

NINTH ANNUAL REPORT

OF THE

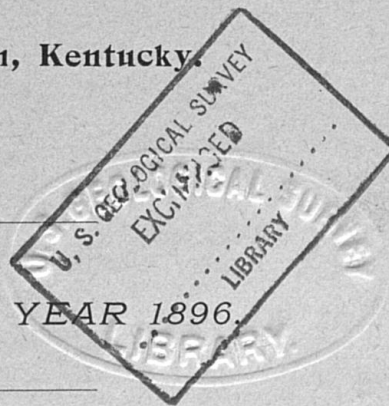
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Kentucky Agricultural
Experiment Station,

OF THE

STATE COLLEGE OF KENTUCKY,

Lexington, Kentucky.

FOR THE YEAR 1896.



1898:
GEO. G. FETTER PRINTING CO.
LOUISVILLE, KY.



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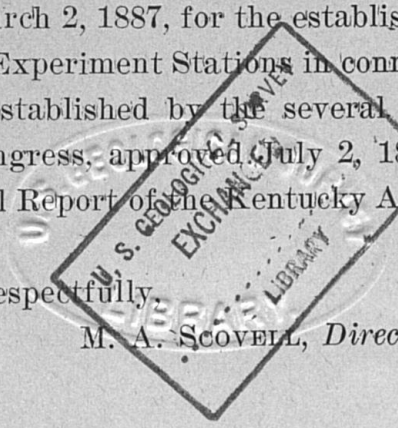
Letter of Transmittal.

To His Excellency, HON. WM. O. BRADLEY,
Governor of Kentucky:

Sir—Under the authority of the Board of Control, and in accordance with an Act of Congress, approved March 2, 1887, and entitled "An Act to establish Agricultural Experiment Stations in connection with the Agricultural Colleges established in the several States, under the provisions of an Act, approved July 2, 1862, and 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 Act of Congress, approved July 2, 1862," I herewith submit the Ninth Annual Report of the Kentucky Agricultural Experiment Station.

Very respectfully,

M. A. SCOVELL, *Director.*



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Agricultural and Mechanical College of Kentucky.

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STATION OFFICERS.

M. A. SCOVELL, Director.
A. M. PETER, } Chemists.
H. E. CURTIS, }
H. GARMAN, Entomologist and Botanist.
C. W. MATHEWS, Horticulturist.
R. J. SPURR, Superintendent of Field Experiments.
J. N. HARPER, Dairyman.
V. E. MUNCY, Weather Observer.
Miss ALICE M. SHELBY, Stenographer.

Address of the Station,

LEXINGTON, KENTUCKY.

The Kentucky Agricultural Experiment Station

IN ACCOUNT WITH THE UNITED STATES APPROPRIATION.

To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1896, as per Act of Congress, approved March 2, 1887\$15,000.00

By salaries	\$ 9,628 75
Labor	2,447 00
Publications	974 35
Postage and stationery	134 50
Freight and express	63 56
Heat, light and water	153 46
Chemical supplies	162 17
Seeds, plants and sundry supplies..	420 51
Feeding stuffs	2 00
Library	368 02
Tools, implements and machinery..	47 53
Furniture and fixtures	246 39
Scientific apparatus	16 75
Traveling expenses	225 76
Contingent expenses	96 00
Building and repairs	13 25

Total\$15,000.00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Kentucky Agricultural Experiment Station for the fiscal year ending June 30, 1896; that we have found the same well kept and classified as above and that the receipts for the year from the Treasurer of the United States are shown to have been \$15,000.00 and the corresponding disbursements \$15,000.00, for all of which

proper vouchers are on file and have been by us examined and found correct.

And we further certify that the expenditures have been solely for the purposes set forth in the Act of Congress, approved March 2, 1887.

Signed:

H. BOSWELL,

J. B. KENNEDY,

Auditors.

{ SEAL. }

Attest:

JAS. G. WHITE, Custodian.

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ANNUAL REPORT

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Kentucky Agricultural Experiment Station

FOR 1896.

Report of the Director.

The work of the Station has been planned along lines marked out in previous years.

THE STAFF.

In February, 1896, Mr. T. S. Hawkins resigned as Farm Foreman and Dr. R. J. Spurr, being elected Superintendent of Field Experiments, assumed most of his duties. With these exceptions no changes have been made in the Station Staff during the year.

EQUIPMENT.

The insectary costing \$1,000, has been completed and is now in use. The dairy house, under construction when the last report was made, has been finished at a cost of nearly \$2,000, and experimental work in the dairy line has been transferred to it.

OUR WORK.

In accordance with the State law, we have charge of inspection of fertilizers, and the chemists of the station have given a large portion of their time to fertilizer analyses and experiments.

Prof. Peter has devoted a considerable part of his time to soil analysis, while all the chemists have given some portion of their time to the study of methods of analysis.

Prof. Garman has continued his grass plot work. These experi-

ments are under observation to study the growth, quality and hardiness of different grasses. Prof. Garman has also undertaken experiments in tobacco; in checking potato scab by treatment of the seed; on apple rot and codling moth; on broom rape and with parasitic fungus in destroying chinch bugs. He has also undertaken the destruction of the weed, woolly mullein, which had gotten somewhat of a foothold in Grayson and Edmonson counties of this State.

The horticultural work, under Prof. Mathews, has been limited to experiments chiefly on small fruits, grapes, strawberries and a few vegetables.

More detailed statements of the work may be found under the reports of the various divisions, which are incorporated in this report.

PUBLICATIONS.

We have published during the year 5 bulletins, as follows:

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|---------|-------------------------------------|
| No. 61. | Potatoes. |
| | 1. Experiments with Fertilizers. |
| | 2. Insects and Fungus Pests. |
| | 3. Tests of Varieties. |
| No. 62. | Strawberries. |
| No. 63. | Tobacco. |
| No. 64. | Analyses of Commercial Fertilizers. |
| No. 65. | Analyses of Commercial Fertilizers. |
| | 1. Official Analyses. |
| | 2. Analyses of other samples. |

The reports from the divisions follow, after which the bulletins published during the year are incorporated.

M. A. SCOVELL, *Director.*

Director, M. A. SCOVELL,

Sir:—The following is a general statement of the work done in the Chemical division during 1896.

Yours truly,

A. M. PETER.

Division of Chemistry.

The chemical work in 1896 already published is that on tobacco contained in Bulletin 63, including the determination of arsenic in sprayed tobacco and the phosphoric acid, nitrogen and potash removed by the crop on the experimental plots, and the analyses of commercial fertilizers in Bulletins 64 and 65. Such other analyses as are of any general interest are here given. As usual, quite a number of examinations of miscellaneous rocks, minerals, potable waters, etc., have been made, which it is thought unnecessary to publish.

SORGHUM CANE.

The following analyses of the juice of sorghum cane were made in continuation of the experiments in the selection of seed. Each stalk was run through the mill separately and the amount of juice measured and the specific gravity taken. If the results seemed to justify it, the juice was farther analyzed by polarisation, both direct and after inversion and by determination of glucose with Fehling's solution. Only the analyses in which all these determinations were made are reported here. The same number of stalks was always taken from each acre. The seed used for planting acre (J) was from a selected head of the crop of 1894 (laboratory No. 2665), the juice of which gave the following determinations:—per cent. glucose 1.57, degree Brix 18.6, per cent. sugar 13.92, coefficient of purity 74.8, cc of juice 295.

Acre (N) was planted with mixed seed

ACRE J. SELECTED SEED.

No. and Date.	C. C. of Juice.	Specific Gravity.	Degree Brix.	Per cent. Glucose.	Per cent. Sugar.	Coefficient of Purity.
3476 Oct. 16 ..	230	1.0875	21.1	1.02	15.07	71.4
3477 " ..	255	1.085	20.4	.92	15.37	75.3
3479 " ..	195	1.087	20.9	.94	15.45	73.9
3497 Oct. 17 ..	165	1.080	19.3	1.54	13.47	69.8
3499 " ..	305	1.075	18.2	2.52	12.26	67.4
3503 " ..	230	1.082	19.7	1.34	14.42	73.2
3504 " ..	175	1.086	20.6	.94	15.19	73.7
3507 " ..	235	1.081	19.5	1.05	14.24	73.0
3527 Oct. 19 ..	190	1.088	21.1	1.58	15.20	72.0
3530 " ..	190	1.086	20.6	1.10	15.33	74.4
3531 " ..	300	1.074	17.9	2.72	11.93	66.6
3532 " ..	175	1.085	20.4	1.32	15.23	74.7
3544 Oct. 20 ..	150	1.082	19.7	1.88	14.07	71.4
3547 " ..	170	1.080	19.2	2.15	13.13	68.4
3548 " ..	170	1.084	20.2	1.25	14.10	69.8
3549 " ..	125	1.083	20.0	1.57	14.25	71.3
3551 " ..	225	1.083	20.0	1.44	14.18	70.9

ACRE N. MIXED SEED.

3490 Oct. 16 ..	375	1.068	16.6	3.13	9.70	58.4
3517 " 17 ..	375	1.069	16.8	1.73	11.06	65.8
3553 " 19 ..	320	1.0765	18.5	2.32	12.47	67.4
3557 " 19 ..	270	1.078	18.8	1.89	12.62	67.1

SUGAR BEETS.

The beets analyzed were sent by H. Cordes, Evansville, Ind., formerly of the Ky. Beet Sugar Co. The sugar in the juice was determined by direct polarisation.

3411.—Knauer imperial, conical shaped root. Beets planted April 30, 1896, harvested July 30th; soil a sandy loam, Henderson county, Kentucky.

3412.—Knauer imperial, forked root; grown and harvested same as the preceding.

3413.—Knauer mangolds, conical root; grown and harvested same as the preceding.

3414.—Knauer mangolds, forked root; grown and harvested same as the preceding.

3424.—Knauer imperial, planted April 29th, harvested August 14th; soil a sandy loam, Henderson county, Kentucky.

3425, 3428 and 3429, same as 3424.

3426.—Knauer mangolds, planted May 5th, harvested August 14th; soil and locality same as the preceding.

3427, 3430 and 3431, same as 3426.

3446.—Mangolds, H. Cordes, September 21st.

3447.—Imperial, same.

3469.—Mangolds, grown in the Green River Valley, sent by H. Cordes, Oct. 21st.

3470.—Same, but planted a month later.

3471.—Imperial, grown same as 3469.

3472.—Imperial, but planted a month later.

ANALYSES OF THE JUICE.

Station No.	Variety of Beet.	Weight of Root, Grams.	Specific Gravity of the Juice.	Degree Brix.	Per cent. Sugar.	Coefficient of Purity.
3411	Knauer Imperial..	238	1.057	14.0	9.50	67.9
3412	Knauer Imperial..	360	1.061	15.0	11.05	73.7
3413	Knauer Mangolds.	793	1.038	9.5	5.45	57.4
3414	Knauer Mangolds.	690	1.047	11.65	7.75	66.5
3424	Knauer Imperial..	...	1.056	13.8	8.35	60.5
3425	Knauer Imperial..	...	1.068	16.6	10.05	60.6
3426	Knauer Mangolds.	...	1.073	17.7	10.90	61.6
3427	Knauer Mangolds.	...	1.059	14.5	8.65	59.7
3428	Knauer Imperial..	...	1.052	12.8	6.30	49.2
3429	Knauer Imperial..	...	1.061	15.0	8.60	57.3
3430	Knauer Mangolds.	...	1.063	15.4	11.35	73.7
3431	Knauer Mangolds.	...	1.074	17.9	9.20	51.4
3446	Knauer Mangolds.	805	1.045	11.2	7.15	63.8
3447	Imperial	701	1.050	12.4	8.15	65.7
3469	Mangolds	...	1.035	8.8	4.33	49.2
3470	Mangolds	...	1.057	14.0	9.22	65.9
3471	Imperial	...	1.051	12.6	8.42	66.8
3472	Imperial	...	1.046	11.4	6.62	58.1

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3437. Butter made at the Station farm in churn test of cow
Girlette, from milkings of September 4th, 5th, 6th and 7th, 1896.

3442. Same test, milk of September 8th, 9th and 10th.

3443. Same test, milk of September 11th, 12th, 13th and 14th.

3449. Same test, milk of September 15th, 16th and 17th.

3450. Same test, milk of September 18th, 19th, 20th and 21st.

ANALYSES.

Number	3437	3442	3443	3449	3450
Fat	84.15	79.82	81.33	83.65	84.54
Water	13.73	17.81	15.59	12.73	12.08
Salt and Ash	1.42	1.83	2.56	2.91	2.93
Curd	.70	.54	.52	.71	.45
	100	100	100	100	100

3316.—Horse weed (*Ambrosia trifida*) from the College Campus.
Small growth, 2 to 3 ft. high, the weeds having been recently cut.
Collected August 7, 1895, by A. M. Peter.

ANALYSIS.

	Fresh.	Room-dried.	Water-free.
Moisture	82.71	12.45	....
Ether extract	.32	1.64	1.87
Protein	3.50	17.72	20.24
Nitrogen-free extract	7.10	35.94	41.06
Crude fiber	3.25	16.46	18.80
Crude ash	3.12	15.79	18.03
	100.	100.	100.

Albuminoids	2.65	13.44	15.35
Nitrogen	.56	2.835	3.24
Phosphoric acid	.29	1.47	1.68
Potash	.76	3.87	4.42

Horses and cattle are very fond of this weed in its green state
and the analysis indicates that it possesses a high nutritive value.
As the weed often makes a very heavy growth on waste bottom
land, it has been suggested to utilize it for silage or dry fodder, and

no doubt this may often be done with advantage. The very considerable percentages of phosphoric acid and potash are to be noted in this connection as giving additional value.

3566.—Germ feed, a by-product of hominy factories, sent by Mrs. J. W. Sayre, Lexington, Ky., who obtained it in Cincinnati, Ohio.

The material appears to be the germs and "bran" of corn.

	ANALYSIS.	As received, per cent.	Water free, per cent.
Moisture		11.77	....
Protein		12.44	14.10
Ether extract		7.87	8.94
Fiber		3.86	4.38
Nitrogen-free extract		60.91	69.03
Crude ash		3.15	3.57
		100.	100.
Nitrogen		1.99	2.25
Phosphoric acid		1.16	1.26
Potash		.47	.53

TOBACCO.

Partial analyses were made of the tobacco raised in the field experiment with commercial fertilizers in 1895, and published in part in Bulletin 63, which see for yields on the several plots. The analyses are stated here in a different form and more fully than there given. To obtain the samples for analysis, each grade of tobacco from each plot was carefully sampled and these samples combined in quantity proportionate to the yield of each grade, thus producing a composite sample representing the total yield of each plot.

3229.—Plot 1. Fertilized with double superphosphate and nitrate of potash at the rate of 140 and 200 lbs. per acre respectively. Sample as taken from the barn (in case) contained 26.5 per cent. water.

3230.—Plot 2. Fertilized with sulphate of potash at the rate

of 160 lbs. per acre. The sample as taken from the barn contained 26.08 per cent. water.

3231.—Plot 3. No fertilizer. Sample as taken from the barn contained 26.63 per cent. water.

3232.—Plot 4. Fertilized with double carbonate of potash and magnesia at the rate of 480 lbs. per acre. The sample as taken from the barn contained 27.36 per cent. of water.

3233.—Plot 5. Fertilized with nitrate of potash at the rate of 200 lbs. per acre. The sample as taken from the barn contained 27.10 per cent. of water.

PER CENT. OF THE AIR-DRIED SAMPLES.

Station number	3229	3230	3231	3232	3233
Moisture	5.65	5.11	5.82	6.75	6.42
Nitrogen	3.375	2.89	3.96	2.89	2.88
Phosphoric acid	.88	.95	.71	.84	.81
Potash	1.03	1.02	.58	1.39	.91
Crude ash	21.63	23.73	25.40	20.33	24.49

PER CENT. OF THE WATER-FREE TOBACCO.

Station number	3229	3230	3231	3232	3233
Nitrogen	3.58	3.04	4.20	3.10	3.08
Phosphoric acid	.93	1.00	.75	.90	.87
Potash	1.09	1.07	.61	1.49	.97
Crude ash	22.92	25.01	26.97	21.80	26.17

ANALYSES OF THE ASH.

Station number	3229	3230	3231	3232	3233
Phosphoric acid	4.05	4.02	2.80	4.15	3.30
Potash	4.75	4.31	2.30	6.82	3.71
Soda	.38	.38	.40	.54	.46
Chlorine	.05	.02	.05	.15	.09
Carbon dioxide	21.32	18.06	16.53	17.72	17.71
Silica and sand	20.82	28.48	37.48	37.67	16.13

There was a very considerable proportion of soil in all these ashes. These ashes are remarkable for their small percentage of potash.

TOBACCO STALKS.

The stalks of the tobacco from the fertilizer experiment just referred to were sampled and the nitrogen, phosphoric acid and potash determined. Two other samples of stalks were analyzed in the same way for comparison.

3318.—Tobacco stalks from plot 1, sample lost by air-drying 7.57 per cent. moisture.

3319.—From plot 2, sample lost by air-drying 6.56 per cent.

3320.—From plot 3, sample lost by air-drying 7.04 per cent.

3221.—From plot 4, sample lost by air-drying 8.14 per cent.

3222.—From plot 5, sample lost by air-drying 7.14 per cent.

3223.—From a pile in the barn at the Dr. Peter farm, Fayette county, crop of 1895. Lost 11.87 per cent. on air-drying.

3224.—From the same crop, but picked up from the ground outside the barn where they had been exposed to the weather for a month or two. Lost 11.87 per cent. on air-drying.

PER CENT. OF THE AIR-DRIED STALKS.

Number	3318	3319	3320	3321	3322	3323	3324
Nitrogen	2.64	2.66	2.85	2.02	2.50	3.48	1.89
Phosphoric acid,	.62	.62	.56	.65	.62	1.04	.78
Potash	1.57	1.44	.68	1.63	1.74	4.14	.71

3567.—Bye-product from the manufacture of tobacco extract, sent by Fried. Glöystein, Henderson, Ky., to determine its value as a fertilizer. This material is filtered out of the watery solution of tobacco before evaporation. It is a chocolate-like, soft, dry material, having a strong smell of tobacco. On burning, a brown residue resembling soil remained.

ANALYSIS.

	Per cent.
Moisture	15.22
Volatile and combustible matters	51.53
Ash	33.25
	100.

Per cent.

Nitrogen	2.16
Potash	2.02
Phosphoric acid	2.79

The analysis shows that the material has some value as a fertilizer.

3341.—Saltpeter, sent by Paul Lansing, Versailles, Ky., who obtained it from Fried. Gloystein, Henderson, Ky. This is the same by-product from the manufacture of tobacco stems reported upon in the Eighth Annual Report of this Station, page xx., but the crystals were larger than in previous samples analyzed. The material was quite dry when received.

ANALYSIS.

Per cent.

Moisture	1.32
Potash	42.36
Nitrogen	12.53

3343.—Double carbonate of potash and magnesia. A sample lot donated by the German Kali Works for experimental purposes. Analysis by the official method gave 20.10 per cent. water-soluble potash.

3457.—Wheat bran, to determine its value as a fertilizer. The sample was found to contain:

Per cent.

Nitrogen	2.87
Phosphoric acid	2.56
Potash	1.17

Used in connection with 10 or 15 lbs. of sulphate or muriate of potash to every 100 lbs. of bran it would be an excellent fertilizer.

MINERAL WATERS.

3389.—Sulphur water from the new sulphur spring at Rock Castle Springs, Pulaski county, Ky., sent by R. D. Norwood, Lexington, Ky. The water was found to contain:

Free sulphureted hydrogen gas .0038 grams per liter, equivalent to 0.22 grains per gallon.

Carbonates of iron, lime and magnesia in notable quantity.

Sulphates and chlorides, traces.

Iodides and lithium and potassium compounds, traces.

Total solid matters .429 grams per liter, equivalent to 25 grains per gallon.

It is a good, mild sulphur water.

3433.—Chalybeate water, sent for analysis by Jno. Barker, Gatewood, Ky., from the "Barker Mineral Springs," Daviess county, Ky. There was a ferruginous deposit in the bottle and the water was decidedly acid to litmus paper. It tasted of epsom salts. The water was found to contain 5.949 grams total solid matters per liter, equivalent to 346.9 grains per gallon. A qualitative analysis showed the presence of the following:

Sulphates of iron, manganese and aluminum in notable quantity.

Sulphates of lime and magnesia much.

Chloride of sodium in small quantity.

Sulphates or chlorides of potassium and lithium, traces.

Bromides, traces.

Organic matters in notable quantity.

3434.—Sulphur water sent by Calvin Whitt, Crab Orchard, Ky., from a well recently sunk by him. The water when received, contained much deposited sulphur but did not smell strongly of hydrogen sulphide and was colorless. Upon evaporation the water left 2.652 grams of saline matters per liter, equivalent to 150.6 grains per gallon. A qualitative analysis showed the presence of:

Carbonates of lime and magnesia in considerable proportion.

Chloride of sodium in large proportion.

Iodides, bromides, borates and lithium compounds, marked traces.

Sulphates of magnesium, sodium and potassium in small proportion.

It is a very good alkaline saline sulphur water. The presence of carbonate of soda in very considerable proportion is noteworthy.

3444.—Chalybeate water sent by Jno. A. Goodman, Elkton, Ky., from a spring in the northern part of Todd county. The water

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was found to contain .0382 grams solid matter per liter, equivalent to 2.2 grains per gallon. The amount of iron in the residue was determined and was found to correspond to .0253 grams carbonate of iron per liter, equivalent to 1.5 grains per gallon. Qualitative tests showed the presence of the following constituents in the water:

Free carbonic acid gas in small quantity.

Carbonate of iron.

Carbonates of lime and magnesia, traces.

Sulphates of manganese, lime, magnesia, potash and soda in small quantity.

Borates and lithium compounds, traces.

Organic matters, traces.

The analysis indicates that it is a very good mild chalybeate water which should possess valuable tonic properties. The presence of manganese as well as iron is to be regarded as advantageous.

3445.—Sulphur water sent W. J. Withers, Hopkinsville, Ky., from a recently bored well. Mr. Withers states that the water "has proven to be of considerable benefit to several persons suffering with kidney or bladder trouble." The water was found to contain 3.119 grams solid matters per liter, equivalent to 181.8 grains per gallon. Qualitative tests indicated the presence of the following:

Carbonates of lime and magnesia in small proportion.

Chloride of sodium in large proportion.

Sulphide of sodium in very considerable proportion.

Sulphate of magnesium in considerable proportion.

Iodides and bromides very marked.

Potassium, lithium and strontium compounds and borates, traces.

It is quite a strong sulphur water, the sulphur being mainly in the form of sulphides. A determination gave .1952 grams sulphur in this form per liter.

3564.—Sulphur water from a bored well situated one-fourth mile west of the city limits of Hopkinsville. This is the same

water as 3445, which was sent in September, while the present sample was received November 24th. Mr. Withers says "the water is still showing wonderful curative properties for stomach and kidney or bladder troubles." The water when received was colorless, though slightly turbid, and became yellow on standing. It smelled only slightly of sulphuretted hydrogen gas.

ANALYSIS.		
	Grams per liter.	Grains per gallons.
Carbonate of iron	.0007	.04
Carbonate of lime	.1604	9.36
Sulphate of strontium	.0288	1.69
Sulphate of magnesia	.4470	26.06
Sulphate of soda	.1403	8.17
Sulphate of potash	.0208	1.21
Sulphide of sodium	.3167	18.46
Chloride of sodium	1.8934	110.39
Chloride of lithium	.0034	.20
Bromide of sodium	.0023	.13
Iodide of sodium	.0012	.07
Borates and carbonates of soda	Marked traces.	
Silica	.0110	.64
Total solid matters	3.0260	176.42
Free sulphuretted hydrogen gas	.0634	3.70

The sediment in the jug was found to contain both iron and zinc sulphides. Calculating upon the amount of water in the jug the quantity of each was as follows:

Sulphide of iron .0023 per liter, equivalent to .13 grains per gallon.

Sulphide of zinc .0096 per liter, equivalent to .56 grains per gallon.

Whether these sulphides were originally in solution in the water or were only in suspension, possibly as borings, could not be determined.

3565.—Calcareous sandstone, probably the "siliceous mud-

stone" of the old Ky. Geol. Survey reports, from the McCarthy place in Fayette county, about 5 miles from Lexington on the Downing and Wilson lane, near the Tates creek pike, collected by A. M. Miller, November, 1896.

A compact, fine-grained, buff-colored rock with patches of a bluish color and showing some fossils. It has the appearance of limestone, except where much weathered. The specimen analyzed was not weathered or very slightly so. It is thought that the weathering down of this formation may have produced some of the less fertile soils of parts of the blue grass region, similar to that of the Experiment Station Farm.

ANALYSIS.*

Per cent.

Peroxide of iron and alumina	4.29
Lime	15.18
Magnesia	.83
Potash	.33
Phosphoric acid	.42
Silica and insoluble silicates	65.80
Ignition	13.62
	100.47

ALFRED M. PETER.

*By W. H. Scherffius and A. M. Peter.

Director, M. A. SCOVELL,

Sir: The following is a general statement of the work done in the Entomological and Botanical Division during 1896.

Very truly yours,

H. GARMAN.

Division of Entomology and Botany.

Complaints of insect depredations in Kentucky were more frequent than usual during the summer of 1896. With the opening of spring applications began to be received for the parasite fungus used to destroy chinch bugs and continued to be received in small numbers during the remainder of the season. Fifty applications were received in all, from thirteen different counties. The insect was most troublesome in the counties in the vicinity of Cincinnati and in the western end of the State. The following is a list of the counties from which applications came, with the number of persons applying from each:

Kenton 11; Marshall 9; Pendleton 7; Gallatin 6; Mason 5; Boone 2; Marion 2; Mercer 2; Ballard 1; Calloway 1; Grant 1; Lyon 1; Shelby 1. The remaining applications came from Indiana. After the appearance of the insects favorable rains scattered and destroyed them so that much less damage was done than farmers expected, and a good many of those who sent for the fungus did not use it. Of those who did use the fungus, a small majority report success in clearing their fields of bugs by means of it. Quite a number who received packages did not report, although several letters have been sent to each one of them requesting that they state the results of their tests. The following are the names of those who received packages, given in the order in which their applications were received:

1. W. W. McCain, Sharp, Marshall Co.
2. David Morrison, Sharp, Marshall Co.
3. W. G. Miller, Sharp, Marshall Co.
4. J. R. Hutchinson, Nevins, Mercer Co.

