCEPTING THE PROVISIONS OF THE HATCH ACT.

CHAPTER 208.

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 Experment Stations, in connection with the Agricultural Colleges established by the several States and Territories, under the act of Congress approved July 2, 1862.

WHEREAS, The Congress of the United States passed an act, entitled "An act to establish agricultural experiment stations, in connection with the colleges established in the several States, under the provisions of an act approved July 2, 1862, and of the acts supplementary thereto," approved March 2, 1887; and whereas, by section 9 of said act, whatever appropriations may be made by Congress in pursuance of the purpose contemplated by said act beome available to the stations established in connection with agricultural colleges, only on condition that "the legislative assent of the several States and Territories to the purpose of said grants" be obtained; therefore,

Be it enacted by the General Assembly of the Commonwealth of Kentucky: 1. That the assent of the Legislature of this Commonwealth be, and is hereby, given to the provisions of said act.

2. That the Governor of this Commonwealth send a certified copy hereof to the Secretary of the Treasury of the United States.

3. That this act shall take effect from and after its passage.

Approved February 20, 1888.

THE FERTILIZER LAW.

CHAPTER 638.

AN ACT to regulate the sale of fertilizers in this Commonwealth, and to protect the agriculturist in the purchase and use of same.

Be it enacted by the General Assembly of the Commonwealth of Kentucky, § 1. On or before the first day of May in each year, before any person or company shall sell, offer or expose for sale in this State, any commercial fertilizer whose retail price is more than $10 per ton, said person or company shall furnish to the Director of the Agricultural Experiment Station, inaugurated by the Agricultural and Mechanical College of Kentucky (which station is hereby recognized as the "Kentucky Agricultural Experiment Station"), a quantity of such commercial fertilizer, not less than one pound, sufficient for analysis, accompanied by an affidavit that the substance so furnished is a fair and true sample of a commercial fertilizer which the said person or company desires to sell within the State of Kentucky.

§ 2. It shall be the duty of the Director of the Kentucky Agricultural Experiment Station to make, or cause to be made, a chemical analysis of every sample of commercial fertilizer so furnished him, and he shall print the result of such analysis in the form of a label; such label shall set forth the name of the manufacturer, the place of manufacture, the brand of the fertilizer, and the essential ingredients contained in said fertilizer, expressed in terms and manner approved by said Director, together with a certificate from the Director, setting forth that said analysis is a true and complete analysis of the sample furnished him of such brand of fertilizer; and he shall also place upon each label the money value of such fertilizer computed from its composition as he may determine. The Director shall furnish such labels, in quantities of five hundred or multiple thereof, to any person or company desiring to sell, offer or expose for sale, any commercial fertilizer in the State.

§ 3. Every box, barrel, keg or other package or quantity of any commercial fertilizer "whose retail price is over $10 per ton," in any shape or form whatever, sold, or offered for sale in the State, shall have attached to it, in a conspicuous place, a label bearing a certified analysis of a sample of such fertilizer from the Director of the "Kentucky Agricultural Experiment Station," as provided in the foregoing sections of this act.

§ 4. Any manufacturer or vender of any commercial fertilizer, who shall sell, offer or expose for sale, any fertilizer without having previously complied with the provisions of this act hereinbefore set forth, shall, upon indictment and conviction, be fined $100 for each violation or evasion of this act, which fines, less the percentage of the prosecuting attorney fees, shall accrue to the benefit of and be paid into the State Treasury.

§ 5. The Director of the Kentucky Agricultural Experiment Station shall receive for analyzing a fertilizer and affixing his certificate thereto, the sum of $15; for labels furnished, $1 per hundred.

§ 6. The Director of said Kentucky Agricultural Experiment Station shall pay all such fees received by him into the treasury of the Agricultural and Mechanical College of Kentucky, the authorities of which shall expend the same in meeting the legitimate expenses of the Station, in making analysis of fertilizers, in experimental tests of same, and in such other experimental work and purchases as shall inure to the benefit of the farmers of this Commonwealth. The Director shall, within two months of the biennial meeting of the General Assembly, present to the Commissioner of Agriculture a report of the work done by [him], together with an itemized statement of receipts and expenditures for the two years preceding, under the operations of this act.