5. J. H. Morris, Morgan, Pendleton Co.
6. J. B. Winston, Kenton, Kenton Co.
7. C. D. Holt, Murray, Calloway Co.
8. J. D. Clark, Lovelaceville, Ballard Co.
9. M. M. Johnston, Sharp, Marshall Co.
10. James Howard, Sharp, Marshall Co.
11. R. H. Rudolph, Sharp, Marshall Co.
12. J. B. Watson, Sharp, Marshall Co.
13. Felix Arant, Sharp, Marshall Co.
14. J. H. Miller, Sharp, Marshall Co.
15. J. H. Morris, (for neighbor) Morgan, Pendleton Co.
16. W. T. Williams, Harrodsburg, Mercer Co.
17. Geo. P. Morris, Morgan, Pendleton Co.
18. J. A. Ewing, Morgan, Pendleton Co.
19. Dr. T. C. Nichols, Morgan, Pendleton Co.
20. W. Matthews, Mayslick, Mason Co.
21. J. P. Moore, Morgan, Pendleton Co.
22. F. M. Landram, Napoleon, Gallatin Co.
23. J. B. Park, Napoleon, Gallatin Co.
24. W. E. Snodgrass, Falmouth, Pendleton Co.
25. Jno. B. Holton, Washington, Mason Co.
26. Kirby Richardson, Visalia, Kenton Co.
27. Edwin Brown, Crittenden, Grant Co.
28. J. W. Gibson, Napoleon, Gallatin Co.
29. E. Hogan, Jr., Napoleon, Gallatin Co.
30. J. B. Coleman, Pruett, Kenton Co.
31. T. C. Adams, Visalia, Kenton Co.
32. Mrs. M. A. Richardson, Visalia, Kenton Co.
33. Geo. W. Hill, Covington, Kenton Co.
34. James B. Key, Washington, Mason Co.
35. Essex Spurrier, Star Lime Works, Lyon Co.
36. G. A. Ballinger, Staffordsburg, Kenton Co.
37. J. M. Mills, Kenton, Kenton Co.
38. R. Pruett, Pruett, Kenton Co.
39. Edward Mattingly, St. Marys, Marion Co.
40. H. T. W. Hill, Sardis, Mason Co.
41. J. C. Hamilton, Sparta, Gallatin Co.

42. Thomas R. James, Maysville, Mason Co.
43. M. R. Tanner, Gunpowder, Boone Co.
44. L. Ericson, Shelbyville, Shelby Co.
45. H. E. Landes, Lebanon, Marion Co.
46. Henry B. Ruttle, Visalia, Kenton Co.
47. J. H. Stephens, Utzinger, Boone Co.
48. G. W. Clark, Madison, Indiana.
49. J. McKay, Ludlow, Kenton Co.
50. M. Sleet, Warsaw, Gallatin Co.

Each applicant received a small tin box containing a quantity of the fungus that had been grown at the station on corn meal charged with meat infusion. It was found easy to grow the fungus in this way in large quantities, and no attempt was made to send out infected bugs. With each package was sent printed directions for the use of the fungus. These directions require of the user the making of a box in which to keep living chinch bugs until they become infected, when they are to be set free to carry the contagion to bugs in the fields. There are some objections to the procedure, notably the slowness with which bugs become affected with the disease when the quantity of fungus used is as small as that sent out by us. While waiting for it to catch the bugs may do a great deal of mischief, and the farmer become discouraged. Moreover, the cultivation of the fungus in this way requires care and watchfulness, which in the press of other work farmers are not always disposed to give to the subject. I am sure that some of the failures to report to us are the outcome of the indisposition to expend the necessary time on the part of people who applied for the fungus, expecting it to be very easily set at work.

I am disposed to believe that this defect of the method may be overcome to a considerable extent by sending out larger packages of the fungus. With some additional expense it would be easily possible to send each applicant a pint or quart jar filled with the fungus, unless the applications become much more numerous than they have been, in which case provision must be made at the station for special assistance to manage the cultures.

There can be no question about the effectiveness of this fungus

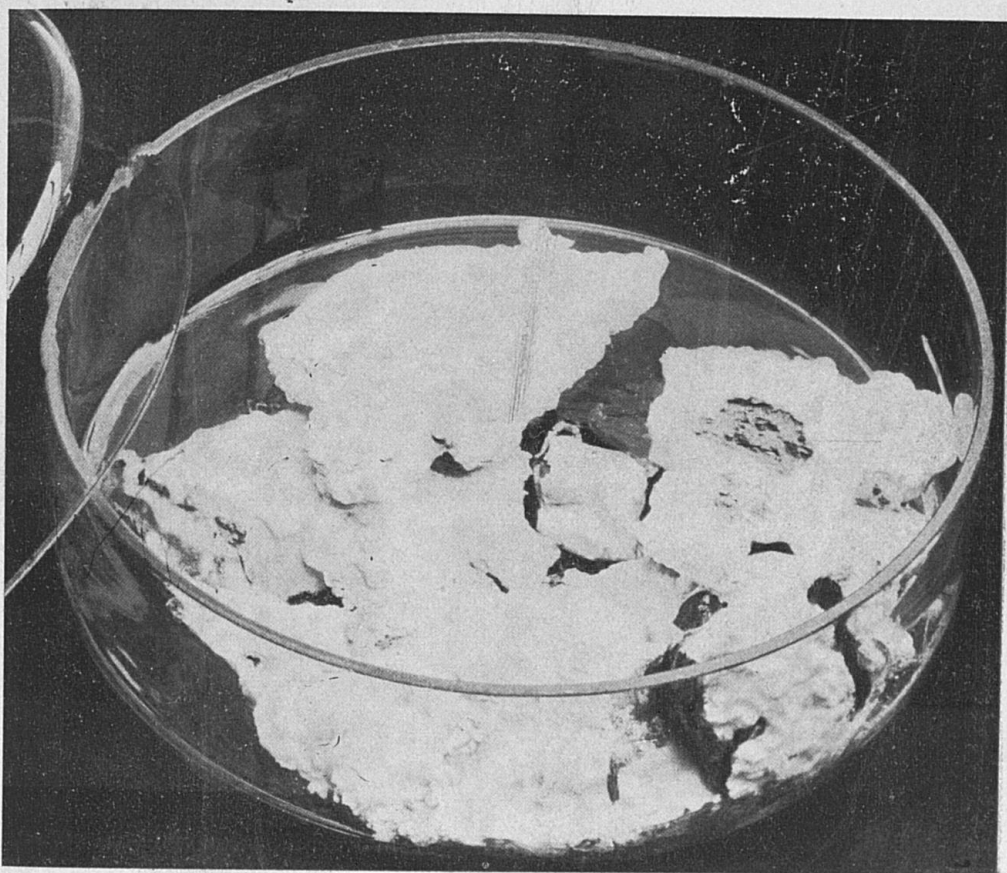


FIG. 1. A culture of the chinch bug fungus in corn meal. Reduced to less than one-half natural size.



seen

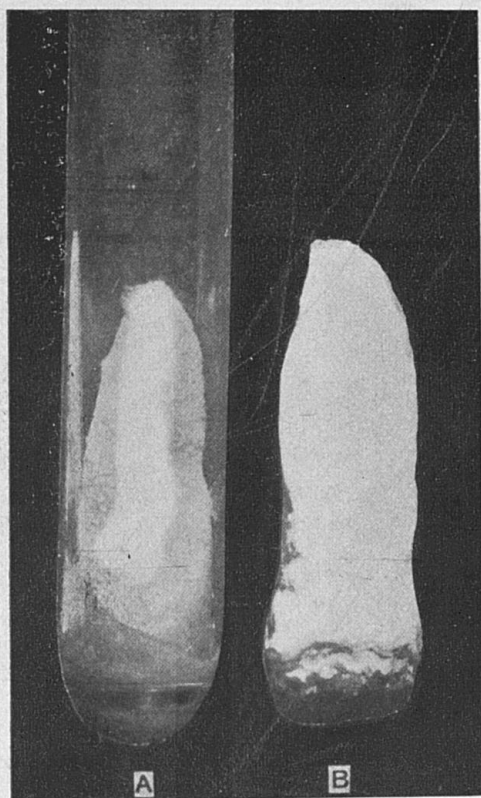
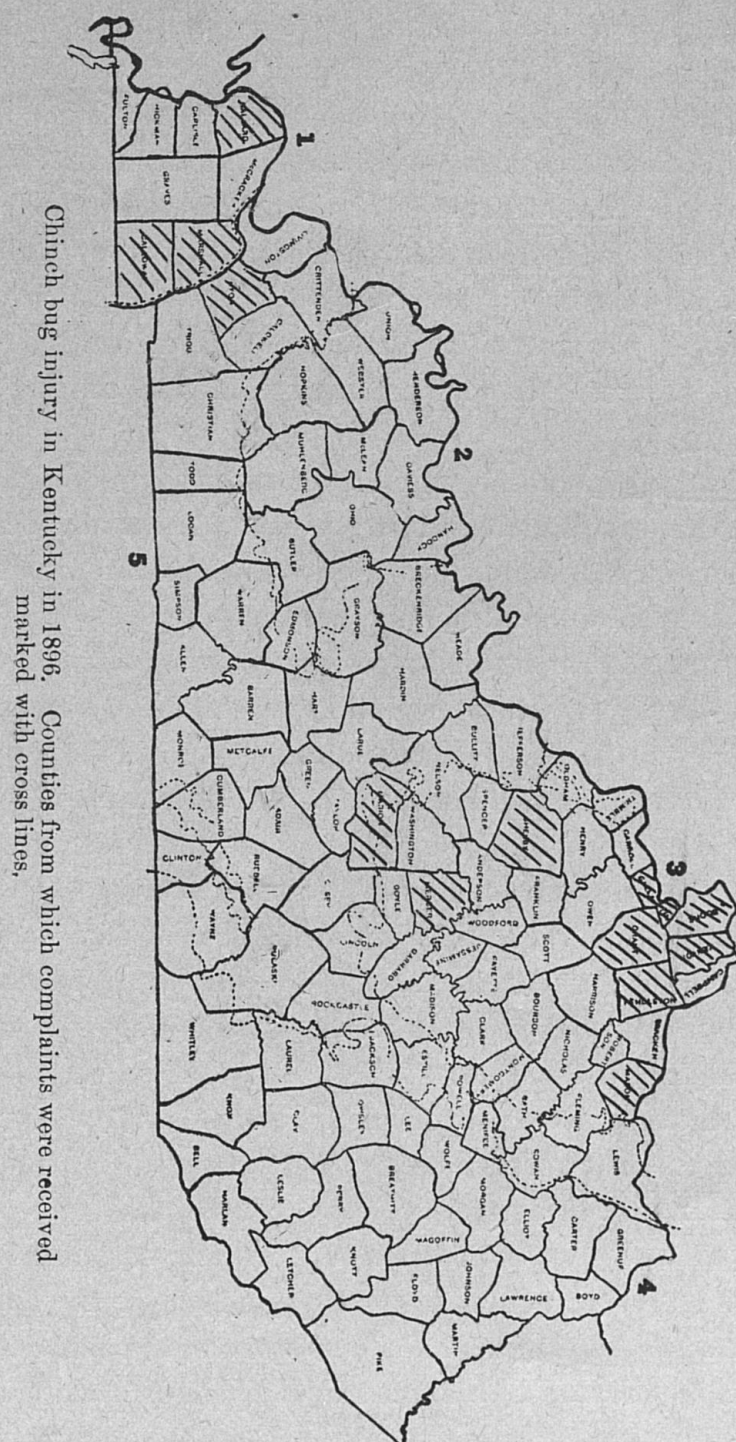


FIG. 2. Growth of chinch bug fungus in test tube on sterilized potato. A, as seen in tube; B, culture removed from tube.





as a destroyer of insects, when the conditions are right. Tests of our cultures at the station showed the *Sporotrichum* employed by us to be very active in the vivarium, not only on chinch bugs, but on other insects as well. It did not fail in a single instance to destroy the harlequin cabbage bug, and sometimes attacked our experimental lots of confined tobacco worms spontaneously. This is not of course saying that it would be equally active out of doors. That would depend very much on the weather. But I do not consider the outlook along this line of work as at all discouraging, and have hopes that improvement in methods of growing and applying these fungi may yet lead to important results in combating injurious insects.

The army worm, another notable enemy of farm crops, appeared locally in immense numbers last spring and was the occasion of some anxiety on the part of farmers. Its injuries were not confined to this State but were rather more serious in New England and elsewhere north. The means employed by farmers for checking the marching worms were those which have long been known as most effective for the purpose, namely ditching and destroying the accumulated insects by the use of coal oil. Such work may be made to confine the worms largely to the fields in which they gather head, but the infested fields often suffer severely, when the crop is not utterly destroyed. It is evident that spraying herbage with poisons, to be effective in heading off the armies of worms must be practiced quickly as soon as the worms show a disposition to march. Delay in dealing with this pest is certain to lead to loss, and farmers will do well to examine their meadows, and especially any neglected grass land on their places, during the coming spring for evidence of the presence of army worms.

Some time was spent last summer in Grayson and Edmonson counties engaged in efforts to destroy and check the spread of a newly introduced mullein. The plant is somewhat like our common mullein in appearance but is more aggressive as a weed and likely to be troublesome on farms should it become widely scattered in the United States. So far as we know it does not at present occur anywhere else in this country. As explaining the nature of this weed and its history the following is quoted from a letter dated

FIG. 3.
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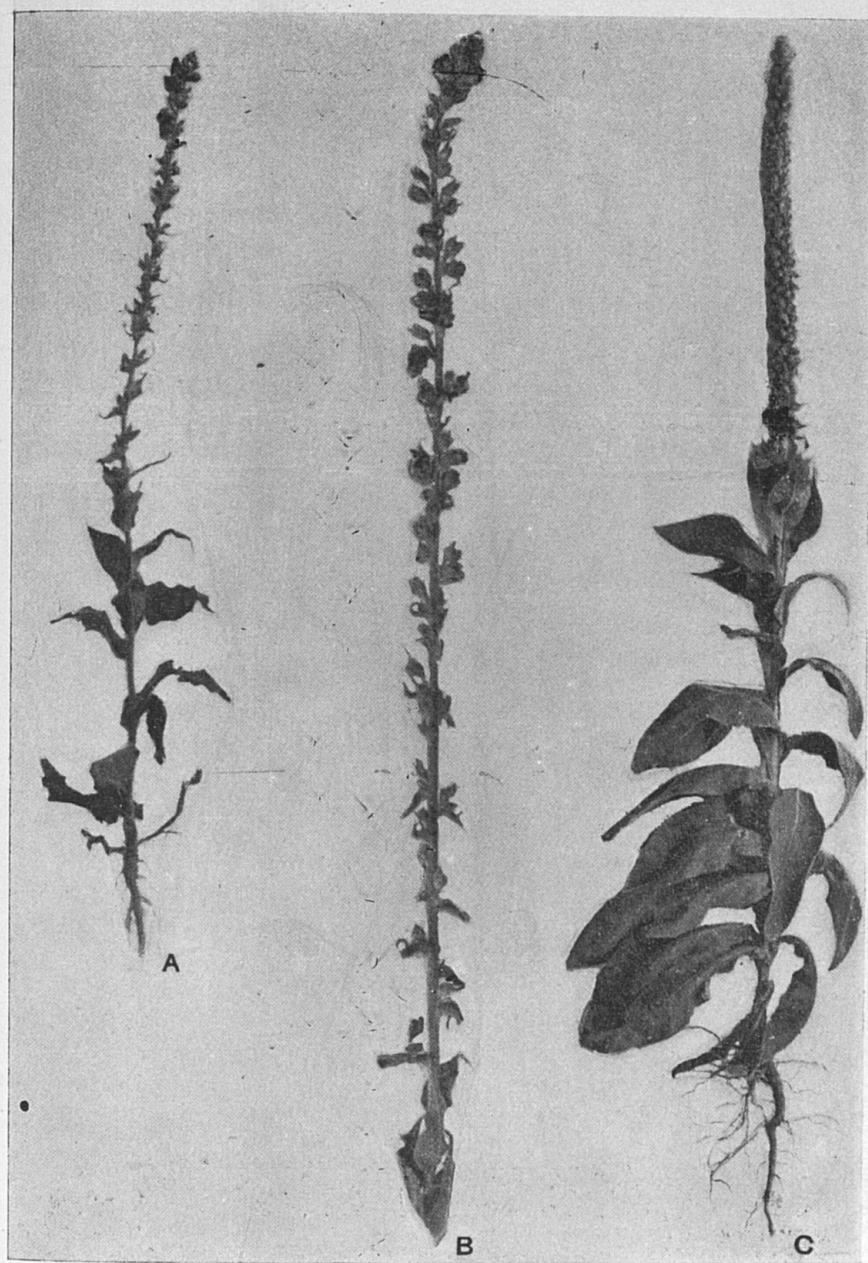
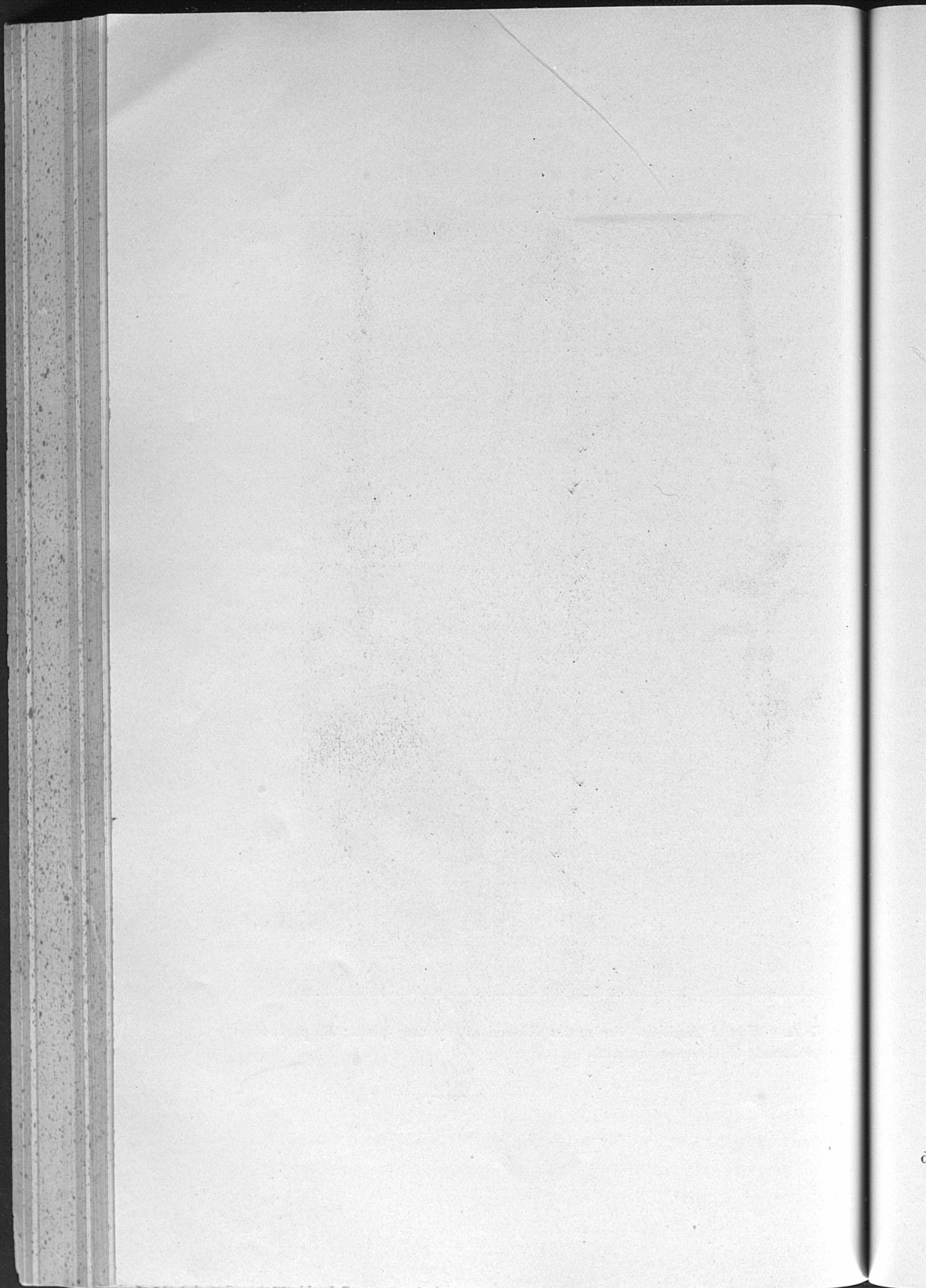


FIG. 3. A. Woolly Mullein (*Verbascum phlomoides*) young plant; B, part of
 same, less reduced; C, common mullein.



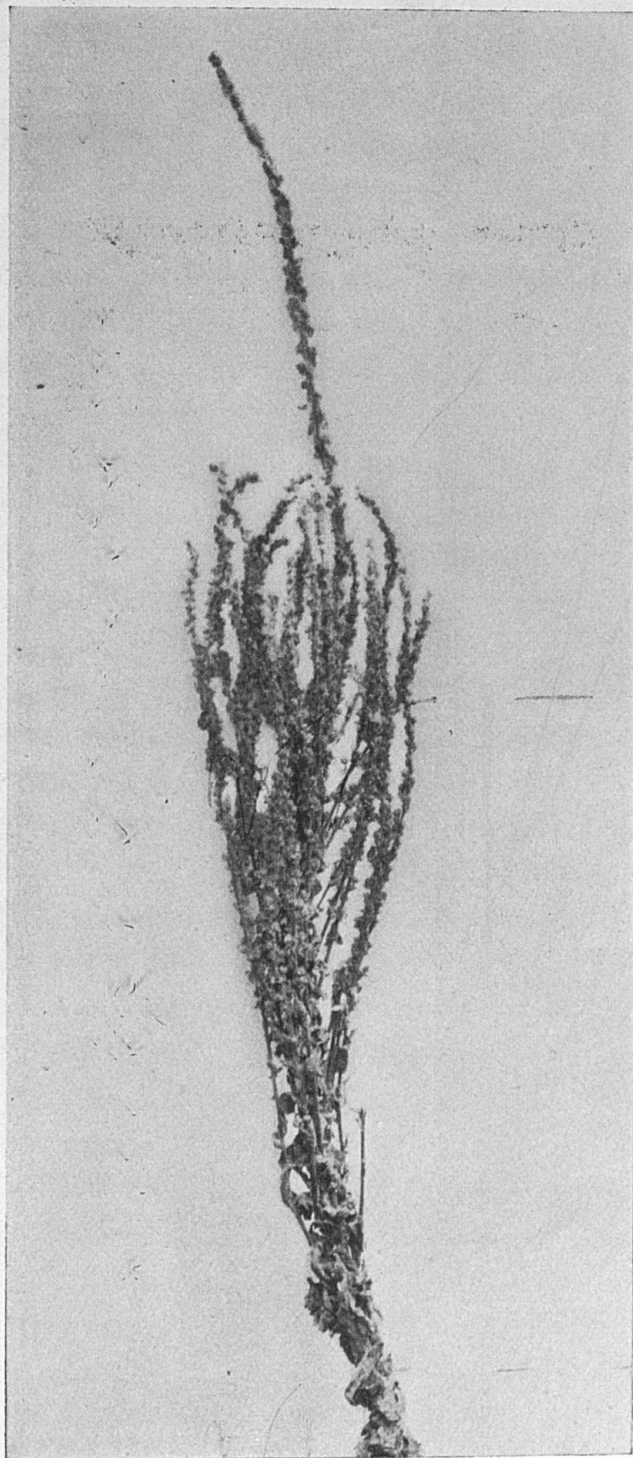


FIG. 4. Woolly Mullein; showing branched character of the grown plant. Reduced.

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February 21, 1896, from Dr. Chas. W. Dabney, Jr., Assistant Secretary of Agriculture, urging the station to undertake its extermination.

"About eight years ago a specimen of the woolly mullein was received at this department from Mr. C. F. Very, of New Albany, Indiana. He had collected the plant near Dickey's Mills, Edmonson county, Kentucky, and reported as recently introduced at that place. The plant was determined as woolly mullein, *Verbascum phlomoides*, a native of Europe where it grows as a weed in waste places and fields much like our common mullein, *Verbascum thapsus*. Subsequent reports received from Mr. Very indicated that the plant was increasing and developing a weed-like character in Kentucky. In 1895 Mr. J. N. Rose, Assistant Botanist in this department, was detailed to investigate in regard to its present distribution and the possibilities of its complete eradication before it should become scattered.

"The report made by Mr. Rose indicates that the woolly mullein is now found growing along the roads to the distance of about one-half mile north and three-fourths of a mile west of the store at Dickey's Mills, Edmonson county, and about one-fourth of a mile along the road on the south side of Nolin river in Grayson county. There is also a patch of about three or four acres in extent pretty thickly seeded with the mullein, on the opposite side of the road from the store. So far as known at this department this constitutes the only introduction of this species in America except in botanic gardens where its seeds will be taken care of so as to prevent spreading. A single specimen collected by Mr. Rose is estimated to bear 337,000 seeds. This species is evidently quite as well adapted for rapid dissemination as the common mullein. It is therefore of the utmost importance to the farmers of Kentucky and also to those of other States that prompt and effective steps be taken to completely eradicate the plant while this remains possible. The history of this weed compared with that of other known introduced species indicates that, unless its progress is checked within the next two seasons, it is almost certain to spread to such an extent that eradication will be practically impossible.

"The woolly mullein is a biennial, beginning to blossom about

the first of July, and producing the first mature seeds about twenty days later. The best method of eradication is to cut off the roots below the crown during the first week in July. Some of the seedlings would probably escape notice, and some of the seed now in the ground might not germinate until next year, therefore the place should be watched carefully for two or three years and all the plants found should be exterminated."

Acting on this suggestion the matter was brought to the attention of the Board of Trustees, and with their approval I visited the region in the latter part of June (25-29), to make a preliminary examination of the ground and determine if the project was feasible with the time and expenditure which the Station could bestow on the matter. It was found that the plants could be readily destroyed on the land mapped by Dr. Rose, and I employed men at once and had this done, but fearing that plants might occur in places unknown to us, the following circular letter was prepared and addressed to all the farmers on our mailing list who reside in the two counties named, and in those adjoining. The same circular was published in most of the newspapers of that part of the State, and in others in Louisville and elsewhere.

A NOXIOUS WEED IN GRAYSON AND EDMONSON COUNTIES.

TO FARMERS.

KENTUCKY AGRICULTURAL EXPERIMENT STATION
OF THE STATE COLLEGE OF KENTUCKY,
Divison of Entomology and Botany,
Lexington, July 1, 1896.

A weed known as the woolly mullein (*Verbascum phlomoides*) has by some means been brought to Grayson and Edmonson counties, where it has become established at Dickey's Mills and southward on both sides of Nolin river. The plant is a pest in foreign countries, and should it become widely scattered is likely to become troublesome on farms in the United States. The region immediately about Dickey's Mill has recently been cleared of the weed, but there may be other places unknown to us where it has

obtained a foothold, and farmers and others interested are requested to aid us by pulling up such scattered plants as they may find along roads and about fields, and by reporting to this Station at the earliest possible moment the discovery of its occurrence in any considerable numbers.

The weed looks somewhat like the common mullein, but differs in bearing larger flowers, of a brighter yellow color, scattered along the stem, instead of being closely crowded. The stem of the new weed is round, and does not have the ridges (extensions of the leaves) which are so noticeable in common mullein. It grows to a height of six feet or more in rich soil, and shows a tendency to branch; but young plants are generally without branches, and large ones may have none, hence the presence of branches can not be trusted entirely as a means of distinguishing the new plant from the old, and especially so since the common mullein branches under some circumstances.

The scattered flowers and round stem are a constant feature of the new weed.

So far as known, the woolly mullein is now restricted in the United States to the region along Nolin River. If it once gets outside this region it will be difficult, perhaps impossible, to keep it from becoming scattered everywhere in this country. It is highly important therefore that it be destroyed at once. The farmers of Grayson and Edmonson counties owe it to themselves and to farmers elsewhere to prevent its further spread.

M. A. SCOVELL,

Director of the Kentucky Station.

H. GARMAN,

Entomologist and Botanist of the
Kentucky Station.

In removing these plants it was observed that many of them grew close along Nolin river, where the ground is flooded in winter and spring, and I was led to suspect that the seeds might have been carried in the water to points below Dickey's Mills. I engaged one of the men who had helped in the work to go down the river to its junction with Green river examining both banks to see if any of the weed had been thus sown. He reported that there was a large number some three miles down stream, in a direct course, probably as many as we had already destroyed, but that he found no others farther down the stream. On my second trip to Dickey's

Mills in July we went over this ground and cleared it of plants and I went down to Brownsville examining the banks of Green river in that neighborhood, then went up to the mouth of Nolin river and thence back to Dickey's Mills. I found no plants of the woolly mullein at any point examined.

We found no difficulty in destroying the flowering plants either by cutting them off with a hoe just below the surface of the ground, or by pulling them up with the hands. Where the soil was moist the latter practice proved most simple and effective, but when dry it required the united strength of two or even three men to uproot some of the large plants in this way. No special attention was paid to young plants of the year, though a great many were destroyed. It was not thought best to follow them up closely then, because they could not readily be distinguished from seedlings of the common mullein, which were in some places thickly interspersed among them, and they were besides exceedingly hard to find among the miscellaneous herbage that covers much of the ground.

I followed the men over much of the infested land, and can say that very few flowering plants escaped. And while the eradication was as thorough-going as it seemed practicable to make it, it is too much to hope that not a single plant developed seeds in the vicinity. I had occasion to go over much of the ground repeatedly in passing back and forth, and sometimes encountered small plants hidden away among other herbage where we supposed every mullein had been destroyed. Some of these finds had developed their spikes of flowers after we began work, and had been missed because of their small size when the men had been there. Still, considering the ease with which they can be destroyed and the seeming slowness with which they are dispersed, I believe that another season's work will practically eradicate the weed, unless it should prove to have been carried down Green and Ohio rivers. No doubt thousands of its seeds have been thus carried in the waters of Nolin river and the plants we found some six miles, by river, below Dickey's Mills had every appearance of having been sown in this way. But from my examination of Nolin and Green rivers I am disposed to think the seeds do not retain their viability persistently in water, and

that the weed does not at present occur outside of Grayson and Edmonson counties.

When I left Dickey's Mills in the middle of July I requested two of the men who had been with me to watch the infested locality during the remainder of the season and to learn if possible of other localities in which it occurred. Some time later I received from one of these men a couple of plants by express which he said grew twenty-five or thirty miles northeast of Dickey's Mills. The seeds had already matured, hence another trip to the region to destroy the plants seemed useless and I have been unable since by correspondence to learn the exact location of this new patch. I hope to make a trip to Grayson county this spring when I will locate it definitely, if possible.

At the Station, work has been continued on tobacco insects both in the vivarium and in the field, and some of the results have been ready for some time for publication. Material is also ready for publication on experiments made during 1896, in checking potato scab with bichloride of mercury and with sulphur. A good deal of space in the vivarium has been given up to experiments on broom-rape of hemp and tobacco, and a report is in progress on this pest covering work done with it for several years past. It proves not to be restricted in its attacks to the plants hitherto recorded as its host-plants. Cabbage, rape, and the common weed known as shepherd's purse (*Capsella bursa-pastoris*) were found last summer to be attacked. On the other hand it has refused to establish itself thus far on watermelon, clover, wheat, and somewhat to my surprise, potato. It is important to know what it will not attack, since its seeds retain their vitality in soil with wonderful persistence. Seeds which were collected in 1891, and have been kept ever since in a bottle in a dry, and often very warm room, were tested in the vivarium and found to produce plants. The seeds kept in earth in flower pots since 1889, germinated and produced plants on hemp last summer as usual, showing that broom-rape seeds may retain their vitality after lying six years in the soil.

The grass plots have been kept under close observation during the year, and notes collected for future use with reference to the

quality, yield, hardiness, rate of growth, etc., of the different species; and material of both cultivated and native forage plants has been collected and turned over to the Chemical Division of the Station for analysis.

The experiments on apple trees were continued, as far as was possible with an almost total failure of the crop, and notes are on hand for a statement of results in a future bulletin.

In the fall of the year, at the request of the Division of Forestry U. S. Department of Agriculture, we collected and sent to Washington, the seeds of a number of forest trees to be used in a co-operative experiment, by the Stations, testing the rate of growth, quality etc., of trees of the same species, but grown from seeds collected in different parts of the United States. We received subsequently packages of seeds for planting here, and they have been planted under Dr. Spurr's direction on the Experiment Farm.

In concluding I wish to call your attention to the fact that Kentucky is in need of a law that will operate to keep such pests as San Jose Scale from being brought here and disseminated. Experience has shown that the scale above mentioned is capable of completely destroying fruit trees, and its introduction would prove a serious blow to our nurseries and fruit growers. The question of State legislation has recently been brought to the attention of our State Horticultural Society by one of our most prominent and intelligent nurserymen, and a resolution was adopted recommending the consideration of the matter by the General Assembly at its called session. A bill will probably be presented calling for the inspection of nursery stock, and I wish to bespeak your support and that of the President of the College and the Board of Trustees for any bill which the Society may present. The matter is one of vital importance to the fruit interests of Kentucky.

Respectfully submitted,

(Signed.) H. GARMAN,
Entomologist and Botanist.

AN EXPERIMENT WITH APPLE ROT MADE IN 1896.

By H. Garman, Entomologist and Botanist.

In earlier work on apple rot it has been my practice to spray the trees early in the season, sometimes before the leaves are out

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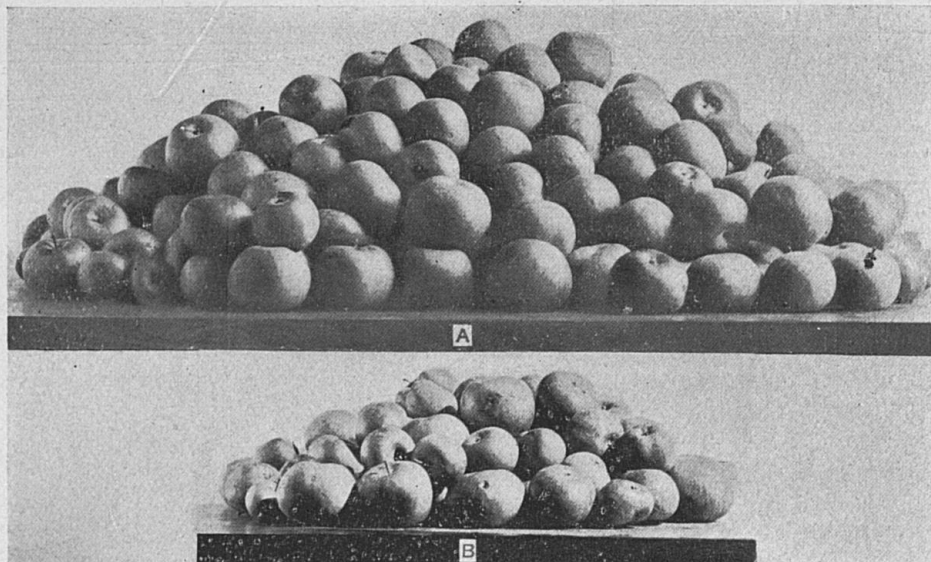
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A, Sound apples picked from sprayed tree; weight 62 lbs., 4 oz.
 B, Sound apples picked from check tree; weight 8 lbs , 6 oz.

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and to suspend the work for some time previous to harvesting the crop. The object of this practice was, as has been explained, to destroy the rot fungi in whatever stage they might occur on the twigs and leaves, and thus to get the tree in a clean condition before the young fruit began to be attacked. The general results were favorable to the treatment practiced, the sprayed trees yielding in most cases more and better apples than those not so treated.

This experiment was undertaken more especially to decide if the results would not be equally good when the spraying was done in the latter part of the season, instead of in the fore part.

Two Janet trees were selected for the experiment.

One of them was sprayed as follows, the other being untreated and serving for comparison.

June 26.	4½	gallons of Bordeaux mixture*	were applied.	
July 20.	5¼	"	"	"
Aug. 10.	4½	"	"	"
Aug. 18.	4½	"	"	"
Aug. 24.	4½	"	"	"
Aug. 31.	4	"	"	"
Sept. 9.	4½	"	"	"
Sept. 14.	4½	"	"	"

The foliage of the sprayed tree was in much better condition at the last, showing less of the spot disease and the leaves averaging larger.

The apples, too, were visibly better, being larger and more symmetrically developed, besides showing a smaller percentage of rotting ones. The largest apples weighed over 4 ounces, while those of the untreated tree in no case reached a weight of 3 ounces.

The weight of the sound apples from the sprayed tree, picked September 26th, was 62 lbs., 4 oz., being 59 per cent. by weight of all of those taken from the tree at this time. By number, 58.68 per cent. of the apples taken from the tree at this date were sound.

From the unsprayed tree were taken at the same time 8 lbs., 6 oz., of sound apples, constituting 26.17 per cent. of the total yield.

*6½ lbs. bluestone.

2½ lbs. lime.

32 gallons water.

while from the same tree the percentage of sound apples was by number, 30.37.

The weight of the total yield of sound apples from the treated tree may therefore be said to have been increased to more than seven times what it would have been, if the leaves had not been sprayed.

Director, M. A. SCOVELL,

Dear Sir:—The following is a general statement of the work done in the Horticultural Division during 1896.

Very truly,

C. W. MATHEWS

Division of Horticulture.

The work of the year has been limited to a very few subjects from necessity, as the time of the horticulturist is being required to an increasing extent in teaching the subjects of botany, horticulture, and agriculture in the college.

The early part of the season was extremely dry, so that the earlier crops were a partial failure. The strawberries of which we had a large variety from which fruit was expected, scarcely yielded half a crop, and a number of kinds gave practically no fruit at all.

The behavior of some varieties, however, under these unfavorable conditions was quite interesting, the yield being greater in one or two cases, than in the preceding season, which was in general much better suited to the strawberry crop.

A number of additional varieties of grapes was placed in the experiment vineyard last spring, and many of the vines gave their first crop of fruit during the past summer. Some of these grapes give promise of becoming valuable additions to our list of Kentucky varieties, and their future behavior will be looked forward to with great interest.

It is proposed to extend the vineyard from year to year as it is

believed that this will be one of the most valuable features of the horticultural work.

No report has yet been published upon the results of this experiment with grapes, as it seems wiser to secure the results of at least one more season's fruitage before attempting to pronounce upon their value.

The experiments with potatoes were continued during the past season, and the results of the variety test are now ready for publication in connection with a number of experiments upon the potato crop conducted by other departments of the Station.

The work noted above, together with a number of minor experiments with vegetables in the field and forcing houses, comprises all that was undertaken by this department during the past season.

It seems a proper time to again call attention to the fact that during the present college year the time of the horticulturist has of necessity been given more largely than ever before to the work of instruction, and it has become impossible to give that detailed attention either to the planning or carrying out of horticultural experiments that is essential to success.

The college duties now devolving upon the writer, are fully equal in extent to those of the related departments of instruction, in all of which the time of the instructor is given exclusively to teaching.

I hope therefore that this condition may soon receive the consideration that it calls for, and some arrangement be made whereby it will be possible for both Station and College work to receive their due share of attention.

Respectfully submitted,

(Signed). C. W. MATHEWS.

Division of Meteorology.

M. A. SCOVELL, *Director*.

Dear Sir:—A brief meteorological summary for the year, 1896, is herewith submitted.

Very respectfully,

V. E. MUNCY, *Observer*.

ANNUAL METEOROLOGICAL SUMMARY FOR 1896.—STATION, LEXINGTON, KY.

STATION	FROM SELF-REGISTERING INSTRUMENTS.										No. of Days.		
	MEAN.			High est.	Date.	Low est.	Date.	RANGE.		Mean daily change	Max. below 32°.	Max. above 90°.	Min. below 32°.
	Max.	Min.	Month-ly.					Abso- lute.	Mean daily.				
	°	°	°	°		°		°	°	°			
Jan. . . .	40.7	28.0	34.4	60	31	0	4	60	12.7	6.2	3	0	20
Feb. . . .	42.5	27.9	35.2	68	27	-2	21	70	14.6	7.2	6	0	17
Mar. . .	45.5	29.9	37.7	65	28 29	13	12	52	15.5	7.0	3	0	22
Apr. . .	71.7	51.8	61.8	88	18	28	3	60	19.9	5.2	0	0	4
May . . .	81.2	60.6	70.9	92	11	42	30	50	20.6	3.2	0	3	0
June . .	80.9	63.0	72.0	90	20	53	13	37	17.9	3.0	0	1	0
July . . .	83.4	67.5	75.4	94	30	56	9 17	38	15.9	3.6	0	5	0
Aug. . .	84.8	65.5	75.2	94	22	54	27	40	19.4	2.6	0	8	0
Sept. . .	78.2	56.7	67.4	95	18	36	23	59	21.5	5.5	0	6	0
Oct. . . .	64.2	44.4	54.4	77	29	30	18	47	17.7	5.2	0	0	1
Nov. . . .	55.7	39.6	47.6	72	25	14	30	58	16.1	7.5	2	0	8
Dec. . . .	46.0	30.9	38.4	63	12	13	1	50	15.1	5.1	2	0	16
Sum. . . .	774.8	565.8	670.4	a. Max.	a. Date. Sept. 18	a. Min.	a. Date. Feb. 21	621	206.9	61.3	16	23	88
Mean . .	64.6	47.2	55.9	95		-2		52	17.2	5.1	a.	a.	a.

Jan.
Feb.
Mar.
Apri
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Sum.
Mean

PRESSURE.

(Corrected for temperature and instrumental error only.)

ELEVATION OF BAROMETER CISTERN ABOVE MEAN SEA-LEVEL, ON DEC. 31, 989 FEET.

(All barometer readings have been reduced to above elevation.)

MONTHS.	Monthly.	Highest observed.	Date.	Lowest observed.	Date.	Absolute range.
	In.	In.		In.		In.
Jan.	29.09	29.54	4	28.54	23	1.00
Feb.	28.91	29.43	21	28.21	6	1.22
March	29.00	29.50	14	28.47	11	1.03
April	29.06	29.34	8	28.50	1	.55
May	28.98	29.23	8	28.80	28	.43
June	28.96	29.22	26	28.64	9	.57
July	29.03	29.21	11	28.85	16	.36
Aug.	29.03	29.29	28	28.79	22	.50
Sept.	28.99	29.31	23	28.64	30	.67
Oct.	29.01	29.24	8	28.70	23	.54
Nov.	29.12	29.50	30	28.68	5	.82
Dec.	29.14	29.58	24	28.70	14	.88
Sum.	348.32	a. Highest.	a. Date.	a. Lowest.	a. Date.	8.57
Mean	29.03	29.58	Dec. 24	28.21	Feb. 6	.71

PRECIPITATION.

(Amount in inches and hundredths.)

ELEVATION OF TOP OF GAUGE ABOVE GROUND DEC. 31, 2 FEET.

MONTHS.	Total Amount.	Greatest Amount in any 24 Consecutive Hours.		No. of Days on which 1 inch fell	No. of days on which no rain except "trace" fell	No. of Consecutive Days without Rain.
		Amt.	Date.			
	In.	In.				
Jan.	1.25	.38	{ 23 24	0	21	from 8 to 17 inc.
Feb.	3.15	.95	{ 12 13	0	18	from 25 to 28
March . . .	5.41	1.06	{ 18 19	1	16	from 2 to 5
April . . .	.40	.21	24	0	24	from 10 to 23
May	3.20	.96	{ 27 28	0	17	from 3 to 10
June . . .	3.74	1.14	27	1	15	from 14 to 16
July	10.39	2.86	{ 20 21	5	16	from 25 to 30
Aug. . . .	3.37	2.18	{ 1 2	2	25	{ from 3 to 9 from 11 to 15 from 24
Sept. . . .	4.25	2.24	{ 27 28	2	21	{ to 2 from 6 to 12 from 22 to 26
Oct.	1.27	.70	{ 23 24	0	23	{ from 1 to 5 from 7 to 10 from 14 to 19
Nov. . . .	4.30	2.27	{ 27 28	1	19	{ from 13 to 19 from 29
Dec.	2.56	1.80	{ 8 9	1	26	{ to 7 from 19 to 31
Sum. . . .	43.29	a.	a.	13	241	
Mean . . .	a.	a.	a.	a.	a.	

Normal rainfall for April 3.56 inches.

Normal rainfall for May 3.42 inches.

Normal rainfall for June 4.29 inches.

Normal rainfall for July 5.24 inches.

Normal rainfall for August 3.55 inches.

Normal rainfall for September 2.69 inches.

KENTUCKY AGRICULTURAL EXPERIMENT STATION.

SUNSHINE AND CLOUDINESS.

MONTHS.	NUMBER OF DAYS.			MEAN CLOUDINESS. (0 to 10.)		
	Clear.	Partly Cloudy.	Cloudy.	8 a. m.	8 p. m.	Monthly.
January	0	8	23	8.6	7.3	8.6.
February	3	7	19	8.3	6.7	7.8
March	2	7	22	8.5	6.7	8.3
April	2	13	15	6.5	6.2	7.2
May	7	10	14	6.5	6.7	6.8
June	3	10	17	6.3	6.9	7.3
July	5	16	10	6.7	6.5	6.5
August	9	11	11	4.8	5.2	5.5
September	6	10	14	5.2	4.8	6.5
October	13	12	6	4.1	3.5	4.4
November	7	10	13	7.6	5.9	6.3
December	6	8	17	7.2	5.3	6.8
Summary	63	122	181	80.3	71.7	81.5
Mean	a.	a.	a.	6.7	6.0	6.8

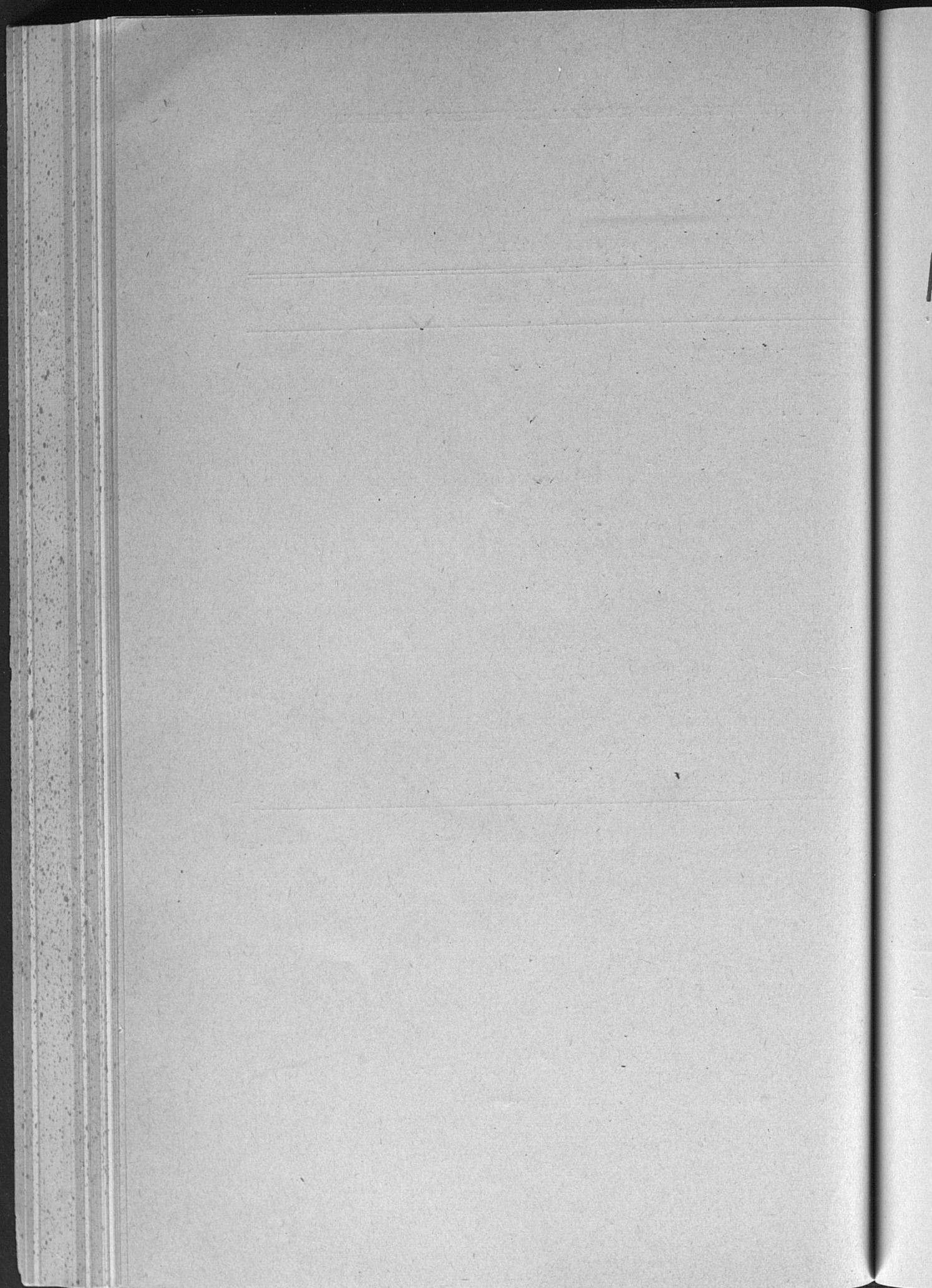
WIND.

ELEVATION OF ANEMOMETER CUPS ABOVE GROUND DEC. 31, 122 FEET.

MONTHS.	Pre- vailing Direction.	Maximum Hourly Velocity During Month.			No. of Days with Gales.	No. of Calms.
		Miles.	From.	Date.		
January	S. W.	36	S.	2	0	0
February	S. W.	48	W.	19	4	0
March	W.	48	S. E.	28	2	0
April	S. W.	44	W.	2	1	0
May	S. W.	48	S.	1	1	2
June	S.	36	S. W.	8	0	0
July	S.	40	S. W.	15	1	0
August	S.	40	S. E.	23	1	1
September	N. E.	56	S. W.	30	2	2
October	N. E.	48	S. W.	30	1	1
November	S. W.	48	W.	27	3	0
December	S. W.	38	S.	22	0	0
Summary	a.	a.	a.	a.	16	6
Mean	S. W.	a.	a.	a.	a.	a.

NUMBER OF DAYS.

MONTHS.	Thunder- storms.	Snow.	Hail.	Fog.
January	0	2	0	0
February	0	3	0	0
March	2	6	1	0
April	1	0	1	0
May	8	0	1	0
June	3	0	0	0
July	6	0	0	0
August	7	0	0	0
September	3	0	0	0
October	0	0	0	0
November	0	1	0	0
December	1	0	0	0
Summary	31	12	3	0
Mean	<i>a.</i>	<i>a.</i>	<i>a.</i>	<i>a.</i>



KENTUCKY
AGRICULTURAL EXPERIMENT STATION

OF THE
STATE COLLEGE OF KENTUCKY.

BULLETIN No. 61.

POTATOES.

1. Experiments with Fertilizers.
2. Insects and Fungus Pests.
3. Tests of Varieties.

LEXINGTON, KENTUCKY.

MARCH, 1896.

KENTUCKY

Agricultural Experiment Station.

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R. J. SPURR, Superintendent Field Experiments.

V. E. MUNCY, Weather Observer.

MISS ALICE M. SHELBY, Stenographer.

Address of the Station : LEXINGTON, KY.

NOTICE.

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

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

Address :

KENTUCKY AGRICULTURAL EXPERIMENT STATION
LEXINGTON, KY.

BULLETIN No. 61.

POTATOES.