§ 7. The Director of said Experiment Station is hereby authorized in person, or by Deputy, to take samples for analysis from any lot or package of any commercial fertilizer which may be in the possession of any dealer in this State. And he is hereby authorized to prescribe and enforce such rules and regulations as he may deem necessary to carry fully into effect the true intent and meaning of this act, and any agriculturalist a purchaser of any commercial fertilizer in this State, may take a sample of the same, under the rules and regulations of the Director of the said Experiment Station, and forward the same to the Experiment Station for analysis, which analysis shall be made free of charge.

§ 8. This act shall be in force from and after its passage; and all acts in conflict with this act are hereby repealed.

Approved April 13. 1886.

Rules and Regulations.

By authority of section 7 of the fertilizer law the Director makes the following rules and regulations concerning the sale of fertilizers in this State :

1. The *seller* is responsible for affixing the *official* label to the fertilizer packages, unless the manufacturer has provided and attached them.

2. All labels, to be official, must emanate from the Director of the Kentucky Agricultural Experiment Station. Persons attaching other than official labels for official labels, are evading the law, and are subject to the penalties thereof.

3. Official labels are issued only to persons guaranteeing by affidavit that the fertilizer to which they are to be attached is true to the sample on which the results of the analysis and commercial value are determined. Persons attaching labels to goods misrepresenting the fertilizers, or the sample for which they are issued, are subject to the penalties of the law for each offense.

To Purchasers of Fertilizers.

It is estimated that from four hundred to five hundred thousand dollars are expended annually in this State for fertilizers. It becomes, therefore, of vast importance to the State that the fertilizers sold should be of the quality represented. To this end the Director would advise farmers purchasing fertilizers :

1. To purchase with a guarantee that the fertilizer is as represented by the official tag attached.

2. To take a sample, especially if purchasing in large quantities, and send it to the Director for analysis, to see whether the fertilizer is as represented by the seller.

3. To have nothing to do with fertilizers which are not labeled with a tag bearing an analysis, and certified to and signed by the Director. Manufacturers of genuine goods are always willing to comply with a law which protects them as well as the purchaser, and their goods will be found labeled as required by law. It is generally those who offer adulterated or inferior goods that do not desire the quality of their goods to be known.

In order to obtain a fair sample for this purpose, the following directions should be observed:

How to Take Samples.

**a.* Select at least two average packages of the fertilizer, preserving the labels to send with sample. Open these packages and mix well together the contents of each, down to one-half of its depth, emptying out upon a clean floor, if necessary, and crushing any soft, moist lumps, in order to facilitate mixture, but leaving hard, dry lumps unbroken, so that the sample shall exhibit the texture and mechanical condition of the fertilizer.

b. Take out five equal cupsfull from different parts of the mixed portions of each package. Pour them (ten in all) one over another upon a paper; intermix again thoroughly, but quickly, to avoid loss or gain of moisture; fill a can or jar from this mixture; inclose labels taken from the packages; seal; label plainly, giving name also of sender, and send to

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

*Connecticut Experiment Station.

FINANCIAL STATEMENT.

The Kentucky Agricultural Experiment Station, in Account With the United States Appropriation.

		Cr.	Dr.
1888.			
	To receipts from Treasurer of the United States, as per appropriation for year ending June 30, 1888, under act of Congress approved March 2, 1887		$15,000 00
June 30,	by salaries	$4,112 50	
	By labor	1,373 06	
	By supplies	597 65	
	By freight and expressage	55 44	
	By postage and stationery	144 35	
	By printing	178 00	
	By library	2,137 20	
	By tools, implements and machinery	568 69	
	By chemical apparatus and supplies	2,012 39	
	By furniture	213 89	
	By live stock	475 00	
	By traveling	117 15	
	By incidental expenses	11 25	
	By buildings	3,000 00	
			14,996 57
	Balance unexpended		$3 43

I, the undersigned, duly appointed auditor for the institution, do hereby certify that I have examined the books and accounts of the Experiment Station of the Agricultural and Mechanical College of Kentucky for the fiscal year ending June 30, 1888; that I have found the same well kept and correctly classified as above, and that the receipts for the time named are shown to have been $15,000, and the corresponding disbursements $14,996.57, for all of which proper vouchers are on file, and have been by me examined and found correct, thus leaving an unexpended balance of $3.43 to be accounted for in the fiscal year commencing July 1, 1888.

Signed, R. J. SPURR,
Auditing Committee Board of Trustees.

I hereby certify that the foregoing statement of account, to which this is attached, is a true copy from the books of account of the Institution named. Signed, W. D. NICHOLAS, *Treasurer.*

INDEX.