1. *Tests with Fertilizers.*
2. *Insect and Fungus Pests.*
3. *Test of Varieties.*

1.—TESTS WITH FERTILIZERS.

BY M. A. SCOVELL.

The Season.

The season was unfavorable to the potato crop on account of dry weather. The following table gives the summary of rainfall, the mean temperature and the average per cent. of sunshine during the time specified:

MONTH.	Rainfall. Inches.	Degrees Mean Temperature.	Per cent Sunshine.
April	3.17	55.8	34
May	4.05	62.3	35
June	2.93	75.4	47
July	5.07	73.4	46
August	1.56	75.8	48
September	.33	72.8	53
October	1.28	52.3	64

THE SOIL.—The soil is derived from the Lower Silurian limestone, and is rich in phosphoric acid. The land is worn, having been in cultivation many years. The subsoil is a light-colored clay, so retentive as to make the soil deficient in natural drainage.

Explanations—The leading elements of plant food are nitrogen, phosphoric acid and potash. Plants feed on other soil elements besides these, and they are just as essential to plant life as these three, but generally speaking all but these ingredients are furnished to plants in abundance, and therefore in studying what to put on our soils to make them more productive, we need concern ourselves with only these three. Commercial fertilizers are manufactured and sold for the purpose of supplying nitrogen, phosphoric acid and potash, and the market prices depend upon these ingredients. Some fertilizers contain one of these ingredients, some two, and some all. Generally speaking, a commercial fertilizer is a mixture containing two of these ingredients, and sometimes all; the proportions varying greatly in the various brands and often in the same brand. It is at once seen to be a very difficult, if not an impossible task, to test all the various brands sold on a given soil in order to find out those that produce the best effect. It is an easy matter, however, to find out whether a given soil needs potash, phosphoric acid or nitrogen or any combination of these elements for a given crop. Having found out this by experiment, we have only to look to the analyses of the various fertilizers to tell which brands, if any, could be used to advantage on the soil and crop tested. If the experiment proved that potash was all that was needed on a given soil for the corn crop, all those fertilizers whose analyses show little or no potash would not produce favorable results, under whatever name sold.

The Experiments.

The potatoes used for seed were Northern grown Early Rose. They were immersed for $\frac{1}{2}$ hour in a solution of mercuric chloride before being planted. This solution contained $3\frac{1}{2}$ ounces of corrosive sublimate (mercuric chloride, or bichloride of mercury) to 30 gallons of water. After drying, the potatoes were cut and planted. (As the above solution is poisonous, the work of treating the potatoes with the solution should never be done where stock might get to the solution or the treated potatoes.)

The size of the experimental plots was 1-10 acre each.

After the ground was well prepared with plow and harrow, the rows were marked out with a small plow. The fertilizers used were scattered in the row by hand and afterwards slightly mixed with the soil by a brush being dragged along in the row.

The fertilizers were applied and the potatoes planted April 6th.

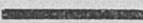
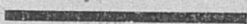
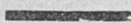
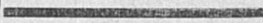
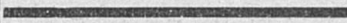
The following table shows the kind of fertilizers applied to the various plots, their amount calculated per acre, the number of pounds of leading elements of plant food applied per acre, and the per cent. of these elements in the various fertilizers:

TABLE 1—Showing fertilizers applied and per cent. of ingredients.

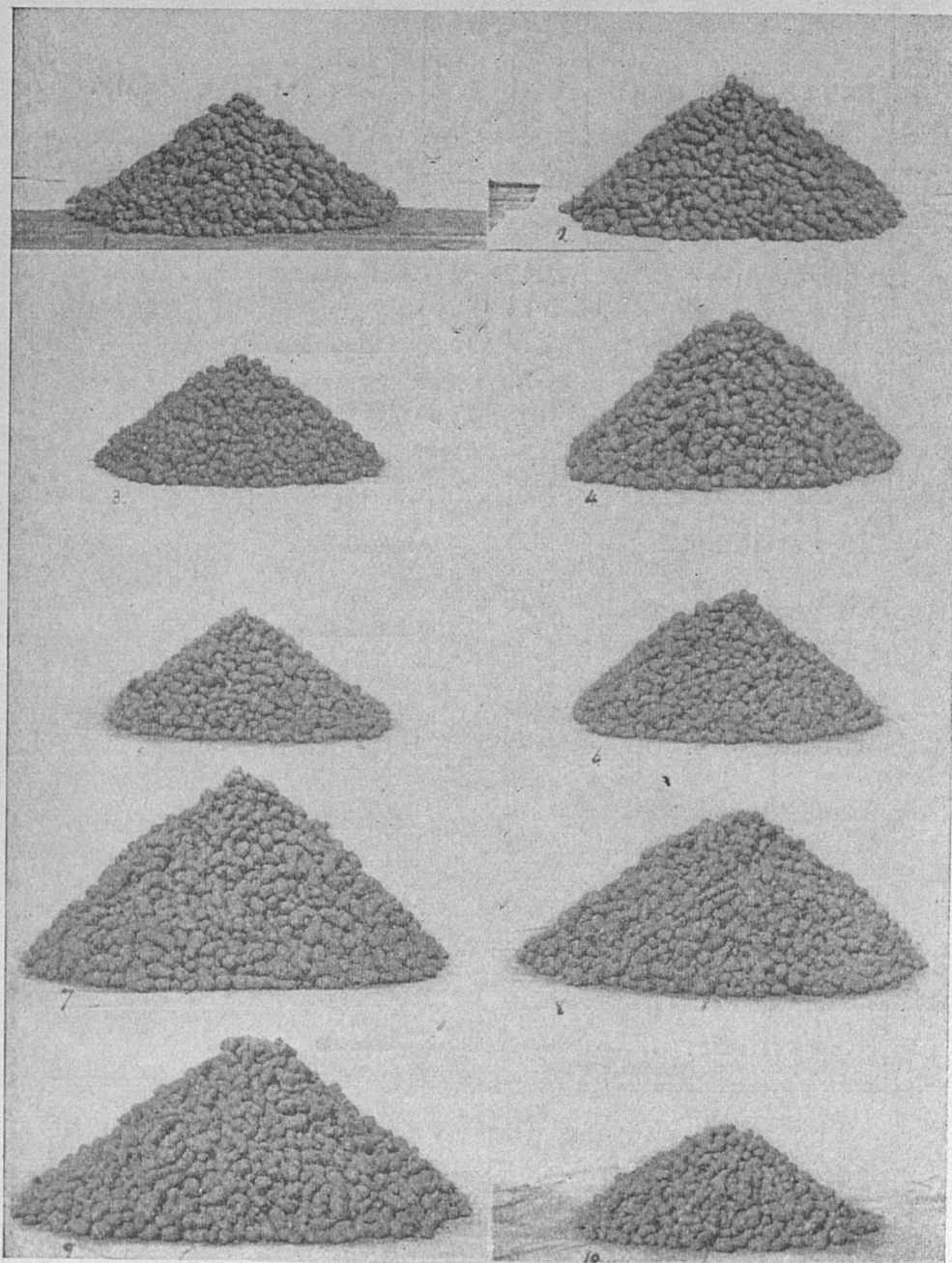
NUMBER.	FERTILIZERS USED.	Number of Pounds.	Number of pounds of the leading elements of plant food.			Per cent. of the leading elements of plant food in fertilizers used.		
			Phosphoric Acid.	Potash.	Nitrogen.	Phosphoric Acid.	Potash.	Nitrogen.
1	No Fertilizer.....							
2	Nitrate of Soda.....	160	0	0	25.6	0	0	5.5
3	Acid Phosphate.....	140	57	0	0	12.4	0	0
4	Muriate of Potash..	160	0	80	0	0	17.	0
5	No Fertilizer.....							
6	Acid Phosphate.....	140						
	Nitrate of Soda.....	160	57	0	25.6	12.4	0	5.5
7	Muriate of Potash..	160						
	Nitrate of Soda.....	160	0	80	25.6	0	17.	5.5
8	Acid Phosphate.....	140						
	Muriate of Potash..	160	57	80	0	12.4	17.	0
9	Acid Phosphate.....	140						
	Muriate of Potash..	160	57	80	25.6	12.4	17.	5.5
	Nitrate of Soda.....	160						
10	No Fertilizer.....							

The following table gives the name and amount of fertilizer used and the yield of potatoes, calculated to the acre, for each plot:

TABLE 2—Showing Results of Fertilizers on Potatoes.

No. of Plot.	FERTILIZER USED.	Amt. per acre, pounds.	Yield per acre, bushels.	Comparative Scale.
1	No Fertilizer .....	.....	50.0	
2	Nitrate of Soda	160	60.5	
3	Acid Phosphate	140	43.8	
4	Muriate of Potash ..	160	87.0	
5	No Fertilizer .....	.....	45.0	
6	Nitrate of Soda	160	59.3	
	Acid Phosphate	140		
7	Nitrate of Soda	160	122.8	
	Muriate of Potash ..	160		
8	Acid Phosphate	140	95.0	
	Muriate of Potash ..	160		
9	Nitrate of Soda	160	126.8	
	Acid Phosphate	140		
	Muriate of Potash ..	160		
10	No Fertilizer .....	.....	33.8	

The accompanying plate is an exact reproduction of a photograph taken of the potatoes grown on each plot. Each pile was exactly the same distance from the camera when photographed, and therefore the difference in size of each pile is owing to the difference in yield.



Financial Results.

The Financial Results obtained by the use of the fertilizers in various combinations may be seen in the following table. The acid phosphate costs at the rate of \$3.30 per acre, the muriate of potash \$3.60, and nitrate of soda \$3.60. In these estimates the potatoes are rated at 30 cents per bushel, including the small potatoes.

TABLE 3—Showing Financial Results.

	FERTILIZER USED.	Cost of Fertilizer used per Acre.	Value Potatoes per Acre.	Value of Increased Yield of Potatoes per Acre.	Profit or Loss.
1	No Fertilizer.....		\$15.00		
2	Nitrate of Soda.....	\$ 3.60	18.15	\$ 5.28	\$1.68
3	Acid Phosphate	3.30	13.14	0.27	3.03*
4	Muriate of Potash ...	3.60	26.70	13.83	10.23
5	No Fertilizer.....		13.50		
6	Nitrate of Soda..... Acid Phosphate	6.90	17.79	4.92	1.98*
7	Muriate of Potash ... Nitrate of Soda.....	7.20	36.84	23.97	16.77
8	Muriate of Potash ... Acid Phosphate	6.90	28.50	15.63	8.73
9	Nitrate of Soda..... Acid Phosphate	10.50	38.04	25.17	14.67
10	Muriate of Potash ... No Fertilizer.....		10.14		

* Loss.

From the results obtained it would appear that both potash and nitrogen are needed on our soil, for potatoes; that potash alone greatly increases the yield; that nitrogen does to some extent, but that the best results are obtained by a combination of the two. Trials for six years have shown that potash greatly increases the yield of potatoes, when applied to our soil.

That this is not true for all soils is demonstrated by the experiments of Mr. Thos. R. Walker, of Junction City, Boyle Co. His results show that phosphoric acid is the element needed on his soil. Below are given the results of Mr. Walker's experiments in detail:

Experiments of Mr. Thos R. Walker,

JUNCTION CITY, BOYLE CO., KY.

SOIL.—A light, clayey loam, cleared from original timber about twenty two years ago, and has received no manure during that time. Probably of the Devonian geological formation.

Medium sized, home grown, Early Rose potatoes cut into two pieces were planted April 25.

The plan of the experiment was the same as that followed out by the Station. Ten 1-10 acre plots were used for the experiments, each plot being $181\frac{1}{2}$ feet long and 24 feet wide. The fertilizers used were the same as heretofore given in this bulletin.

Mr. Walker reports the following field notes: Rows run north and south. Potatoes covered with Planet Jr. Cultivator.

May 9. Harrowed crosswise of the rows, some potatoes beginning to show above the ground.

May 14. Heavy rain all day washed out some few gulleys in the plot.

May 31. Cultivated with Planet Jr. Plot No. 6 showed by far the best growth and color of tops.

June 3. Hoed plot.

Potatoes.

II

June 11. Cultivated with Planet Jr.

June 17. Potatoes beginning to bloom.

July 8. Cultivated.

July 25. Vines on No. 6 beginning to die.

July 29. Vines on Nos 7, 8 and 9 beginning to die.

Aug. 19. Vines all dead.

Sept. 10 and 11. Dug potatoes.

The following table gives the kind and quantity of fertilizers used and the yield of potatoes in bushels. All calculations made per acre :

TABLE 4—Effect of Fertilizers on Potatoes.

No. of Plot.	FERTILIZER USED.	Amt. per acre, pounds.	Yield per acre, bushels.		
			Merchant- able.	Small.	Total.
1	No Fertilizer .....	.....	57.4	21.1	78.5
2	Nitrate of Soda.....	160	51.3	21.0	72.3
3	Acid Phosphate.....	140	86.7	34.8	121.5
4	Muriate of Potash.....	160	56.3	20.3	76.6
5	No Fertilizer .....	.....	53.1	21.0	74.1
6	Nitrate of Soda.....	160	106.0	39.8	145.8
	Acid Phosphate.....	140			
7	Nitrate of Soda.....	160	46.5	28.5	75.0
	Muriate of Potash.....	160			
8	Acid Phosphate.....	140	80.6	44.5	125.1
	Muriate of Potash.....	160			
9	Nitrate of Soda.....	160	86.3	34.5	120.8
	Acid Phosphate.....	140			
	Muriate of Potash.....	160			
10	No Fertilizer.....	.....	44.5	35.5	80.0

The results are striking, and they show the necessity for each farmer to experiment to find out the kind of fertilizer that is needed on his own land. Mr. Walker was under the impression that he needed potash until he obtained these results.

Sometime after his first report Mr. Walker sends the following interesting item:

"I may say that after digging my potatoes on the 10th and 11th of Sept. last I sowed rye, and though I cultivated cross ways of the potato rows with a Planet Jr. Hoe, the rows where double superphosphate was applied are as distinctly visible as a board on a fence. The rye on these plots are thick and green whilst on the other plots no difference is discernable between the plots fertilized and those without fertilizer."

INSECT AND FUNGUS ENEMIES OF POTATOES IN KENTUCKY.

BY H. GARMAN, ENTOMOLOGIST AND BOTANIST.

The Colorado Potato Beetle

(*Doryphora 10-lineata*).

The Colorado potato beetle is the most destructive insect enemy of the potato in Kentucky. It occurs everywhere in the State and is constantly injurious, though varying somewhat in the mischief it does from year to year. The adult beetles may be seen flying about on warm days of spring, when potatoes are being planted. They have spent the winter in the soil, and are ready to place their eggs as soon as the plants come up. Several broods develop during the season, hence one can during several months find young, adults, and eggs, about the plants. In the fall only adult beetles can be found, and these go into the soil for the winter only when the plants of late potatoes cease to furnish them food.

The injuries of the insect have ceased to interest the economic entomologist since the use of Paris green on the plants has been found to be an inexpensive and sure remedy. Any one who will take the trouble to mix Paris green with water in the proportion of one pound to 160 gallons, and apply this to his plants promptly when the adults are laying their eggs in the spring, and once or twice later in the season when the second brood begins to appear, can rest assured that the beetles will do his crop little injury. He can apply the mixture with a watering can, a knapsack sprayer, or with a large force-pump connected with a barrel or fixed to a tank, as in the accompanying figure.

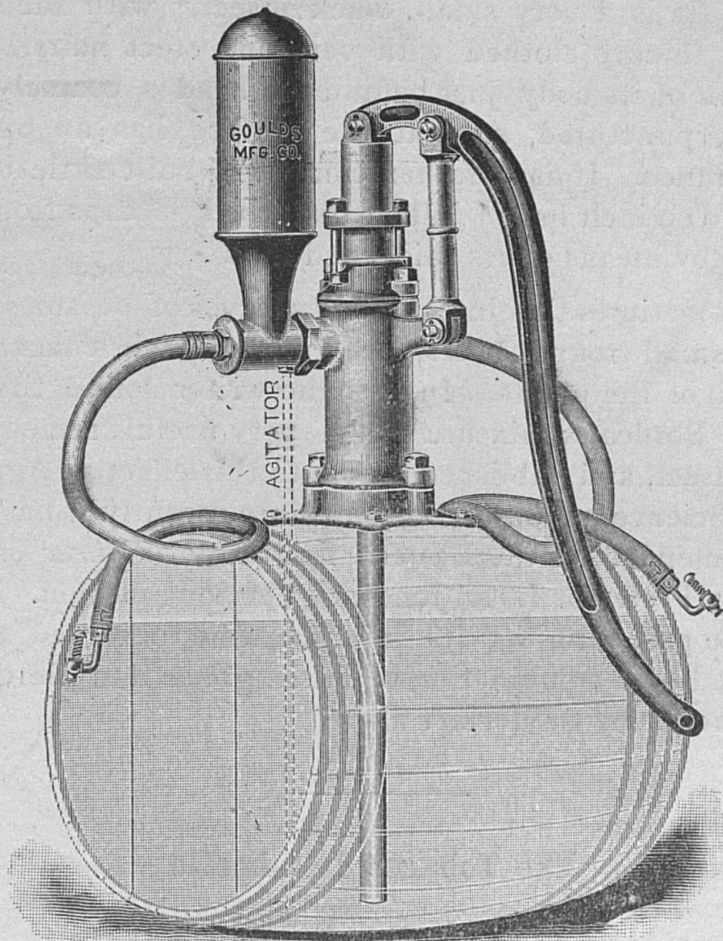


FIG. 1.—A force-pump suitable for spraying potatoes. Price given in manufacturer's list, with hose and nozzle, \$14.00.

The knapsack sprayer and spray pump are much the best for the work, since they save much time, and make possible a more thorough wetting of the plants.

The Southern Flea-beetle of Potatoes

(*Epitrix fuscula*).

Another beetle belonging to the same family as the Colorado potato beetle is a common frequenter of potato patches, and can when abundant do a good deal of mis-

chief. It is a very small, black insect,* with the body rather thickly clothed with very fine erect hairs. The division of its body just behind the head is coarsely and closely punctured, so that the surface has an opaque appearance. It is a rather compactly built little beetle about 0.09 inch long. When disturbed, it leaps from the leaves by means of its thickened hind legs.

Sometimes this insect riddles leaves of potatoes with very small round holes, an injury which checks the growth of the plants. In 1889 the writer found that the use of Bordeaux mixture was a very useful remedy for this insect, and published a note to this effect in Agricultural Science, volume 6, 1892. More recently it has been recommended for the Eastern flea-beetle (*Epitrix cucumeris*) by Professor L. R. Jones, of Vermont Station. During the past summer its injuries were observed to be checked by a combination of Paris green and Bordeaux mixture, or by the former alone.

The Tobacco Flea-beetle

(*Epitrix parvula*).

This small brown beetle (about 0.06 inch long) is often associated with the preceding species on potatoes, where it does mischief of the same sort. It is to be destroyed by the same insecticides as the other species, as I have recently proved both on tobacco and potatoes.

* This beetle is closely related to the *Epitrix cucumeris* of Harris, often mentioned in the writings of economic entomologists as injurious to the leaves of potatoes and related plants. Harris's species has not been seen by me about potatoes here. It may be distinguished from the southern species by its less densely punctured thorax, more shining surface, and smaller average size; it is about 0.06 inch in length. I am disposed to think that some recent references by writers to injuries supposed to have been occasioned by *E. cucumeris* will be found to be the work of *E. fuscula* instead.

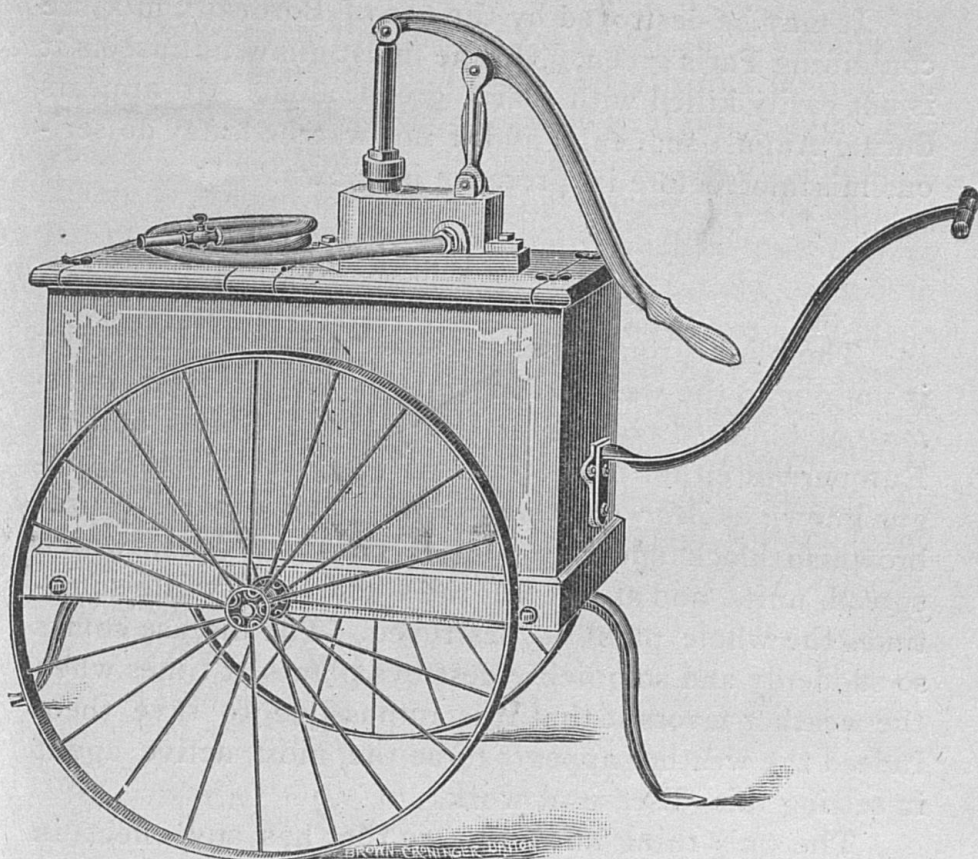


FIG 2.—A spray cart suitable for spraying potatoes. It can either be hauled by hand, or, better, placed in a wagon or horse cart. Capacity of tank, 20 gallons. List price, ready for work, \$20—\$22.50, according to size of pump.

The Margined Blister Beetle

(*Epicauta cinerea*).

A rather slender black blister beetle, 0.50–0.56 inch long, is often very common on both potatoes and tomatoes in Kentucky, from which it may completely remove the leaves in a few days. It is a near relative of the "old fashioned potato beetle," but differs in color, being black, with gray margins to the wing-covers, a gray line along the middle of the thorax, and some gray on the head and under parts.

It may be destroyed by the use of Bordeaux mixture containing Paris green. Unlike most gnawing insects it is not easily killed with Paris green alone. It appears during August suddenly, and if not watched may do serious mischief before its presence is known.

Potato Blight.

The blight from which potatoes suffer in Kentucky is not due to the well known fungus (*Phytophthora infestans*) of blighted potatoes in the Eastern States and in Europe, but either to bacteria, or else possibly to a fungus known as *Macrosporium solani*. The disease causes brownish black spots to appear on the leaves, which spread, unite, and at last kill the whole leaf; while sometimes the whole plant is destroyed. The disease comes so suddenly and so quickly destroys plants at times when the weather favors it that it is impossible to save them. Indeed the weather appears to be the most active agent in setting this disease at work.

The only thing known to me that has any effect in preventing its attacks is spraying with Bordeaux mixture, and where the blight is troublesome this mixture should be applied at intervals during the summer to ward off its attack. The Bordeaux mixture with a little Paris green added becomes a very effective preventive of insective attacks also, and hence the combination is to be used in preference to the Bordeaux mixture alone.

Scab Produced by Insects.

For many years it has been claimed that scab is caused by insects, among other things, which gnaw the tubers, thus admitting moisture, which in turn causes the discoloration and roughening of the surface. Wireworms are sometimes accused of the mischief. White

grubs have been thought to take part in it. Quite recently the entomologist of the West Virginia Station has announced that it is the work of a minute maggot, the young of an insect of the same order as the housefly. There is ground for some of these assertions, for quite a list of insects could be made out which at one time or another have been observed to gnaw potatoes when in the ground. Mr. Hopkins' observations have been made with care and thoroughness, and must be given weight in considering the subject. The truth appears to be that scab is a term that has been somewhat indiscriminately used by writers in agricultural journals, and some of the forms referred to seemed to be beyond question the result of insect attack.

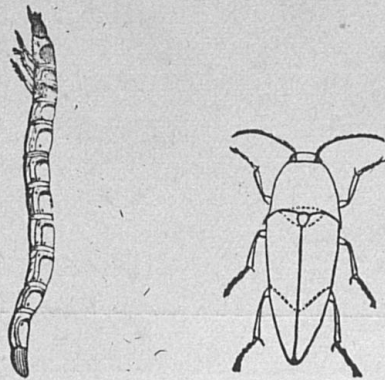


FIG. 3.—A wire-worm, young and adult.

I have had the insect origin of the trouble in mind since 1889, and without making it an object of special study, have examined every year scabbed potatoes taken from the plots on the Experiment Farm at Lexington, and also those which come to our market. In none of the potatoes examined have I found Mr. Hopkins' dipterous larva. I think this can not be because it has been overlooked. Several species of the same family are common here among decaying vegetation and fungi. Several mould-eating species (described by me in the Bulletin of

the Essex Institute and in Science) are found in our caves. A similar species, with which I have long been familiar, is found in Illinois on rotting seed corn in the ground during cold damp springs. Nothing of the kind has been found by me here at Lexington on potatoes, and I am well satisfied that the prevailing scab in this part of Kentucky is caused by something else. It would be unwise perhaps to assume that but one kind of scab prevails in all sections, and it may yet prove that the fly maggot does mischief in the State.

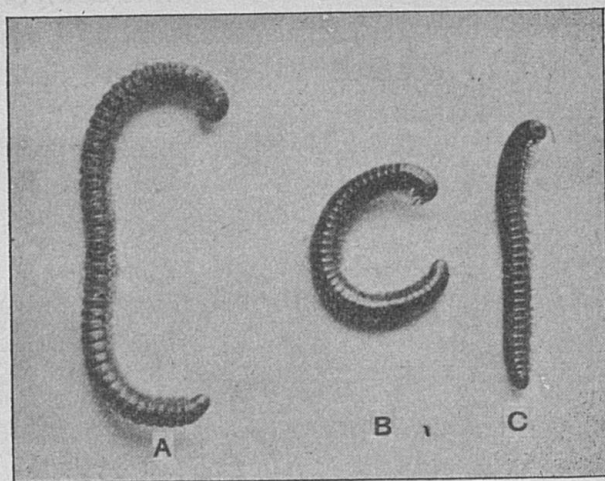


FIG. 4.—Millipedes which occur in potato patches. A, *Cambala annulata*. B & C, *Parajulus impressus*.

The "insect" which does produce a sort of scab in this region is one of the millipedes (*Cambala annulata*). On October 4, 1889, Mr. C. L. Curtis, Assistant Agriculturist at the Experiment Station, brought me a large potato with several examples of this species lodged in fissures of the blackened and deadened tissue. They were confined in a jar with a couple of thick slices of potato so cut that any gnawing could be readily detected. On the 24th it was found that they had made small pits in the cut surface of the slices. The millipedes are fre-

quent every year in potato fields, and I have several times encountered them on and about tubers which seemed to have been gnawed by them. The creatures are sometimes called wire-worms by farmers, and it is just possible that some of the statements with reference to wire-worms causing scab may have had in view this animal instead of true wire-worms.

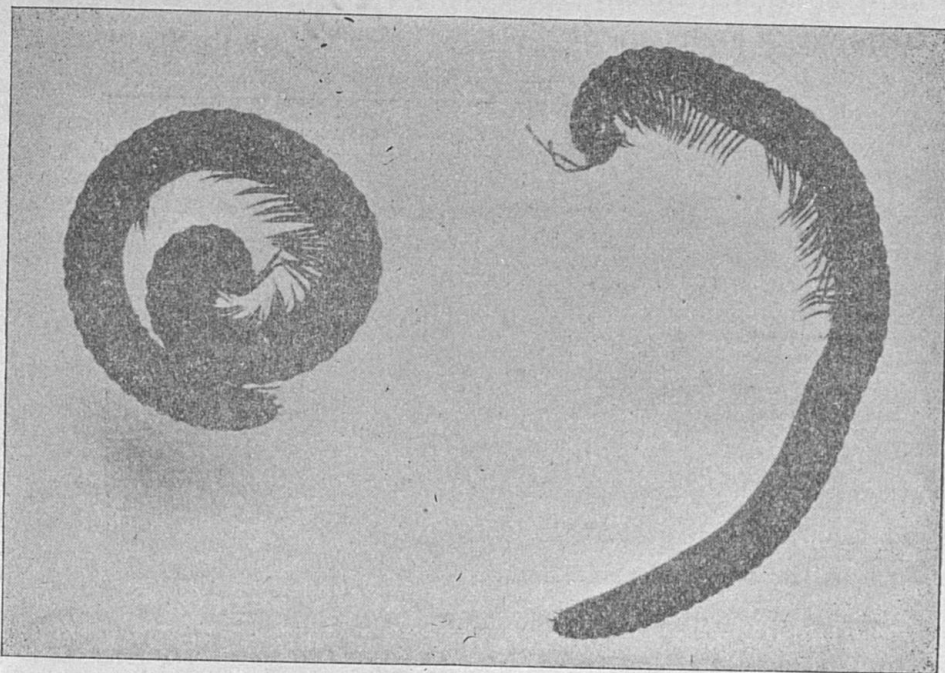


FIG. 5.—A millipede (*Lysiopetalum lactarium*) sometimes found about potatoes.

But wire worms (immature *Elateridae*) may sometimes be found with their heads buried in the substance of a potato, and where a potato patch is allowed to become very weedy may occasion a good deal of mischief.

Potatoes Injured by White Grubs

An injury to potatoes which is widespread in this country is that done by white grubs. It is so characteristic, however, that it is not very likely to be taken for scab.

The grubs gnaw into potatoes, making a large opening, and then push on in, sometimes mining out most of the substance before leaving. When potatoes are dug late in the fall the mines are found empty, but early potatoes when dug up for use sometimes show the grubs in their burrows. The ones observed here are the young of brown beetle called in northern States June bugs. They are most abundant in land recently in sod. The injury was frequent in experiment plots last season.

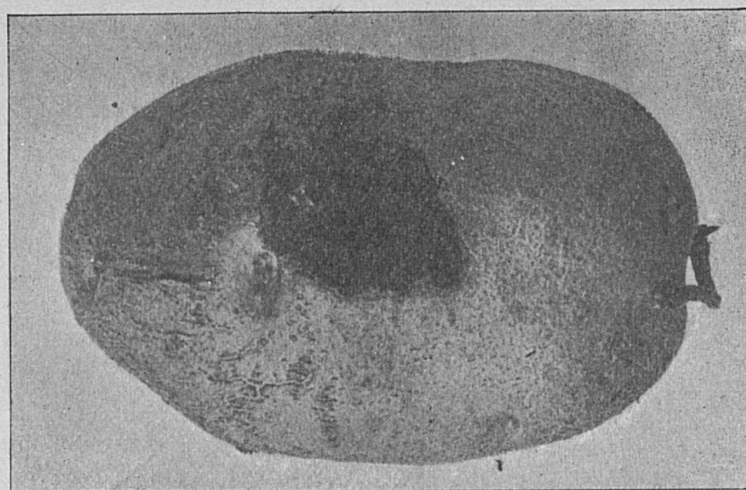


FIG. 6.—A potato injured by a white grub.

Injury by Small Mammals.

Still another injury noted in our plots was due to some small mammal, probably a field mouse. The marks of the teeth are very plain in many cases, and occasionally the greater part of a potato is devoured. The mole has been accused of this latter mischief. But if guilty he certainly pays for all the potatoes he eats by destroying white grubs and wire-worms. An examination of the stomachs of 14 moles (See our Annual Report for 1894), collected mostly on the Experiment farm, shows that this animal depends very largely for food on earthworms and insects, and that it is especially fond of white grubs.

Since my paper on the food of the mole was printed I have chanced upon a published observation on this point that bears out my conclusion as to the generally insectivorous and useful character of the mole. In the Canadian Entomologist, volume 14, page 17, Professor E. W. Claypole, writing from Yellow Springs, Ohio, says: "In digging potatoes this year I observed the runs of a mole in all directions through the ground. It was a piece of old sod, and very much infested with white worms, the larvæ of the cockchafer (*Lachnosterna fusca*). Many of the potatoes had been partly eaten by these worms, but I observed that wherever a mole-run traversed a hill of potatoes no white worm could be found, even though the half-eaten potatoes were proof of his former presence. The inference is fair that the mole had found him first and eaten him, and very likely the mole's object in so thickly tunnelling this piece of ground was to find these grubs." Professor Claypole goes on to say that it would be easy to make of these facts an accusation against the mole, but that the work of the grubs is very different from that which would be done by a mole, and that he has never seen marks on potatoes which could have been made by a mole's teeth. As has already been stated, such marks do occur, but the fact does not weaken the force of his argument as applied to the particular case he had in view.*

*But while I am still of the opinion that the mole is in the main useful on the farm I have a fact to report that goes counter to all my other experience with it.

On January 31, 1890, the Assistant Agriculturist of the Experiment Station Farm brought me a large mole which was caught in the pasture. It was killed at once and the contents of its stomach given a preliminary examination. The vial containing this material is now before me, and after having made three separate examinations of it the following is my best judgment as to its constituents:

Vegetable matter, 50 per cent.

Insects, 50 per cent.

The vegetation as far as recognizable seems to consist of grasses, together with a few seeds.

The insects recognizable are a leather-jacket (the larva of a crane-fly) and a white grub, both insects known to be injurious in grass lands.

It seems to me not improbable that even this large percentage of vegetable matter was taken unintentionally while the mole was eating the grass-infesting insects. But the proportion is much larger than in any of the fourteen stomachs examined in preparing the paper published in our 1894 report.

Scab Due to Fungus Attack.

Scabbed potatoes from this region show at first faint rust-colored spots on the skin which are certainly not the work of any insect. They are confined largely at this stage to the surface, and beyond the effect on the appearance of the tubers cannot be considered as affecting the quality of potatoes. They are often so faint that



FIG. 7.—Scab due to fungus attack. Photographed from a potato raised on the Experiment Farm.

they are likely to be completely overlooked except by one who knows their nature and makes special search for them. This was the condition of most of the scab occurring on potatoes or experiment plots on the Experiment Farm last summer. A good many of the potatoes were examined carefully as soon as exposed by the plow, and certainly no insect was at work on them. Occasionally tubers were pretty well covered with the growth in an advanced stage, the skin being brown, hard and fissured, but still careful search showed no insect present that could reasonably be charged with the injury. The scab occurring here seems to me to be in great part at

least occasioned by some fungus, probably *Oospora scabies* (Thaxter, Annual Report Connecticut Station for 1890, p. 80). Scabbed potatoes kept through the winter have in the diseased tissue the threads of some one of the higher fungi, but this is probably not in any way concerned in producing the scabbed skin, since the fungus now assumed to cause the trouble is of a very different character.

Recent experiments made by Prof. Bolley and others indicate that this fungus is often carried to the soil on scabbed seed potatoes, the supposition being that the fungus retains its vitality among potatoes stored during the winter, and makes its way from the diseased seed to the potatoes which develop from it. The results obtained by the use of materials calculated to destroy the fungus on the seed potatoes seem to support this view of the manner in which the trouble is conveyed to new soil. But once the fungus is in the soil, such treatment would not avail against the scab, and hence when potatoes suffer greatly from the disease when planted repeatedly on the same land, it is well to put the crop elsewhere for a time until the fungus has disappeared. Just how long it is necessary to avoid infested land is not yet settled, I believe. Such fungi are often short-lived, and probably a couple of seasons in corn or wheat would be sufficient to rid land of the scab fungus. Then by treating seed planted with corrosive sublimate, avoiding also badly scabbed seed, a return of the trouble may be avoided.

The experiment reported below was suggested by tests made and published by Professor Bolley. The results are not such as to warrant any very positive statements as to the merits of the treatment practiced, because the scab was not common enough on any of the rows, treated or untreated, to give opportunity for satisfactory comparisons. They will be supplemented by other tests the coming spring.

Experiments in Checking Scab, Made in 1895.

An acre of land on the Experiment Farm was devoted to this preliminary test of fungicides for checking scab. The land was recently in meadow, but had been the preceding summer in tomatoes and tobacco. It was thus new land for potatoes, a circumstance probably to be accepted as explaining to some extent the scarcity of scab on the crop. There was, however, some scab on the seed potatoes used, and occasional tubers were badly effected, hence it is probable that the weather conditions also were unfavorable to the development of the fungus.

The acre of land was divided into tenths, each tenth constituting a plot and containing eight rows planted in the usual way. The potatoes were cut to bear three eyes. They were all planted April 6. The variety used was "White Star." All the plants were sprayed with Paris green to check the injuries of the Colorado potato beetle.

PLOT 1.—The first four rows of this plot received no treatment of any sort and constituted a check on the remaining four rows. The seed used for the latter was dipped in a barrel of Bordeaux mixture, while in bags, and left ten minutes. Then the potatoes were poured on the ground to dry, and were finally cut for planting. When dropped in the furrows the pieces, and the soil about, received a spraying with Bordeaux mixture.

When the plants came up those of rows 5 and 7 were sprayed with Bordeaux mixture and Paris green, on May 31, June 8, June 17, and July 11. Rows 6 and 8 were not sprayed and serve for comparison, to show if the spraying benefited the plants.

From the four untreated rows we gathered in September 557 pounds of potatoes. From the four treated rows were gathered only 481 pounds. Rows 5 and 7 together, the leaves of which were sprayed, yielded $249\frac{1}{2}$

pounds, while rows 6 and 8, which were not sprayed during the season, yielded at harvest time $231\frac{1}{2}$ pounds, showing a slight advantage for spraying.

PLOT 2.—This was a duplicate of Plot 1, except that the seed used in rows 5-8 was not sprayed as it lay in the furrows. Rows 1-4 yielded $480\frac{1}{2}$ pounds, while rows 5-8, the treated rows, yielded only $464\frac{3}{4}$ pounds, the advantage being with the untreated rows. Rows 5 and 7 were sprayed during the season on the same dates as the corresponding rows of Plot 1 and yielded $239\frac{1}{2}$ pounds, as against $225\frac{1}{4}$ pounds yielded by rows 6 and 8, the plants of which were not sprayed. The spraying of the plants is in this case again apparently beneficial.

PLOT 3.—This is a duplicate in every respect of Plot 1. The four untreated rows produced $474\frac{3}{4}$ pounds, while the treated half of the plot yielded 393 pounds. The two rows (5 and 7) of which the plants were sprayed yielded $173\frac{1}{2}$ pounds, to $218\frac{1}{2}$ pounds from the two check rows (6 and 8), the result in this instance being opposed to that from corresponding rows in Plots 1 and 2.

PLOT 4.—This plot duplicates the treatment of Plot 2. The four untreated rows produced 370 pounds of potatoes, while the four treated rows yielded 331 pounds, the advantage being again with the untreated rows. The two rows (5 and 7) whose plants were sprayed, yielded $185\frac{1}{4}$ pounds to only $145\frac{3}{4}$ produced by rows 6 and 8, the leaves of which were not treated.

PLOT 5.—The seed used for this plot was not treated in any way. But the plants of alternate rows, beginning with row 1, were sprayed with Bordeaux mixture containing Paris green, May 31, June 8, June 17, and July 11. The four remaining rows (2, 4, 6 and 8) received no treatment. In every case the sprayed rows yielded better than the adjacent unsprayed rows, and the total yield for the four sprayed rows was 406 pounds as against $334\frac{1}{2}$ pounds from the untreated rows of the plot.

PLOT 6.—This is the first of the plots on which corrosive sublimate was tested on the seed. The seed was dipped while in bags in a barrel containing $4\frac{1}{2}$ ounces of corrosive sublimate dissolved in $\frac{1}{2}$ gallon of water and then diluted to 30 gallons. They were left in the solution one-half hour. The rows 1-4 were, as in preceding plots, left untreated. They yielded 441 pounds. The treated rows produced $526\frac{1}{4}$ pounds, a considerable gain, but hardly to be considered the result of treating the seed. Two of the treated rows (5 and 7) were sprayed during the season on the same dates as were corresponding rows of Plots 1 and 4. They produced $272\frac{1}{4}$ pounds of potatoes as against 254 pounds taken from the two unsprayed rows of this half of the plot.

PLOT 7.—This plot duplicates Plot 6 in every way. The untreated half produced 480 pounds of potatoes, while the treated rows, 5-8, yielded 521 pounds. The result from the two sprayed rows of this plot is opposed to that of all the others, rows 5 and 7 producing only 235 pounds, while the check rows, 6 and 8, yielded 286 pounds.

PLOT 8.—This duplicates Plots 6 and 7 except that none of the plants were sprayed. Rows 1-4 produced $487\frac{3}{4}$ pounds, while the treated rows 5-8 produced $487\frac{1}{4}$ pounds.

PLOT 9.—Plot 9 duplicates in every way Plot 8. The untreated half of the plot yielded $495\frac{1}{2}$ pounds, while the treated half produced only $483\frac{3}{4}$ pounds.

PLOT 10.—This duplicates Plots 8 and 9 as far as treatment is concerned. The yield from rows 1-4, which received no treatment, was $472\frac{1}{2}$ pounds. Rows 5-8, the seed of which was dipped in the corrosive sublimate solution, produced but $330\frac{1}{2}$ pounds.

Summary.

1. The scab present on both untreated and treated plots was not abundant enough anywhere to give opportunity for profitable comparison. The potatoes were not appreciably injured by it. By close examination one could find the faint, rust-colored stains showing the trouble beginning, but they were so small and slight that they would not have been seen at all by the average man, and certainly would not have had the slightest effect on the market value of the potatoes. Occasional tubers showed the surface pretty badly injured, and this was especially true of potatoes near the south ends of rows of Plots 6-10. I thought it probable at first that potatoes had been grown on adjoining land, but inquiry of those who have had the land in charge showed this not to be the case. As far as fertilizers were concerned, too, the treatment had been the same. It seems probable that it was due to something in the drainage. The potatoes of both treated and untreated rows were affected, from which it would seem reasonable to suppose the fungus to have been brought to this part of the land by water.

2. It is evident that the soaking of seed potatoes in the Bordeaux mixture as here practiced has no beneficial effect on the yield. In fact it looks very much from our results as if this treatment reduced the yield by injuring the seed. During the summer I thought the rows of Plots 1-4 from seed soaked in this mixture were not quite as thrifty as those from untreated seed. But the difference was not marked. In every case the untreated halves of plots produced more potatoes than the treated halves. The total yield from the untreated parts of Plots 1-4 taken together is 1882 $\frac{1}{4}$ pounds. It will be observed, however, by reference to the table that there was a gradual diminution in yield from Plot 1 to Plot 4 (from east to west) due probably to a change in the soil, the un-

treated halves of plots being always on the east side, had the advantage of position; but I think this will not account for all the difference. Certainly the treatment did no good else it should have checked this diminution in yield.

3. Spraying the plants with Bordeaux mixture, on the contrary, benefited the plants, as shown both by their condition during the summer and by the yield. In every plot but one (Plot 7) the sprayed rows produced more than the unsprayed rows adjacent. The total yield from sprayed rows of Plots 1-4 was $847\frac{3}{4}$ pounds, while the unsprayed rows of the same parts of the same plots was 821 pounds. Taking all the sprayed rows, without regard to the treatment of the seed, and comparing them with the check rows we get a sum of 1761 pounds from sprayed rows and $1695\frac{1}{2}$ pounds from those not sprayed.

4. The effect of spraying without other treatment is well shown in the results obtained from Plot 5, where the sprayed rows yielded 406 pounds, to $334\frac{1}{2}$ pounds from the unsprayed rows. This is an increase at the rate of 15.25 pounds per row. If the whole 80 rows of the acre had been sprayed, we may suppose that the increase would have been in proportion, and consequently 1220 pounds more potatoes would have been obtained as a result of spraying (about 20 bushels).

5. There is no very apparent reason why soaking seed potatoes in corrosive sublimate solution should increase the yield and value of the crop, unless it be as a result of checking the scab. Since the scab did not appear on the untreated potatoes, there is but little of interest in the results from this treatment, beyond the possibility of an injury to the seed and a consequent reduction of yield. Plots 6 and 7 show a decided increase in yield from the treated rows as compared with their

untreated rows. In Plot 8 the yield is a half pound the greater from the untreated half of the plot. In Plot 9, again, the untreated rows show a better yield, while in Plot 10 the treated plants fell 142 pounds below the untreated ones. However, the totals for treated and untreated rows are not very different, the former having a yield of $2348\frac{3}{4}$ pounds to their credit, while the latter have $2376\frac{3}{4}$ pounds. Such differences may be the result of differences of soil, and in this instance the reduction of total yield of the treated rows was caused by a poor piece of soil in Plot 10. If this plot is excluded, the total yield of the rows planted with treated seed will be found to be greater than that of the rows from untreated seed.

In short, I do not think the corrosive sublimate had the slightest injurious effect on the potatoes.

Conclusion.

While the season was not a favorable one for scab and consequently our results do not give us the data we wanted concerning the prevention of scab by the use of corrosive sublimate, I have confidence in the statements made by other workers to the effect that it will check this trouble to a great extent when properly used.

To those who are troubled with the scabbing of potatoes I would recommend the following:

1. Plant on land which has not been in potatoes for several seasons.
2. Soak the seed potatoes from an hour to an hour and a half in a solution of corrosive sublimate made by dissolving $4\frac{1}{2}$ ounces crystals of corrosive sublimate in a couple of gallons of hot water and then diluting this to thirty gallons. The solution is very poisonous and

must be kept where stock will not get it. The crystals cost about eighty-five cents a pound. The potatoes can be most conveniently dipped while in bags, the bags used being thus disinfected the cut potatoes can be returned to them for taking to the field. Dry the potatoes at once after taking them from the solution.

Table Showing Results of Treatment.

	Row.	Treatment of seed.	Treatment of plants.	Weight by half plots.	Weight by rows.
PLOT 1.	1	.....	.....	557 lbs.	
	2	.....	.....		
	3	.....	.....		
	4	.....	.....		
	5	Dipped in Bord. mixture 10 m. Sprayed.	Sprayed.	481 lbs.	122¼ lbs.
	6	Dipped in Bord. mixture 10 m. Sprayed.			105 lbs.
	7	Dipped in Bord. mixture 10 m. Sprayed.	Sprayed.		127 lbs.
	8	Dipped in Bord. mixture 10 m. Sprayed.			126½ lbs.
PLOT 2.	1	.....	.....	480½ lbs.	
	2	.....	.....		
	3	.....	.....		
	4	.....	.....		
	5	Dipped in Bord. mixture 10 m.	Sprayed.	464¾ lbs.	123½ lbs.
	6	Dipped in Bord. mixture 10 m.			110¼ lbs.
	7	Dipped in Bord. mixture 10 m.	Sprayed.		116 lbs.
	8	Dipped in Bord. mixture 10 m.			115 lbs.

Table Showing Results of Treatment — *Continued.*

	Row.	Treatment of seed.	Treatment of plants.	Weight by half plots.	Weight by rows.
PLOT 3.	1	.....	.....	474 $\frac{3}{4}$ lbs.	
	2	.....	.....		
	3	.....	.....		
	4	.....	.....		
	5	Dipped in Bord. mixture 10 m. Sprayed.	Sprayed.	392 lbs.	77 $\frac{1}{4}$ lbs.
	6	Dipped in Bord. mixture 10 m. Sprayed.	.....		101 $\frac{3}{4}$ lbs.
	7	Dipped in Bord. mixture 10 m. Sprayed.	Sprayed.		96 $\frac{1}{4}$ lbs.
	8	Dipped in Bord. mixture 10 m. Sprayed.	.....		116 $\frac{3}{4}$ lbs.
PLOT 4.	1	.....	.....	370 lbs.	
	2	.....	.....		
	3	.....	.....		
	4	.....	.....		
	5	Dipped in Bord. mixture 10 m.	Sprayed.	331 lbs.	94 $\frac{3}{4}$ lbs.
	6	Dipped in Bord. mixture 10 m.	.....		67 lbs.
	7	Dipped in Bord. mixture 10 m.	Sprayed.		90 $\frac{1}{2}$ lbs.
	8	Dipped in Bord. mixture 10 m.	.....		78 $\frac{3}{4}$ lbs.
PLOT 5.	1	.....	Sprayed.		85 lbs.
	2	.....	.....		76 lbs.
	3	.....	Sprayed.		108 lbs.
	4	.....	.....		82 lbs.
	5	.....	Sprayed.		105 lbs.
	6	.....	.....		86 $\frac{1}{2}$ lbs.
	7	.....	Sprayed.		108 lbs.
	8	.....	.....		90 lbs.

Table Showing Results of Treatment.—Continued.

	Row.	Treatment of seed.	Treatment of plants.	Weight by half plots.	Weight by rows.
PLOT 6.	1	.....	.....	441 lbs.	
	2	.....	.....		
	3	.....	.....		
	4	.....	.....	526 $\frac{1}{4}$ lbs.	136 lbs.
	5	Dipped in corr. subl. sol. $\frac{1}{2}$ hr.	Sprayed.		118 $\frac{1}{2}$ lbs.
	6	Dipped in corr. subl. sol. $\frac{1}{2}$ hr.	.....		136 $\frac{1}{4}$ lbs.
	7	Dipped in corr. subl. sol. $\frac{1}{2}$ hr.	Sprayed.		135 $\frac{1}{2}$ lbs.
	8	Dipped in corr. subl. sol. $\frac{1}{2}$ hr.	.....		
PLOT 7.	1	.....	.....	480 lbs.	
	2	.....	.....		
	3	.....	.....		
	4	.....	.....	521 lbs.	104 $\frac{1}{2}$ lbs.
	5	Dipped in corr. subl. sol. $\frac{1}{2}$ hr.	Sprayed.		136 $\frac{1}{2}$ lbs.
	6	Dipped in corr. subl. sol. $\frac{1}{2}$ hr.	.....		130 $\frac{1}{2}$ lbs.
	7	Dipped in corr. subl. sol. $\frac{1}{2}$ hr.	Sprayed.		149 $\frac{1}{2}$ lbs.
	8	Dipped in corr. subl. sol. $\frac{1}{2}$ hr.	.....		
PLOT 8.	1	.....	.....	487 $\frac{3}{4}$ lbs.	
	2	.....	.....		
	3	.....	.....		
	4	.....	.....	487 $\frac{1}{4}$ lbs.	
	5	Dipped in corr. subl. sol. $\frac{1}{2}$ hr.	Sprayed.		
	6	Dipped in corr. subl. sol. $\frac{1}{2}$ hr.	.....		
	7	Dipped in corr. subl. sol. $\frac{1}{2}$ hr.	Sprayed.		
	8	Dipped in corr. subl. sol. $\frac{1}{2}$ hr.	.....		

Table Showing Results of Treatment.—Continued.

	Row.	Treatment of seed.	Treatment of plants.	Weight by half plots.	Weight by rows. :
PLOT 9.	1			495 ½ lbs.	
	2	.....	.....		
	3	.....	.....		
	4	.....	.....		
	5	Dipped in corr. subl. sol. ½ hr.		483¾ lbs.	
	6	Dipped in corr. subl. sol. ½ hr.	.....		
	7	Dipped in corr. subl. sol. ½ hr.	.....		
	8	Dipyed in corr. subl. sol ½ hr.	.....		
PLOT 10.	1			472 ½ lbs.	
	2	.....	.....		
	3	.....	.....		
	4	.....	.....		
	5	Dipped in corr. subl. sol. ½ hr.		330 ½ lbs.	
	6	Dipped in corr. subl. sol. ½ hr.	.....		
	7	Dipped in corr. subl. sol. ½ hr.	.....		
	8	Dipped in corr. subl. sol. ½ hr.	.....		

VARIETIES OF POTATOES.

BY C. W. MATHEWS, HORTICULTURIST.

A large number of varieties of potatoes was planted upon the station farm in 1895, these being the entire collection offered by the Edward F. Dibble Seed Co. of Honeoye, N. Y.

This collection of seed potatoes (2 pounds of each variety) was shipped to us about the first of April, and was an unusually fine lot of tubers, having evidently been well cared for during the winter, as even the early varieties had not commenced to sprout, so that the seed was in the best condition to give good results in planting.

Although the tubers showed no indications of being affected with scab or other diseases, they were nevertheless treated, as a preventive measure, with a solution of corrosive sublimate (1 part to 1000 parts of water) for half an hour and then dried before cutting. Each lot of two pounds was cut into twenty pieces of as nearly an even size as possible, the pieces thus weighing approximately $1\frac{1}{2}$ ounces each.

The soil was in fair condition, probably about that of the average farm in this locality, and the only fertilizer applied was sulphate of potash at the rate of 80 pounds per acre.

The potatoes were planted on April 15, in drills about 4 inches deep, the pieces being placed 16 inches apart, each variety thus occupying about 27 feet of a row. The plot was given good cultivation through the season; at first—just as the potatoes were breaking through the ground—with a smoothing harrow across the rows, and afterwards with a one-horse cultivator.

Most of the varieties were allowed to remain in the ground until the last of September, as, on account of the small amount of rainfall in August and September, this was considered the best method of keeping them.

Each variety was sorted and weighed in the field as

dug. All tubers under a diameter of $1\frac{1}{2}$ to $1\frac{3}{4}$ inches were placed in the "unmarketable" lot.

It will be observed that the yield of each variety is given in *bushels per acre*.

This estimate, being based upon the product of so small an area as 80 square feet, is liable to error, and cannot, of course, be relied upon as the exact measure of productiveness of the different varieties. The product is given in this way, however, because to most people the yield in "bushels per acre," gives a clearer idea both as to absolute and relative productiveness than when it is given in pounds and ounces.

The following table, showing the product of each variety, is given therefore as a suggestion of what some of these varieties can do, not as a final and absolute test. Doubtless in a repetition of the experiment, a number of varieties which appear considerably below the head of the list might be found to be among the best in productiveness, and, on the other hand, those varieties which stand at the head would perhaps take a more subordinate position.

Variety No.	NAME OF VARIETY.	Total yield per acre.	Market-able.	Small.	Per cent. of market-able potatoes.
		BU.	BU.	BU.	
227	Vaughan	265 $\frac{1}{2}$	216	49 $\frac{1}{2}$	81
131	Marshall White.....	239 $\frac{1}{2}$	231 $\frac{1}{2}$	8	97
203	Sherman	219	190 $\frac{1}{2}$	28 $\frac{1}{2}$	87
32	Crown Jewel	206	142	64	69
99	Hilton Rose	204 $\frac{1}{2}$	155 $\frac{1}{2}$	49	76
133	Mill's Prize	204 $\frac{1}{2}$	179	25 $\frac{1}{2}$	88
113	King of Roses.....	200 $\frac{1}{2}$	175	25 $\frac{1}{2}$	87
31	Clay Rose.....	200	176	24	88
215	Tiral Rose.....	195 $\frac{1}{2}$	175	20 $\frac{1}{2}$	90
202	Salzer's Prizetaker	195	118	77	61
233	White Whipple.....	193 $\frac{1}{2}$	177 $\frac{1}{2}$	16	92
143	Nameless	192 $\frac{1}{2}$	172 $\frac{1}{2}$	20	90
7	Arizona	192	172 $\frac{1}{2}$	19 $\frac{1}{2}$	90
124	Monroe Pride	191 $\frac{1}{2}$	170 $\frac{1}{2}$	21	89
147	New York State	191 $\frac{1}{2}$	164 $\frac{1}{2}$	27	86

Variety No.	NAME OF VARIETY.	Total yield per acre.	Market-able.	Small.	Per cent. of market-able potatoes.
		BU.	BU.	BU.	
244	Wilson Rose	191 1/2	185 1/2	6	97
166	Polaris	190	117	73	62
93	Green Mountain.....	187 1/2	179 1/2	8	96
75	Early Norther	187 1/2	129 1/2	58	69
223	Vick's Perfection ..	187 1/2	173	14 1/2	92
218	Vick's Early Market.....	183 1/2	164 1/2	19	89
185	Rochester Rose.....	183 1/2	154 1/2	29	84
53	Early Washington.....	181 1/2	138 1/2	43	76
33	Crane's June Eating	181 1/2	140 1/2	41	77
111	James Vick.....	181	152	29	84
98	Henderson's Late Puritan	180 1/2	147 1/2	33	82
209	Thornburn's Early.....	180 1/2	136	44 1/2	76
49	Early Fortune.....	180	154 1/2	25 1/2	86
71	Early Walton	179 1/2	162	17 1/2	90
186	Rose No. 10	179	162	17	91
50	Early Rose.....	179	157	22	88
226	Vick's Early White	178	149	29	84
135	Moore's Dakota.....	177	159 1/2	17 1/2	90
210	Tuscarora Red	177	150	27	85
239	White Imperial	175	165	10	94
136	Narragansett Red	172	164 1/2	7 1/2	96
40	Carman's Favorite	171	143	28	84
44	County Cork	170	147 1/2	22 1/2	87
134	McCormick Seedling.....	169 1/2	154 1/2	15	91
125	Matchless	169 1/2	154 1/2	15	91
56	Early Mohawk Valley.....	169	152	17	90
15	Bill Nye.....	168	150	18	89
9	Baldrige Seedling	168	131 1/2	36 1/2	78
106	Irish Daisy	168	154	14	92
142	Napoleon ...	168	150	18	89
191	Summit	167 1/2	122 1/2	45	73
83	Fuller's Seedling	167 1/2	154 1/2	13	92
178	Red Star	167	95 1/2	71 1/2	57
109	Jersey White	166 1/2	151 1/2	15	91
57	Early Mohawk	166 1/2	120 1/2	46	72
190	Sherman White.....	166 1/2	154 1/2	12	93
204	State of Maine.....	165	147 1/2	17 1/2	89
88	Good News.....	164 1/2	151	13 1/2	92
73	Early Harvest	164	118	46	72
157	Paris Rose..	164	143	21	87
61	Early Ohio	163 1/2	147 1/2	16	90
46	Dewdrop	163	129 1/2	33 1/2	79
151	Ontario. Red.....	163	152	11	93
114	Lee's Favorite	162 1/2	128	34 1/2	79
80	Flower's Extra	162 1/2	137 1/2	25	85

Variety No.	NAME OF VARIETY.	Total yield per acre.	Market-able.	Small.	Per cent. of market-able potatoes.
		BU.	BU.	BU.	
92	Gov. Rusk	162	145 1/2	16 1/2	90
230	White Bermuda.....	162	143	19	88
180	Reeve's Rose	161	128	33	80
194	Signal.....	160 1/2	118	42 1/2	74
76	Early Pride.....	160	130 1/2	29 1/2	81
240	Wall's Maggie Murphy	159 1/2	155	4 1/2	97
96	German Rose.....	157	141 1/2	15 1/2	90
238	World's Fair	156 1/2	138	18 1/2	88
235	Webster Rose.....	156	143	13	92
42	Caroma Beauty	156	118	38	76
85	Gregory's No. 1.....	155 1/2	141 1/2	14	91
58	Cream City	155 1/2	116	39 1/2	75
192	Stray Beauty	155 1/2	140 1/2	15	90
26	California Best.....	155 1/2	66 1/2	89	43
123	Monroe Beauty	155	146 1/2	8 1/2	95
245	White May Queen	155	136	19	88
58	Early Essex	154 1/2	138	16 1/2	90
60	Early Puritan	154 1/2	73	21 1/2	47
77	Everett Rose	154 1/2	124	30 1/2	80
78	Early Vermont	154 1/2	104 1/2	50	68
220	Vick's Early Advance.....	154 1/2	125	29 1/2	81
236	White Mayflower.....	154	138 1/2	15 1/2	90
234	Watson's Seedling.....	154	143	11	93
104	Irish Cups.....	154	140 1/2	13 1/2	91
41	Colossal	153 1/2	145 1/2	8	95
64	Early Hebron	153	109	44	71
62	Everett's Heavy Weight.....	153	127 1/2	25 1/2	83
103	Henderson's Best.....	153	145 1/2	7 1/2	95
59	Early White Prize	152 1/2	128 1/2	24	84
74	Early Vanguard	152 1/2	112 1/2	40	74
183	Rochester Favorite	152 1/2	116	36 1/2	76
173	Queen of the Valley	152 1/2	131	21 1/2	86
159	Pat Murphy.....	152	138 1/2	13 1/2	91
79	Elephant.....	152	152	.....	100
55	Early Mayflower	152	136	16	89
228	Vick's Long Late White	152	129 1/2	22 1/2	85
23	Chapman's Early.....	151 1/2	113 1/2	38	75
19	Banner	151 1/2	151 1/2	.....	100
184	Rural New Yorker No. 2	151 1/2	118	33 1/2	78
156	Prolific.....	150 1/2	144 1/2	6	96
145	No Name.....	150	130	20	87
11	Burpee's Extra Early.....	150	118	32	79
163	Pride of the West	150	125	25	83
126	Maggie Murphy	149	125	24	84
21	Brook's No 2	149	132 1/2	16 1/2	89

Variety No.	NAME OF VARIETY.	Total yield per acre.	Market-able:	Small.	Per cent. of market-able potatoes.
		BU.	BU.	BU.	
13	Belle Rose.....	148 ½	140 ½	8	95
119	Monroe Seedling.....	148 ½	128 ½	20	87
199	State Peacon.....	148	113	35	76
8	Blush Rose.....	147 ½	138 ½	9	94
25	Charter Oak.....	147 ½	105	42 ½	71
39	Clark's No. 27.....	146 ½	104 ½	42	72
116	Lightning Express.....	146 ½	143	3 ½	98
206	Stoor's Seedling.....	146	117	29	80
176	Randall's Beauty.....	145 ½	131	14 ½	90
68	Early White Wax.....	145	127	18	88
219	Vick's Armstrong.....	145	122 ½	22 ½	84
108	Jarrard Harbinger.....	145	122	23	84
242	White Superior.....	144 ½	138	6 ½	96
243	White Elephant.....	143 ½	140	3 ½	98
158	Prolific Alexander.....	143	132 ½	10 ½	93
14	Burbank Seedling.....	143	134	9	94
81	Ford's Late White.....	143	128	15	90
69	Early Harbinger.....	143	134	9	94
43	Cayuga Chief.....	142 ½	109	13 ½	77
37	Champion.....	141 ½	128	13 ½	91
195	Strong's Pride.....	141	129 ½	11 ½	92
127	Maine Pearl.....	141	133 ½	7 ½	95
112	King Excelsior.....	140	110 ½	29 ½	79
20	Brownell's Winner.....	140	106	34	76
231	Wood's Early.....	139 ½	95 ½	44	68
217	Vick's Late White.....	138 ½	125	13 ½	91
198	Snowflake.....	138 ½	95 ½	43	69
171	Pride of America.....	138 ½	120	18 ½	87
63	Empire State.....	138 ½	109	29 ½	79
237	Wheeler's Seedling.....	137 ½	120 ½	17	88
110	Jersey Peachblow.....	136 ½	111	25 ½	82
169	Pullman's Seedling.....	136	128	8	94
107	Jumbo Charley.....	134	124 ½	9 ½	93
122	Monroe Prize.....	133 ½	120 ½	13	90
200	Seneca Beauty.....	133 ½	122 ½	11	92
189	Suffolk Beauty.....	133	118	15	89
160	Pride.....	133	125	8	94
86	Garfield.....	132 ½	129 ½	3	98
241	Wilson Rose.....	132 ½	128	4 ½	97
144	Nameless.....	132 ½	124 ½	8	94
128	Montana Rose.....	132 ½	109	23 ½	83
129	Messuck.....	132 ½	120	12 ½	91
36	Chicago Market.....	132	102	30	77
175	Rundle Rose.....	130 ½	126	4 ½	97
82	Freeman.....	130	129 ½	½	100

Variety No.	NAME OF VARIETY.	Total yield per acre	Market-able.	Small.	Per cent. of Market-able potatoes.
		BU.	BU.	BU.	
214	Telephone.....	128 ½	109	19 ½	85
222	Victor Rose	128	125	3	98
28	Chas. Downing	128	55	73	43
154	Peerless Jar	127	121	6	95
174	Queen of the Valley	127	105 ½	21 ½	83
164	Pride of New Jersey	126 ½	119 ½	27	94
72	Early Six Weeks	125	114 ½	12 ½	92
16	Bliss' Triumph	125	86 ½	38 ½	69
148	Overturn No. 9	125	113	12	90
22	Chapin's Seedling	124 ½	106 ½	18	85
118	Lake Erie	123	113	10	92
188	Rupert's Perfection	123	104 ½	18 ½	85
24	California Giant	123	111	12	90
187	Roseman Seedling	122 ½	94 ½	28	77
196	Sarnia Red	122	104 ½	17 ½	86
172	Queen Victoria	121 ½	98 ½	23	81
94	Great Eastern	121 ½	114 ½	7	94
201	Summit	121 ½	91	30 ½	75
84	Garlic	121	107 ½	13 ½	89
30	Carter's Early Sunrise	120 ½	83	37 ½	69
101	Harvest Queen	119 ½	108 ½	11	91
211	Tuscarora	119 ½	113	6 ½	95
67	Early Sunlit Star	119 ½	117	2 ½	98
193	Snowflake Jr.	119 ½	94 ½	25	79
89	Gov. Foraker	118 ½	104 ½	14	88
208	Sackett's Early	118 ½	118 ½	.....	100
197	Snow Queen	117 ½	91 ½	26	78
170	Potentate	117 ½	116 ½	1	99
152	Pinkeye Rusticate	117 ½	115	2 ½	98
90	G. B. McClelland	116 ½	97	19 ½	84
207	Spanish Beauty	116 ½	91 ½	25	78
182	Rever Rose	116	102 ½	13 ½	88
66	Enos' Seedling	116	108 ½	7 ½	94
231	Vick's Baker	115 ½	88 ½	27	77
150	Ohio Junior	115	102 ½	12 ½	89
161	Pride of the East	115	100	15	87
149	Orphan	113 ½	102	11 ½	89
51	Early Albino	113	88	25	78
65	Early Oxford	112	94 ½	17 ½	84
141	New Queen	111 ½	91 ½	20	82
213	Troy Seedling	111 ½	98	13 ½	88
120	Manchester Rose	111	107 ½	3 ½	97
121	Morning Star	111	94 ½	16 ½	85
52	Early California	111	102	9	92
225	Vick's Early White	111	103 ½	7 ½	93

Variety No.	NAME OF VARIETY.	Total yield per acre.	Market-able.	Small.	Per cent. of market-able potatoes.
		BU.	BU.	BU.	
130	Money Maker	110 1/2	103	7 1/2	93
162	Purple Blush	110	91 1/2	18 1/2	83
146	New Seedling	110	96	14	87
45	Durand Seedling	110	88 1/2	21 1/2	80
4	American Wonder	110	89 1/2	20 1/2	81
246	Yosemite	109 1/2	91	18 1/2	83
229	Vick's Abundance	109 1/2	100 1/2	9	92
168	Peerless	108 1/2	100	8 1/2	93
12	Burpee's Superior.....	107 1/2	97 1/2	10	91
117	Layman Seedling.....	107	94 1/2	12 1/2	88
137	Northern Spy.....	107	102 1/2	4 1/2	96
177	Republican.....	106	72 1/2	33 1/2	68
138	Niggertoe Seedling	105	86 1/2	18 1/2	82
3	Allegheny King	105	91	14	87
155	Putnam's Favorite	104 1/2	94 1/2	10	90
167	Pittsford Prize.....	104	85	19	82
87	Great Divide	103 1/2	91	12 1/2	88
70	Early Peacon.....	103	91	12	88
95	Genesee County	103	94 1/2	8 1/2	92
115	Late Experiment	103	91	12	88
2	Allbright's Seedling	102 1/2	92 1/2	10	90
139	New Champion.....	102 1/2	93 1/2	9	91
47	Dictator	102	102	.....	100
216	Thunderbolt.....	101	79 1/2	21 1/2	79
97	Home Comfort.....	100 1/2	89 1/2	11	89
5	American Beauty	98	94	4	86
54	Excelsior.....	95	88 1/2	6 1/2	93
153	Pane's Rose	92	83	9	90
29	Collin's Pride.....	91 1/2	61 1/2	30	67
91	Garnet Chili.....	89	83	6	93
205	Siberian White	88 1/2	70 1/2	18	80
179	Rural Blush	88	68	20	77
48	Delaware.....	86 1/2	86 1/2	.....	100
6	American Giant	86	72 1/2	13 1/2	84
105	Irish Greys.....	80	72 1/2	7 1/2	91
34	Calico	79 1/2	52	27 1/2	65
100	Home Chili.....	74	66 1/2	7 1/2	90
35	Cuba Orange	52	17 1/2	34 1/2	34
10	Badger State.....	49	36 1/2	12 1/2	74
27	California Peachblow	42 1/2	16 1/2	26	39
1	Alexander's Prolific.....	41	33 1/2	7 1/2	82
232	White Peachblow.....	38 1/2	.....	38 1/2	0
102	Henderson's Best	36	31	5	86
180	Rhode Island Peachblow	35 1/2	27	8 1/2	76
17	Baraboo White.....	30	22 1/2	7 1/2	75
165	Purple Troup	23 1/2	18	5 1/2	77

KENTUCKY
AGRICULTURAL EXPERIMENT STATION

OF THE

STATE COLLEGE OF KENTUCKY.

BULLETIN NO. 62.

STRAWBERRIES.

LEXINGTON, KENTUCKY.
MARCH, 1896.

KENTUCKY Agricultural Experiment Station.

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Address of the Station: LEXINGTON, KY.

NOTICE.

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

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

ADDRESS:

KENTUCKY AGRICULTURAL EXPERIMENT STATION,
LEXINGTON, KY.

BULLETIN No. 62.

STRAWBERRIES NEW AND OLD.

BY C. W. MATHEWS.

There is probably no other single horticultural subject concerning which inquiries are more frequently made of the Experiment Station than that of strawberries and their varieties. Questions relating to the value of any variety for a given locality are very difficult to answer with precision, for several reasons. Little or nothing is usually said as to the purpose for which the fruit is to be grown, the character of the soil under cultivation, or the kind of culture which will be given the plants when set. Even if these facts were known, there are still other causes which occasion variable results in the cultivation of any variety of strawberry, as well as of other plants, so that it is impossible for the Experiment Station to prescribe with certainty the "best" variety for any given locality.

By its tests of varieties, and a study of the conditions and results of their culture throughout the state, the Station may be able to give helpful suggestions regarding varieties, but these suggestions should be supplemented, when possible, by observation and inquiry in the grower's own neighborhood, where the conditions most closely resemble his own. If he produces berries for market, he can well afford to test for himself the

most promising new varieties, as they are brought to his notice.

While it is true, as intimated above, that the best variety, or set of varieties, for one grower may not be the most desirable for another, it is also true that certain varieties are found to give fairly successful results over a wide extent of territory. The variety "Bubach No. 5" is a good illustration of this fact, for not only is it almost universally commended by growers in Kentucky, but it is also a favorite in many other states.

It is found also by inquiry that the behavior of any variety upon our grounds usually agrees with the *general* consensus of opinion regarding it in other parts of the state.

It is therefore believed that a variety which is notable for vigor, productiveness, or other good qualities upon the Station grounds, is very likely to be of some value elsewhere, and especially if its good qualities are endorsed by the experience of growers in other parts of the state, it is reasonable to suppose that it may be found quite generally valuable throughout the Commonwealth.

In order to obtain such a general estimate of the value of different varieties, to supplement our own observations, an effort has been made to gather the experiences of strawberry growers from all parts of the state, by addressing to them letters of inquiry.

About forty of the largest and most successful growers have kindly responded to our inquiries, and the information thus obtained has been incorporated with the results of the comparative tests upon the Station grounds, in the report upon varieties.

In making use of such records and opinions as apply to the newer varieties, it should be remembered that a single season's experience is not sufficient to conclusively

establish the merits or demerits of a variety. One which may seem very promising under the conditions in which it is first grown, may prove utterly worthless under less favorable influences.

The usual methods of strawberry culture are now so well known, and are so commonly outlined in the catalogues of dealers in plants, that it is not necessary to devote space to a description of them here.

All the varieties upon which this report is based, fruited upon the variety plot at the Station farm in 1895, and were set in the spring of 1894.

The plants (usually two dozen of each variety) were obtained from various sources, some having been transplanted from our older beds, while others were purchased from nurserymen, or donated by them or the originators to the Station for trial.

They were set in rows $4\frac{1}{2}$ feet apart, and allowed to run together, forming matted rows about $2\frac{1}{2}$ feet wide. A good stand of most varieties was obtained, although it was impossible to secure this as perfectly as when the stock is all received from one careful grower and packer, or transplanted from our own grounds.

New varieties are received at intervals during the spring from widely different sources, and sometimes arrive in bad condition, owing to improper packing or delays in transit; consequently some plants die, and some, owing to late setting, drought, or individual characters fail to run and take root as freely as others.

On this account it is impracticable to obtain a perfect measure of the comparative productiveness of different varieties, at least during the first season of fruiting, so that the relative product is indicated approximately upon a scale of 0-10 in the following table.

The plot was given good care throughout the season and mulched with wheat straw about December 1; but it was

not designed to bestow any special "petting" upon these varieties, beyond what is entirely practicable with any energetic fruit-grower.

The table following is designed to show the relative period of fruiting of the different varieties between May 23 and June 18. A very few scattering berries ripened before and after these dates, but not in sufficient quantity to justify any grower in picking for market. Michel's Early and Rio would probably have ripened a considerable number of berries before the first date mentioned, had it not been for the cool and cloudy week just preceding the 23d of May, and the season of fruiting of several late varieties was no doubt considerably shortened by the total absence of any rainfall between June 6 and June 19 inclusive.

The scale of comparative productiveness in the table, as well as the duration of yield, represents the results upon our own grounds only, and in the notes upon varieties following, the same thing is true unless otherwise stated.

Strawberries.

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VARIETY.	DURATION OF YIELD.					Product Scale 5-10.
	May.		June.			
	23	30	6	13	18	
Beder Wood.....	_____	_____	_____	_____	_____	8
Michel.....	_____	_____	_____	_____	_____	5
Rio	_____	_____	_____	_____	_____	4
Luther	_____	_____	_____	_____	_____	4
Smeltzer.....	_____	_____	_____	_____	_____	3
Warfield, P*.....	_____	_____	_____	_____	_____	9
Crescent, P	_____	_____	_____	_____	_____	8
Marshall.....	_____	_____	_____	_____	_____	6
Barton's Eclipse P.	_____	_____	_____	_____	_____	9
Boynton, P	_____	_____	_____	_____	_____	7
Burt.....	_____	_____	_____	_____	_____	5
Childs	_____	_____	_____	_____	_____	5
Crawford.....	_____	_____	_____	_____	_____	5
Downing.....	_____	_____	_____	_____	_____	5
Edgar Queen P ..	_____	_____	_____	_____	_____	6
Haverland, P	_____	_____	_____	_____	_____	9
Jay Gould, P	_____	_____	_____	_____	_____	5
Leader.....	_____	_____	_____	_____	_____	5
Lovett	_____	_____	_____	_____	_____	10
Mary, P	_____	_____	_____	_____	_____	5
Middlefield, P ..	_____	_____	_____	_____	_____	4
Mrs. Cleveland, P..	_____	_____	_____	_____	_____	9
Muskingum.	_____	_____	_____	_____	_____	7
No Name.....	_____	_____	_____	_____	_____	7
Princess, P	_____	_____	_____	_____	_____	7
Tennessee Prolific..	_____	_____	_____	_____	_____	9
Beverly.....	_____	_____	_____	_____	_____	5
Bisel, P	_____	_____	_____	_____	_____	10
Brandywine..	_____	_____	_____	_____	_____	5
Enhance	_____	_____	_____	_____	_____	9
Greenville, P	_____	_____	_____	_____	_____	10
Princeton Chief, P	_____	_____	_____	_____	_____	10
Saunders.....	_____	_____	_____	_____	_____	7
Standard, P	_____	_____	_____	_____	_____	8
Swindle, P	_____	_____	_____	_____	_____	8
Jucunda Improved..	_____	_____	_____	_____	_____	5
Parker Earle.....	_____	_____	_____	_____	_____	7
Regina, P	_____	_____	_____	_____	_____	4
Timbrell, P	_____	_____	_____	_____	_____	9
Gandy.....	_____	_____	_____	_____	_____	5

*P.—Pistillate or imperfect flowered.

ACCOMAC. A berry of medium size, unproductive and irregular here, and so reported at other stations.

BARTON'S ECLIPSE, P. A moderately firm berry of good size and productive, but somewhat irregular in shape, and discarded by some of our correspondents on account of rust.

BEDER WOOD. An early, perfect-flowered variety, which is quite productive. First berries are of fair size, but they soon become too small. Foliage is very subject to rust on our grounds as elsewhere. Of some value as an abundant producer of pollen.

BELLE. Not productive or otherwise valuable here; the only report received is also unfavorable.

BEVERLY. Plants strong and perfect-flowered. Berries of medium size. We have received several favorable comments upon this variety, although only moderately productive here and in Woodford county.

BISEL, P. (Dan Bisel) Appeared like a promising market variety upon our grounds. Berries of good size and fine looking, dark red in color and for the most part regular in shape. One of the most productive varieties fruiting here the past season, giving its largest yield June 11. The experience of others in the State is not so decidedly in its favor, although apparently not generally fruited yet. Somewhat affected by rust.

BOYNTON, P. Small to medium in size, evenly colored and fairly regular; productive; considerable rust. Much like the Crescent, if not identical with it.

BRANDYWINE. From reports, apparently not fruited much in Kentucky as yet. Reports upon plants are very favorable, and reports from other States have quite highly commended it, but upon our own grounds it has not shown any superiority in fruit to other varieties; moderately productive of medium to large berries, which with us were often rough and mis-shapen.

BUBACH, P. A standard variety now largely grown for market over a wide extent of country. Owing to local causes we did not secure as good a stand as usual of this variety, but in previous seasons it has been one of the best, the plant being vigorous and productive; berries large, regular and beautiful, and firm enough to ship a short distance; a favorite almost everywhere in Kentucky. A minor fault noted by several, is that it sometimes does not produce runners enough to ensure a good stand of plants.

BURT. A symmetrical berry of medium size, not very productive or good in quality. Plants dwarf, with abundant foliage, which, however, is badly affected by rust.

CAMERONIAN. Berries medium to large; rather irregular; not productive.

CHILDS. A rather pale berry, low conical in form, and quite attractive in appearance upon the few plants which fruited in 1895. Apparently only medium in productiveness.

CRAWFORD. With us, as in most places, not very productive, but the berries are of superior quality, and large and regular in size and coloring. Considerably subject to rust. Best adapted to the amateur who will give it extra care.

CRESCENT, P. This old variety is still evidently one of the favorites with many Kentucky growers, especially with those who ship their fruit, on account of its hardiness and productiveness. It will endure neglect better than any other kind, but many are discarding it in favor of the larger and more showy varieties.

DAYTON. Of good size and fair quality, but only moderately vigorous or productive, and its season was very short here, lasting only eleven days.

DOWNING. One of the older varieties which was long a general favorite, but while still grown considerably

for home use and near market, is now being supplanted by more productive varieties; is used by some to pollinate Crescent, Bubach and other pistillate varieties; generally reported as suffering a good deal from rust.

EDGAR QUEEN, P. A variety which has been cultivated a number of years, and concerning which reports have been quite conflicting. Only moderately productive here, and its large berries are frequently green-tipped and cox-combed.

EDWARD'S FAVORITE. Medium to large berries; not very productive; shows considerable rust.

ENHANCE. Productive here; of medium size and somewhat irregular; not high in quality; valued by some as a shipping berry, because of its firmness. By several correspondents rated high, from one or two season's observation.

ENORMOUS, P. We received in 1894 a few plants of this variety in bad condition, so that only one or two survived. A correspondent in Gallatin county writes concerning it, "If you have none of these try a few by all means; I believe the variety equal to Bubach, and firmer."

EPPING, P. Plant vigorous; moderate in productiveness; has not done as well as in previous seasons. Berries the past seasons were very irregular with many green tips.

E. P. ROE. A failure here as nearly everywhere.

EUREKA, P. Shows no valuable characteristics here. Berries irregular; not productive.

FARNSWORTH. Small to medium berries; regular and of fair quality, but not productive, and had considerable rust.

GANDY. Second only to Bubach and Haverland as a favorite in Kentucky; not on account of its productive-

ness, which is only moderate, but because it possesses nearly every other good quality of a late variety. Plant vigorous; perfect flowered; berries large, firm and handsome, and of good quality. The best shipping variety in general cultivation; does not in general suffer much from rust.

GOV. HOARD. Reports of this variety are generally not very favorable.

GREENVILLE, P. One of the newer varieties from which reports from other Experiment Stations have been almost uniformly favorable. Upon our grounds the plants have appeared vigorous and but slightly affected by rust. The fruit was large, abundant, attractive in appearance, regular in form, and while not firm enough to ship long distances, seems well adapted to home use or a near market. One Kentucky grower of experience, however, reports that "it withered more than anything I had last year during the fierce heat of gathering time."

HAVERLAND, P. A well-known variety in Kentucky and in many other States. One of the most largely grown for market. A long, somewhat flattened and pointed berry, rather light in color, and not high flavored, but very productive and can be shipped for moderate distances; among the early varieties, and holds out in yield for a long time; with very rare exceptions, highly commended by market growers everywhere in Kentucky; not quite equal to some others for the home table or for canning.

H. W. BEECHER. Having arrived in bad condition, there were but few plants to fruit. Our impressions of the variety were not very favorable. Berries large, but irregular and rather insipid in flavor; not very productive here.

JAY GOULD, P. Plant vigorous and but little affected

with rust. Berries of medium size, very symmetrical and handsome, dark glossy red in color, and of good flavor, but not productive enough.

JUCUNDA IMPROVED. Medium to large; regular and attractive in appearance; not very productive.

LEADER. Of no decided excellence here; only moderately productive; at first large and irregular in shape, but rapidly deteriorates in size.

LOVETT. Reports from this variety through the state are quite conflicting, but in the majority of cases favorable; in some localities subject to rust. Upon our grounds the few plants we had gave a large yield of second-class berries of medium size; apparently a profitable market berry with some growers.

LUTHER. An early, large and good berry, although not productive last season.

MARY, P. Medium to large; of even size and coloring, good quality, but from the few plants in fruit it appeared unproductive; plant vigorous and nearly free from rust.

MARSHALL. The largest berry grown here during the past season. Quite regular for so large a berry; dark in color and of good quality. A pleasing variety for the amateur and for home use, but not productive enough for the market grower. Plant strong and healthy.

MARTHA, P. Moderately productive, but has little to recommend it here.

MIAMI, P. Moderately productive, but small and unattractive.

MICHEL. Valuable chiefly for its earliness and abundant pollen. During the past season it ripened its two largest pickings here before Bubach and Haverland were picked at all. Not very productive and usually produces too many plants for the best results if left to itself. A few berries ripened upon our plot May 14, but on account of storms there were no more until May 23. Many of

our correspondents reported upon this variety, and the majority favorably. One grower in Pulaski county values it so highly that while he has now 10 acres of it he will set 5 more the coming season. Plant very vigorous and so early that it not infrequently suffers from late frosts in many localities.

MIDDLEFIELD, P. Large and very handsome berries. Plants vigorous and healthy but generally reported unproductive.

MRS. CLEVELAND. Quite productive and comparatively free from rust as grown here last season, but berries were quite irregular in shape. Other growers report it as rather unreliable, although one commends it.

MUSKINGUM. Berries large and regular in form, attractive in appearance, and fairly productive. Plants vigorous and free from blight. A pleasing variety for home use, although not successful everywhere.

NO NAME, (GANDY BELLE.) Quite productive last season. Berries of good size but often irregular with green tips; rusted considerably; a few favorable reports of it were received.

PARKER EARLE. A perfect flowered variety that is fairly productive on our grounds, although reports from other States vary in character. Sets a large number of berries, and unless conditions as to moisture and fertility are favorable, cannot bring them all to maturity. Plant considerably subject to blight on our grounds.

PRINCESS, P. Yielded a good crop on our soil, of large, fairly regular berries; of good quality, not very firm. A careful grower in Warren county reports it a failure there.

PRINCETON CHIEF, P. A rather late variety, healthy and very productive for the few plants in our plot. Berries medium in size, rather acid in flavor. Favorably commented on in Warren county.

REGINA, P. Late, small and unproductive here.

RIO. Ripens with Michel's Early and yielded about the same. Medium to large in size, regular and attractive in shape and coloring. Worthy of further trial, especially for home use, on account of its earliness, beauty and excellent quality. Nearly free from rust. Like Michel, it is liable to suffer from late frosts.

SAUNDERS. Medium size, fairly productive, but as grown here not very attractive on account of green tips and irregular shape; rather sour.

SMELTZER. Begins to ripen early; not valuable here apparently; because of its unproductiveness and its irregular berries with green tips.

STANDARD, P. Fairly productive but otherwise not especially valuable here, as in other places where it has been observed.

SWINDLE, P. Fairly productive, but rather small and sour, and seriously affected with blight. So far as learned, it is not valuable elsewhere.

TENNESSEE PROLIFIC. Quite productive; berries of good size but with us, were very irregular with many green tips and sides.

TIMBRELL, P. A late variety which is quite productive and ripened its largest picking here later than any other variety. Fruit of good quality, medium to large in size. Its greatest fault, and a serious one for market purposes, is the dingy, spotted appearance of the berries, rendering them almost unsaleable. Has some value for the home garden on account of lateness and quality.

WARFIELD, P. An early, productive variety, of good color and a fair shipper; of medium size, conical in shape, and in several places in Kentucky, reported as one of the best market varieties. Several have noted a difficulty in securing its proper fertilization.

WESTBROOK, P. Unproductive; berries small.

WEST LAWN, P. Medium to large, roundish conical, regular, bright color, and of good quality, but only moderately productive the past season.

SUMMARY.

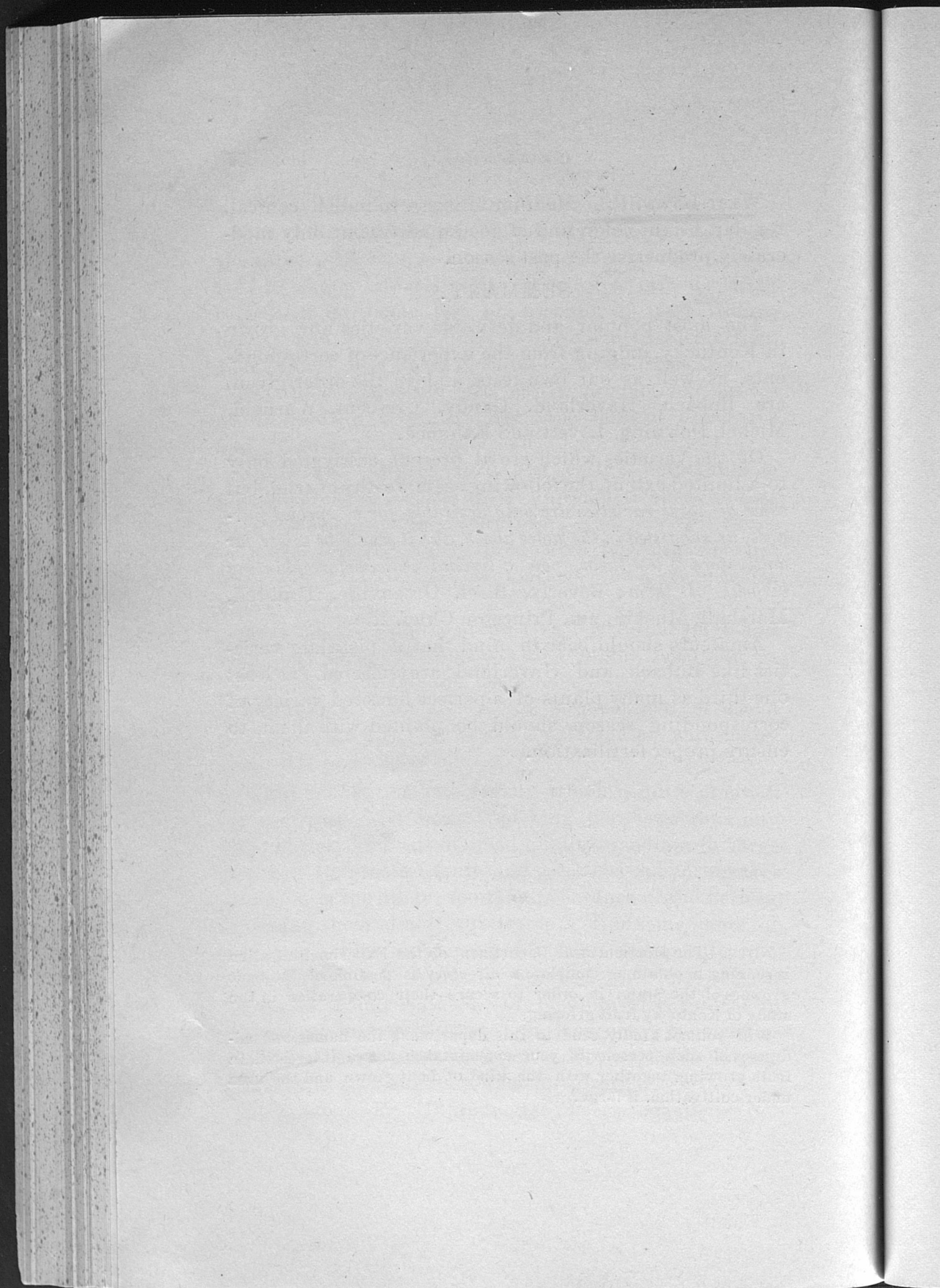
The most popular and desirable varieties now grown in Kentucky, judging from the experience of correspondents, as well as our own tests, and [in the order given, are Bubach, Haverland, Gandy, Crescent, Warfield, Michel, Downing, Lovett and Enhance.

Of the varieties which are at present cultivated only to a limited extent, the following seem worthy of trial, but *some of these varieties are only desirable for a special purpose, as suggested in the notes above, and it would be wiser for cultivators to test them upon a limited scale, before planting largely of them*; Beverly, Bisel, Greenville, Timbrell, Marshall, Muskingum, Princeton Chief, Rio.

Amateurs should bear in mind that if pistillate varieties like Bubach and Haverland are selected, at least one-third as many plants of a perfect flowered variety of corresponding season should be planted with them, to ensure proper fertilization.

NOTE.—The Horticultural Department of the Experiment Station is seeking to obtain as complete a directory as possible of the fruit growers of the State, in order to secure their co-operation in the study of Kentucky fruit growing.

Will you not kindly send to this department the names and addresses of such persons of your acquaintance as are interested in fruit growing, together with the kind of fruit grown and the area under cultivation, if large?



KENTUCKY
AGRICULTURAL EXPERIMENT STATION

OF THE
STATE COLLEGE OF KENTUCKY.

BULLETIN NO. 63.

TOBACCO.

LEXINGTON, KENTUCKY.
MAY, 1896.

KENTUCKY Agricultural Experiment Station.

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NOTICE.

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

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

ADDRESS:

KENTUCKY AGRICULTURAL EXPERIMENT STATION,
LEXINGTON, KY.

BULLETIN NO. 63.

TOBACCO.

Test of Fertilizers.

BY

M. A. SCOVELL AND A. M. PETER.

The object of the test was to study the effect of commercial fertilizers on the quantity and quality of Burley tobacco grown on worn out land.

It has been shown from our experiments heretofore that phosphoric acid, or phosphoric acid and nitrogen, without the assistance of potash compounds had little, if any, effect on increasing the yield of tobacco. Therefore, in our plan of experiments, no plots were reserved for applying phosphoric acid or nitrogen alone, or the combination of the two.

The plan adopted was as follows :

Plot 1.—Received 20 pounds crude nitrate of potash, from tobacco stems, and 14 pounds double superphosphate of lime.

Plot 2.—16 pounds sulphate of potash.

Plot 3.—No fertilizer.

Plot 4.—48 pounds carbonate of potash and magnesia.

Plot 5.—20 pounds nitrate of potash.

The nitrate of potash used was obtained from Henderson, Ky., and is a by-product resulting from concentrating

an extract of the stems, or mid-ribs of the leaf. This by-product is nearly pure nitrate of potash, as shown by the analysis. The percentage of potash found in this nitrate was 41 and percentage of nitrogen 11.5. Therefore, on the plots receiving the nitrate of potash, 82 pounds of potash were applied, and 23 pounds of nitrogen as nitrate.

The double superphosphate contained 40 per cent of available phosphoric acid, so that plot No. 1 received 56 lbs. of phosphoric acid. The sulphate of potash contained about 50 per cent of potash, therefore, plot No. 2 received 80 pounds of potash. The carbonate of potash and magnesia contained 20 per cent. potash, or plot 4 received 96 pounds potash.

As plot 5 received the same amount of nitrate of potash as plot 1, it received the same amount of potash and nitrogen as plot 1.

The latter part of the season was unfavorable to the experiments, for the continued dry weather undoubtedly caused the plants to prematurely ripen. Our field notes show that on August 15, all plots with the exception of No. 3, that which had received no fertilizer, were growing well, and that the plants in plots 1 and 5 were especially fine. On September 1st, the field notes give the condition "as only fair" on all the plots save No. 3, which is given as "poor."

The following table shows the kind and amount of fertilizer used and the yield of tobacco calculated per acre for each plot:

Table 1.—Tobacco—Test of Fertilizers.

No. plot.	Fertilizers Used.		No. stalks to plot.	Yield of Tobacco in pounds per acre			
	Name.	Pounds per acre.		Long Red.	Short Red.	Trash.	Total.
1	Double Superphosphate.	140					
	Nitrate of Potash.....	200	819	635	320	440	1395
2	Sulphate of Potash.....	160	824	470	330	390	1190
3	No Fertilizer.....		792			555	555
4	Carbonate of Potash and Magnesia.....	480	866	520	380	420	1320
5	Nitrate of Potash.....	200	855	535	410	430	1375

In none of the plots was the stand perfect. Eight hundred and eighty plants were set out in each plot. There is no question but that some correction should be made for missing hills in making comparisons as to the yield of the various plots, but it is difficult to determine the true correction. In correcting to a perfect stand more or less of an error creeps in, in the fact that wherever there is a missing hill the plants immediately adjacent have more space in which to grow, and in consequence are ranker than they otherwise would have been. With this error in view the corrected yields are perhaps better for comparison. The yield of the plots corrected to a perfect stand is here given.

Table 2—Effect of Fertilizers on Tobacco.

No. Plot.	Fertilizers Used.		Yield of Tobacco in pounds per acre			
	Name.	Pounds per acre.	Long Red.	Short Red.	Trash.	Total.
1	Double Superphosphate ...	140				
	Nitrate of Potash.....	200	682	344	473	1499
2	Sulphate of Potash.....	160	502	352	417	1271
3	No Fertilizer.....				617	617
4	Carbonate of Potash and Magnesia.....	480	528	386	427	1341
5	Nitrate of Potash.....	200	551	422	442	1415

The results indicate that a satisfactory yield can be produced on our worn soils by applying potash fertilizers, and especially potash with nitrogen. The quality of tobacco raised, however, was only fair, not up to standard. The leaves were too short, deficient in "body," and color only fair. The dry weather, causing the plants to dry up rather than ripen, probably had more to do with the inferior quality than the soil. Further experiments may enable us to determine this.

Chemical analyses were made of the tobacco from each plot and also of the stalks, for the purpose of determining the amount of nitrogen, phosphoric acid and potash removed from the soil in each case by the crop. The results are given in the following tables.

They show that the tobacco raised on the experimental

plots was much poorer in these constituents, especially in potash, than is usually the case. The general run of tobacco contains at least three or four times as much potash as was found in that raised on plot No. 4. A reason for this has already been suggested in the fact that the plants seem to have dried up before they were fully developed. At any rate, the results, while interesting, appear to be exceptional and should not be used in estimating the effect which an average crop would have upon the soil.

TABLE 3.—Pounds of Nitrogen, Phosphoric Acid and Potash Contained in 100 lbs. of Tobacco, "In Case" as Taken From the Barn, Grown on the Experimental Plots.

Number of Plot.	1	2	3	4	5
Moisture	26.5	26.1	26.6	27.4	27.1
Nitrogen	2.63	2.25	3.08	2.25	2.24
Phosphoric Acid..	.69	.75	.55	.65	.62
Potash.....	.80	.79	.45	1.08	.71
Fertilizer used contained.	Nitrogen, Phosphoric Acid, Potash.	Potash.	No Fertilizer	Potash.	Nitrogen, Potash.

TABLE 4.—Pounds of Nitrogen, Phosphoric Acid and Potash Contained in 100 lbs. of Stalks of the Tobacco Grown on the Experimental Plots.

Number of Plot.	1	2	3	4	5
Nitrogen	2.44	2.49	2.62	1.86	2.32
Phosphoric Acid..	.57	.58	.52	.60	.58
Potash.....	1.45	1.35	.63	1.50	1.62
Fertilizer used contained.	Nitrogen, Phosphoric Acid, Potash.	Potash.	No Fertilizer	Potash.	Nitrogen, Potash.

Table 5—Nitrogen, Phosphoric Acid, and Potash Removed in the Crop, Expressed in Pounds Per Acre.

Number of Plot.	1	2	3	4	5
Nitrogen in the tobacco.....	39.4	28.6	19.0	30.2	31.7
Nitrogen in the stalks.....	11.7	9.2	4.6	8.2	11.9
Total in the crop as harvested.....	51.1	37.8	23.6	38.4	43.6
Amount applied in the fertilizer ...	23.	.0	0.	0.	23.
Phosphoric acid in the tobacco.....	10.3	9.5	3.4	8.7	8.8
Phosphoric acid in the stalks.....	2.7	2.2	0.9	2.6	3.0
Total in the crop as harvested.....	13.0	11.7	4.3	11.3	11.8
Amount applied in the fertilizer...	64.	0.	0.	0.	0.
Potash in the tobacco	12.0	10.0	2.8	14.5	10.0
Potash in the stalks.	6.6	5.0	1.1	6.7	8.3
Total in the crop as harvested	18.6	15.0	3.9	21.2	18.3
Amount applied in the fertilizer....	82.	80.	0.	96.	82.
Total Weight of Tobacco and stalks.	1980.	1642.	791.	1780.	1930.

For the sake of comparison we introduce here the analyses of a few other samples of White Burley tobacco as follows:

No. 2117, sent by Maj. Phil Bird, Shelbyville, in February, 1893. A very fine specimen of tobacco; crop of 1892.

No. 2798, grown at the Station farm in 1894, on plot 4 of the experiments with fertilizers. This plot received as fertilizer the double carbonate of potash and magnesia and nitrate of soda at the rate of 300 lbs. and 160 lbs. per acre, respectively, corresponding to 60 lbs. potash and 26 lbs. nitrogen per acre. The total yield of tobacco was at the rate of 1650 lbs per acre and rather poor in quality. (See Bulletin 55, page 53.)

No. 2799, grown by Benj. D. Peter, Fayette county, on good land, without the use of fertilizers. The tobacco was of fair quality. Crop of 1894.

No. 2879, from Maj. P. P. Johnston, Fayette county; a very fine specimen of tobacco. Crop of 1894.

TABLE 6.—Pounds Nitrogen, Phosphoric Acid and Potash Contained In 100 lbs. of Tobacco "In Case."

Station Number.	2117	2798	2799	2879
Moisture	25.	25.	25.	25.
Nitrogen	2.43	3.21	3.32	3.18
Phosphoric Acid.....	.75	.65	.39	.91
Potash	5.91	3.08	3.94	5.02

As these samples were nearly dry when received at the laboratory, the results of the analyses have been calculated to 25 per cent. of moisture, which is about enough to bring the tobacco into "case."

From these results it will be seen at once that the amount of nitrogen, phosphoric acid and potash in tobacco is very variable. We are unable at present to ac-

count certainly for this variation, but a possible explanation is that the crops were gathered at different stages of maturity, owing to differences of season.

The following analysis of tobacco stalks may be of interest here, as showing that good stalks are quite valuable as a fertilizer on account of the nitrogen and potash they contain. A comparison of the two analyses also shows that the greater part of these constituents is easily washed out by exposure to rains.

No. 3323—Tobacco stalks, crop of 1895, from a pile in the barn at the Dr. Peter farm, Fayette county.

No. 3324—Tobacco stalks from the same crop, picked up from the ground outside the barn where they had been exposed to the weather for a month or two.

Table 7—Pounds of Nitrogen, Phosphoric Acid and Potash Contained in 100 Pounds of Tobacco Stalks.

Station Number.	3323.	3324.
Nitrogen	3.06	1.67
Phosphoric Acid.....	.92	.69
Potash.....	3.65	.63

The stalks are not as rich as "stems," but are certainly worth using as fertilizers.

The Use of Arsenites on Tobacco.

BY

H. GARMAN, ENTOMOLOGIST AND BOTANIST.

A tenth acre was set aside in the spring of 1895 for an experiment having for its object to determine when tobacco should be sprayed and the number of times applications should be made during the season. The plot was planted in eight rows. Row 1 was sprayed once; row 2, twice, and so on, the last row receiving eight applications at as many different dates. Hence it was possible at the end of the season to see the effect of sprayings made early in summer side by side with the result of spraying to mid-summer, and of spraying at regular intervals close up to cutting time. The following are the dates of spraying for the eight rows:

Row 1.—July 3.

Row 2.—July 3, 11.

Row 3.—July 3, 11, 18.

Row 4.—July 3, 11, 18, 25.

Row 5.—July 3, 11, 18, 25; August 2.

Row 6.—July 3, 11, 18, 25; August 2, 8.

Row 7.—July 3, 11, 18, 25; August 2, 8, 15.

Row 8.—July 3, 11, 18, 25; August 2, 8, 15, 22.

The proportion of Paris green and water used was one-fourth pound to forty gallons. The quantity of the mixture used varied with the size of the plants, from one to two gallons per row.

While at first it required but eight gallons for the tenth acre, we were obliged when the plants were grown to use the mixture at the rate of sixteen gallons for the tenth, in order to wet the plants thoroughly. Excepting ten plants at the end of each row the tobacco was cut September 4.

Up to the middle of August the appearance of this tobacco was very good, better, perhaps, owing to the superior richness of its soil, than any other plot on the Experiment Farm. But previous to this time some injury from worms had been noted in rows 1 to 3, and after the middle of August rows 1 to 6 were more or less injured. It was evident that early spraying without later applications to back it up, could not be depended on to stop the injuries of the worms. The reason for this is probably because the Paris green is removed in course of time by rain and wind, and is partly due to the fact that early spraying reaches only the early formed leaves, those developing subsequently being completely at the mercy of the worms.

It might be supposed that because the plants sprayed only at the beginning of the season suffered greatly later from the worms, that early applications were useless, and only late ones could be trusted to prevent injury. I think this is not a fair inference. When our first application was made, July 3, a brood of worms was making its appearance on the plants, the dead worms subsequently observed being about one-half inch long. There can be little question, I think, but that these worms would have done a good deal of mischief before going into the ground, and that the later brood would have been much more abundant and destructive as a result of their having been permitted to mature, so that even though the leaves upon which these worms would have fed largely were those next the ground, and consequently of little value, it would have been unwise to permit the worms to complete their development.

At the same time it is evident from our experiment that the late brood is the most destructive one, and that spraying that does not take it into account will completely fail of its object. Very early spraying is useless against

this brood. An examination of the plants with reference to injury on August 31, after the least application had been made gave the following result:

Row 1.—43 plants injured.

Row 2.—50 plants injured.

Row 3.—56 plants injured.

Row 4.—37 plants injured.

Row 5.—31 plants injured.

Row 6.—11 plants injured.

Row 7.— 3 plants injured.

Row 8.—None injured by worms.

Plants injured to any extent, however slight, were included in making this count, and consequently it may be by itself somewhat misleading. The injury did not diminish gradually in severity from row 1 to 3, but the plants of the last were as badly gnawed as any on the first row. On rows 4 and 5 the plants were not so extensively injured, although it was evident that if saving them from injury was the purpose of our work they should have been sprayed subsequent to August 2. Row 6 showed the injury much reduced as compared with row 5, a proof that the mixture applied on August 8 was an effective spraying for the injuries of the late brood, though it did not entirely prevent injury.

The quantity of fluid used and the amount of Paris green which was applied to the plants are of interest in connection with Dr. A. M. Peter's report on the analyses of the tobacco taken from the rows. The following is an estimate of the quantities they received. The spraying was done just as it would be in the tobacco field and some allowance is to be made for the fluid that did not strike the plants, that dripped from the leaves, or was dissipated in the air.

Row 1.—Received 1 gallon containing 0.1 ounce of Paris green.

Row 2.—Received 1.7142 gallons containing 0.1714 ounce of Paris green

Row 3.—Received 2.4642 gallons containing 0.2464 ounce of Paris green.

Row 4.—Received 3.3642 gallons containing 0.3364 ounce of Paris green.

Row 5.—Received 4.4892 gallons containing 0.4489 ounce of Paris green.

Row 6.—Received 5.4892 gallons containing 0.5489 ounce of Paris green.

Row 7.—Received 6.7392 gallons containing 0.6739 ounce of Paris green.

Row 8.—Received 8.7392 gallons containing 0.8739 ounce of Paris green.

Reference to Dr. A. M. Peter's table in his statement following this paragraph shows that on rows 1 and 2 only a trace of arsenic remained at cutting time, and since he finds a small trace in tobacco that has not been sprayed at all it may be assumed that practically all of that applied to these plants was gone when they were cut on September 4. His laboratory number, 3198, is applied to plants of row 1, which were left standing when the rest of the row was cut, and on September 5 were sprayed and then cut as soon as dry. Since only a trace of arsenic was obtained from the other plants of the same row (sprayed only on July 3) it is evident that the large percentage (.0139) of arsenic obtained came mainly from the last spraying. The result illustrates the extent to which arsenic is removed from plants when time elapses between spraying and cutting, and shows the importance of avoiding applications of Paris green near the time of harvesting the crop. Even tobacco from row 8 (sprayed eight times) yielded less arsenic than these late sprayed plants of row 1. The only plants that did yield more of the poison were such as received two late

spraying, once on September 5 and again September 19, and were cut immediately after the last spraying. They are numbered 3206 in Dr. Peter's table. With the exception of numbers 3198 and 3206, all the tobacco analyzed by Dr. Peter was cut September 4.

May 16, 1896.

Prof. H. Garman,

DEAR SIR:—The following is a statement of the amount of arsenic found by analysis in the samples of tobacco from the several sprayed rows in your experiment. The figures given are the averages of two separate determinations and show the amount of "white arsenic" or arsenious oxide found in each sample, calculated both as per cent. of the dry tobacco and as grains in one pound of the same.

Arsenious Oxide in the Dry Tobacco.

Laboratory No....	3197	3198	3199	3200	3201	3202	3203	3204	3205	3206
Number of Row...	1	1	2	3	4	5	6	7	8	1 to 8†
Times Sprayed....	1	*2	2	3	4	5	6	7	8	‡
Per Cent. Arsenious Oxide....	trace	.0139	trace	.0002	.0010	.0034	.0041	.0069	.0693	.0252
Grains Arsenious Oxide in 1 lb....	trace	.973	trace	.014	.070	.238	.287	.503	.651	1.764

* These plants were cut as soon as they were dry from the second spraying.

† A few plants were allowed to remain at the end of each row and were sprayed twice after the main part had been cut.

‡ Sprayed late.

If it is desired to ascertain the corresponding amounts of Paris green, it is only necessary to double these figures, because this material contains about half its weight of arsenious oxide.

Paris green also contains copper, and small amounts of that metal were found in all the samples, but its quantity was not satisfactorily determined.

While the question whether or not there is any danger to the consumer from the practice of spraying with arsenites, is still open to discussion, it would seem hardly probable that such small quantities of arsenic as were found in the tobacco from rows 5 and 6, only two or three tenths of a grain in a pound, would have any perceptible effect. Indeed it may be confidently asserted that the amount of arsenic contained in the small fraction of a pound which a man would consume in a day, even if taken at one dose instead of being distributed throughout the twelve hours, would produce no harmful effect. On the other hand, in view of the serious results to health which have been traced to the use of arsenical wall papers, it may be questioned whether these small quantities of arsenic may not do harm when constantly applied to the surfaces of the mouth and lungs. So far no instance of poisoning from the use of sprayed tobacco has come under the writer's observation, although it is known that a number of men who practice spraying with Paris green are also in the habit of smoking and chewing their own tobacco.

Very respectfully,

ALFRED M. PETER.

The Proportion of Paris Green to be Used.

There is a disposition everywhere in spraying plants of all sorts to use more poison than is needed. If one-quarter pound of Paris green in 40 gallons is enough, why use more? It is sometimes claimed that these dilute mixtures are not as effective as stronger ones. They may not kill as quickly, but they are less costly, and are not hurtful to the plants, besides being less likely to affect the quality of the tobacco. As illustrating this point some tests which I made last fall at the Station with mixtures of different strengths are presented below.

No. 1.

September 16, 1895, two worms in breeding cage were given tomato leaf dipped in Paris green mixture (one-quarter pound to 40 gallons) at 6 p. m.; 3 p. m., September 17, both dead.

No. 2.

September 17, brushed piece of tobacco leaf with Paris green mixture (1 pound to 160 gallons) and put in jar with worm at 2:30 p. m.; 8:30 a. m., September 18, worm alive, has eaten but little; 3:30 p. m., September 18, apparently sick; 7:50 a. m., September 19, dead; has eaten perhaps one square inch.

No. 3.

This is a duplicate of No. 2. 8:30 a. m., September 18, worm alive; has eaten perhaps a half square inch of leaf; 11:05 a. m., September 18, dead; about one square inch of leaf eaten.

No. 4.

This is another duplicate of No. 2. 8 a. m., September 18, worm alive; has eaten about one-half square inch of leaf; 7:50 a. m., September 19, sick; 9 a. m., September 20, alive yet; put in tomato leaf with Paris green of same strength as used in No. 2; 8:10 a. m., September 21, dead; has not eaten any of tomato leaf.

No. 5.

At 2:45 p. m., September 17, gave worm tobacco leaf brushed with Paris green and water (1 pound to 120 gallons); 9 a. m., September 18, worm alive; 7:50 a. m., September 19, alive; 8:10 a. m., September 21, alive; 10 a. m., September 22, alive; has not eaten lately; 10:30 a. m., September 23, nearly dead; 8 a. m., September 24, dead.

No. 6.

This duplicates No. 5. 9 a. m., September 18, worm sick; has eaten about two square inches of leaf; 7:50 a. m., September 19, very sick; 9 a. m., September 20, dead.

No. 7.

Another duplicate of No. 5. 9 a. m., September 18, worm alive and active; can not see that it has eaten anything; 7:50 a. m., September 19, alive; 9 a. m., September 20, dead. Possibly this worm starved rather than eat the poisoned leaf. At any rate I could see no trace of gnawing on leaf.

No. 8.

At 2:50 p. m., September 17, brushed leaf with Paris green mixture (1 pound to 100 gallons); 9 a. m., September 18, worm dead; has eaten about one square inch of leaf.

No. 9.

This is a duplicate of No. 8. 9:10 a. m., September 18, worm very sick; has eaten about one square inch; 11:10 a. m., September 18, dead.

No. 10.

This duplicates No. 8. 9:10 a. m., September 18, alive; has eaten about one square inch of leaf; 7:50 a. m., September 19, alive; 9 a. m., September 20, alive; replaced tobacco leaf with tomato leaf, brushed with same mixture; 8:10 a. m., September 21, alive; 10 a. m., September 22, dead; has not eaten last food.

No. 11.

At 2:50 p. m., September 17, gave worm tobacco leaf brushed with Paris green mixture (1 pound to 60 gallons); 9:20 a. m., September 18, worm very sick; has

eaten about one square inch; 7:55 a. m., September 19, sick; 9 a. m., September 20, alive; replaced tobacco leaf with tomato leaf brushed with same mixture; 8:10 a. m., September 21, dead; has not eaten last food.

No. 12.

This is a duplicate of No. 11. 9:10 a. m., September 18, worm very sick; has eaten about one and one-half square inches of leaf; 7:55 a. m., September 19, sick; 9 a. m., September 20, dead.

No. 13.

This is also a duplicate of No. 11. 9:20 a. m., September 18, worm sick; has eaten about one square inch; 7:55, September 19, dead.

No. 14.

At 2:55 p. m., September 17, a worm was given tobacco leaf brushed with Paris green mixture (1 pound to 40 gallons); 9:25 a. m., September 18, alive; 7:55 a. m., September 19, dead; about three-quarters of a square inch of leaf eaten.

No. 15.

This duplicates No. 14. 9:25 a. m., September 18, alive; has eaten little or nothing; 7:55 a. m., September 19, dead; very little eaten.

No. 16.

This is a second duplicate of No. 14. 9:30 a. m., September 18, worm appears sick; has eaten little or nothing; 11:15 a. m., Sept. 18, dead; very little eaten, perhaps a square inch.

Other worms kept in jars and cages and fed on untreated leaves during this time, completed their growth and changed in most cases, when not parasitized, to pupæ.

The Life History of the Tobacco Worm.

A knowledge of the life-history of this insect, and particularly of the number of broods of worms which appear each season, is of a good deal of importance in spraying. After gathering up all of my notes from 1889 to 1895, inclusive, I find that there is some evidence of three annual broods, instead of two, as has been thought to be the number through the South.

On June 8, 1895, adult moths were captured by me at Lexington. These probably represented the adults from worms which went into the ground and changed to pupæ in the fall of 1894. On July 3 a nearly grown worm was taken from a tomato plant in my garden and on July 9 it had changed to a pupa in the ground.

Young worms recently hatched have been observed on tobacco July 3, 1894; July 9, 1894; July 11, 1889; August 9, 1894, and September 9, 1895.

Those observed during the first half of July probably represent a second brood, the first one developing in tomato or some other plant. The third brood would, therefore, be the one which appears during early August and does most of the injury to tobacco. The young worms, which were noted by me last fall on the refuse tobacco left after cutting, are probably from occasional adults of the third brood which during long mild autumns come out in fall instead of spring. (I took, September 18, 1890, a moth just from the ground, and with the wings not yet expanded.) Such young are liable at any time to be destroyed by frost, and I think ordinarily do not become adult, still, it is not altogether improbable that during some of the exceptionally mild fall and winter weather experienced here, some go into the ground to pass the winter.

To the grower the important facts in the life history of

the insect are the appearance of a brood in early July and of another in early August.

Conclusion With Reference to Tobacco Worm Injury.

1. It is not necessary to spray tobacco more than three times, provided the times of making the applications are well chosen.

2. Judging by our experience, the proper time to apply Paris green is early in July and again in early August, but extended experience will probably show the broods to vary somewhat in times of appearance, with the season. The thing to do, consequently, is to watch the plants and apply the poison as soon as the young worms begin to appear. A third application may safely be made about the middle of August.

3. Use weak mixtures, even if you are forced to spray four times. One pound of Paris green in 160 gallons of water is enough if applied at the proper time, namely, when the worms are young. I should not use more than one pound in 120 gallons, in any case.

4. Where tobacco is grown on a large scale it is economy to get a copper knapsack sprayer, from some maker or dealer of known reliability. An "agitator" should always be attached to the handle of the pump.

5. To those who dislike to use Paris green on tobacco the use of cobalt in the flowers of jimpson weed is commended. It has stood the test of experience now for forty years at least and is still in favor with growers. The best time to use it is during August, when the "fly" is most abundant. The flowers may be plucked from the plants and set upright in the ground about tobacco fields after introducing by means of a quill a little of the following mixture:

Water, one pint.

Molasses, or honey, one-fourth pint.

Cobalt, one ounce.

Grasshopper Injury to Tobacco.

When herbage becomes scarce in the latter part of summer, especially when grass or other close-growing crops are harvested near tobacco, grasshoppers invade tobacco fields. They are not fond of the weed, using it only under compulsion, but with a freedom notwithstanding that is often very exasperating. The Paris green mixture destroys them, but not as quickly as could be desired, and I wish at present to point out the importance of keeping down all unnecessary growth likely to harbor these pests during the early part of the season as a precaution against late summer injury. A number of species of grasshoppers take part in the injury, any of them seemingly feeding on tobacco when starved to it, but by far the greater part of the holes gnawed in leaves is the work of the red-legged grasshopper, here figured (Fig. 3.)

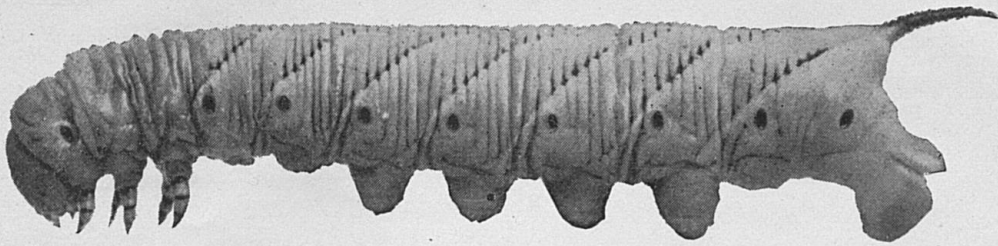


Fig. 1.



Fig. 2.

Fig. 1.—Tobacco Worm (*Phlegethontius carolina*).

Fig. 2.—A leaf injured by tobacco worm.

For figures of the pupa and adult of the tobacco worm see our Bulletin No. 40, p. 19.

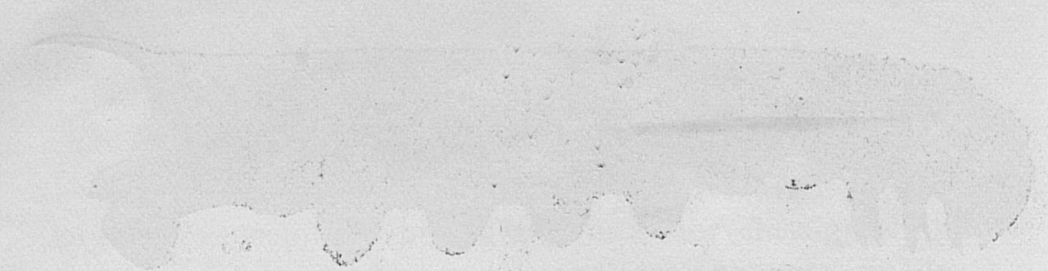


Fig. 1.—Troughed Worm (Glyptothorax) in situ.
Fig. 2.—A half inch of the same worm.
For figures of the eggs and details of the troughed worm see
Bulletin No. 40, p. 10.



Fig. 3.



Fig. 4.

Fig. 3.—The red-legged grasshopper (*Pezotettix femur-rubrum*), $1\frac{1}{4}$ times natural size.

Fig. 4.—Tobacco leaf injured by red-legged grasshopper.

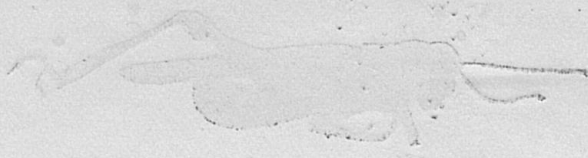


Fig. 2.—The red-legged grasshopper (*Leptodactylus* sp.)
 (from natural size)
 Fig. 3.—Tobacco leaf injured by red-legged grasshopper.

KENTUCKY
Agricultural Experiment Station

—OF THE—

STATE COLLEGE OF KENTUCKY.

BULLETIN NO. 64.

Analyses of Commercial Fertilizers.

LEXINGTON, KENTUCKY.

JULY, 1896.

KENTUCKY Agricultural Experiment Station.

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KENTUCKY AGRICULTURAL EXPERIMENT STATION,
LEXINGTON, KY.

BULLETIN No. 64.

ANALYSES OF COMMERCIAL FERTILIZERS.

For the more important principles on which the intelligent use of fertilizers depends, and for information in regard to the materials of which commercial fertilizers are made, we refer the reader to Bulletins Nos. 41, 46 and 51. This bulletin contains all the "official analyses" for the year 1896 up to the present date, with only such brief explanations as may be necessary for the right understanding of the figures.

Explanations in Regard to the Tables.

For convenience, the analyses in this bulletin are arranged in two tables:

Table I. contains ground bones.

Table II., those fertilizers whose phosphatic materials have been acted upon by sulphuric acid in order to render the phosphoric acid in them more soluble.

The finer a bone is ground the more valuable it is. For this reason we divide ground bone into "fine bone" and "medium bone" and give the phosphoric acid in each

separately in the tables; because, in computing the estimated value, the phosphoric acid in the "fine bone" is given a greater value than that in the "medium bone."

In Table II., the phosphoric acid is given under "soluble," "reverted" and "insoluble" phosphoric acid, the sum of these representing the total amount of phosphoric acid present. The sum of the "soluble" and "reverted" is "available" phosphoric acid, or the phosphoric acid that is of immediate use to plants.

In this table is also given the nitrogen, as well as its "equivalent in ammonia," or, in other words, the greatest amount of ammonia which would be possible to be made from the nitrogen; also the amount of potash either in the form of sulphate or muriate or both. As the sulphate of potash is somewhat more costly than the muriate, it is thought best to give the form in which the potash is found in the fertilizers analyzed.

The "Estimated Value Per Ton."

The fertilizer law requires that the Director shall give, along with the analysis of each fertilizer, "the money value of such fertilizer computed from its composition, as he may determine." This is the "estimated value per ton" given in the last column of the tables.

The words of the law, "the money value of such fertilizer, computed from its composition" define as nearly as possible what these "estimated values" are intended to represent; that is, they are intended to show what the phosphoric acid, nitrogen and potash in a ton of each fertilizer is actually worth in dollars and cents. In other words, they are intended to show about how much the raw materials necessary to furnish the same quantity of "essential ingredients" as is found by the analysis would cost if purchased separately and then combined. It is important to note, however, that on account of the differences in the prices of the different materials which may be used to furnish phosphoric acid, nitrogen and potash, and differences in the price of the same material at different times, as well as differences in rates of freight to the different points in the state, it is practically impossible to make these "estimated values" represent exactly the money value of the fertilizers. At best they are only relatively correct.

In order to calculate these values from the analyses, the Director assigns each year a certain price per pound for each of the "essential ingredients" of fertilizers. These prices are based upon the New York prices of the principal materials of which fertilizers are made, and include an allowance for freight from New York and for cost of mixing and loss in handling.

The framers of the fertilizer law evidently intended these estimated values to be an index that would show at a glance whether the purchaser was getting the worth of his money, and in a general way they do serve this purpose. Thus, when the "estimated value per ton" is very much below the price at which a ton of the fertilizer is sold, it shows that the purchaser at this price is paying high for the plant food it contains. But the estimated value alone is not a sufficient guide in purchasing fertilizers; it is necessary to consider the analysis also.

Importance of the Analyses.

In purchasing fertilizers it is of the first importance to consider the analyses, either in the tables of this bulletin or on the tags which should always be found attached to each sack; for by the analysis only can we tell whether we are getting, in the fertilizer, the plant food that we want to supply to our crop. If we were selecting a fertilizer for corn, for instance, to be used on a soil that was rich in phosphates but deficient in potash, we certainly would not buy a so-called "Corn Grower" that contained no potash, even if it was offered at a price much lower than the "estimated value."

Let us illustrate this farther by example: Suppose that a farmer desiring to purchase a fertilizer for his corn crop, is offered by his merchant either of two "corn growers" at \$25 per ton. The price, fortunately, does not help him to decide in this case. Next he looks at the tags attached to the sacks, and finds that the Director has estimated

the value of each fertilizer at \$25.20 per ton. He next looks at the analyses and finds Fertilizer No. 1 to contain :

Soluble Phosphoric Acid,	}	12.0 per cent.
Reverted " "		
Potash.....		None.
Nitrogen.....		2.4 per cent.

And Fertilizer No. 2 to contain:

Soluble Phosphoric Acid,	}	6.0 per cent.
Reverted " "		
Nitrogen.....		2.4 per cent.
Potash, from muriate		7.0 per cent.

He is now able to judge 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 get only half as much phosphoric acid which* he needs and would be paying for potash which he does not need. But if he is in doubt whether his land needs one or all the elements of a fertilizer, or if he knows that his land needs potash, he will be wise in purchasing No. 2. For should his soil need potash, or all three of the essential elements to produce a large corn crop, and should he purchase No. 1, it is doubtful whether he would receive any benefit from it.

Values Used.

The values for the "essential ingredients" in 1896 are as follows :

Soluble and reverted phosphoric acid in mixed fertilizers, 7 cents; in plain acid and unacidulated phosphates, 5 cents per pound.

Insoluble phosphoric acid in mixed fertilizers, $2\frac{1}{2}$ cents; in plain acid phosphates, nothing; in Orchilla guano, 3 cents; in other unacidulated phosphates, 2 cents per pound.

*Phosphoric acid in fine bone, 4 cents; in medium bone, 3 cents per pound.

Nitrogen in all fertilizers, $17\frac{1}{2}$ cents per pound.

Potash in all fertilizers, from sulphate, 7 cents; from muriate, 6 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.

Station Number.	NAME AND ADDRESS OF MANUFACTURER.	NAME OF BRAND.	POUNDS IN THE HUNDRED.					Estimated Value Per Ton.
			PHOSPHORIC ACID.			Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia.
			In Fine Bone.	In Medium Bone.	Total.			
3287	Akin Fertilizer Co., Evansville, Ind.....	Bone Meal ...	8.44	5.40	13.84	30.23	2.98	3.62
3357	The Armour Fertilizer Works, Chicago, Ill.....	Bone Meal	25.41	2.12	27.53	60.13	2.74	3.33
3358	Same	Raw Bone Meal.....	16.44	9.25	25.69	56.10	3.78	4.59
3375	The Cincinnati Desiccating Co., Cincinnati, O	Fine Ground Bone.....	16.39	5.18	21.57	47.11	2.99	3.63
3279	Dunn & Backer, Troy, Ind.....	Glover Leaf Brand No. 7, Grower	9.46	4.31	13.77	30.06	4.06	4.93
3280	Same	Glover Leaf Brand No. 9, Grower	11.99	12.42	24.41	53.31	4.00	4.86
3208	J. B. Jones, Louisville, Ky	Raw Bone Meal	15.42	6.79	22.21	48.50	3.68	4.47
3363	Same	Ammoniated Bone Meal	13.88	1.24	15.12	33.03	3.97	4.82
3266	The Jones Fertilizing Co., Cincin- nati, O... ..	Ammoniated Bone Meal	14.66	0.97	15.63	34.14	5.40	6.56
3273	Same	Fine Ground Bone.....	15.20	10.87	26.07	56.94	3.10	3.76

* Potash, from muriate, 5.38 per cent.

TABLE I.—Raw Bone Manures. (Concluded.)

Station Number.	NAME AND ADDRESS OF MANUFACTURER.	NAME OF BRAND.	POUNDS IN THE HUNDRED.					Estimated Value Per Ton.
			PHOSPHORIC ACID.			Equivalent to Bone Phosphate	Nitrogen.	Equivalent to Ammonia.
			In Fine Bone.	In Medium Bone.	Total.			
3274	The Jones Fertilizing Co., Cincinnati, O.	Pure Raw Bone	12.83	12.58	25.41	55.49	3.35	4.07
3296	Michigan Carbon Works, Detroit, Mich.	Desiccated Bone N.	25.69	6.54	32.23	70.41	1.47	1.78
3243	North-Western Fertilizing Co., Chicago, Ill.	Horse Shoe Brand Raw Bone....	15.84	7.62	23.46	51.24	4.22	5.12
3244	Same	Horse Shoe Brand, Ralston's Bone Meal.....	9.35	4.82	14.17	30.96	2.87	3.48
3255	Same	Horse Shoe Brand Pure Ground Bone	15.46	5.57	21.03	45.93	3.31	4.02
3260	Standard Guano and Chemical Mfg. Co., New Orleans, La.	Pure Ground Bone—Coarse	11.79	7.73	19.52	42.64	3.39	4.12
3298	Swift & Co., Chicago, Ill.	Bone Tankage.....	16.23	2.75	18.98	41.46	5.13	6.23
3299	Same	Bone Tankage and Potash	15.51	1.86	17.37	37.94	4.84	5.88
3300	Same	Pure Raw Bone Meal	18.92	7.51	26.43	57.72	3.86	4.69
3301	Same	Ground Steamed Bone.....	25.97	1.69	27.66	60.41	2.58	3.13
3302	Same	Bone and Potash	23.20	1.77	24.97	54.54	2.80	3.40

† Potash, from muriate, 3.49 per cent.

‡ Potash, from muriate, 3.04 per cent.

TABLE II.—Complete Fertilizers, Superphosphates, Etc.

TABLE II.—Complete Fertilizers, Superphosphates, Etc.

Station Number.	NAME AND ADDRESS OF MANUFACTURER.	NAME OF BRAND.	POUNDS IN THE HUNDRED.							Estimated Value Per Ton.
			PHOSPHORIC ACID.			Nitrogen.	Equivalent to Ammonia.	POTASH.		
			Soluble.	Reverted.	Insoluble.			From Sulphate.	From Muriate.	
3345	A. D. Adair & McCarty Bros., Atlanta, Ga.	Furman High Grade Fertil- izer.....	8.03	2.37	3.63	2.23	2.71	.....	1.75	\$26 29
3346	Same.....	Furman Soluble Bone with Ammonia and Potash..	7.79	2.64	3.13	1.30	1.58	.....	1.90	23 00
3347	Same.....	Farish Furman Formula	9.48	3.62	2.39	.....	.....	.....	2.56	22 61
3359	The Armour Fertilizer Works, Chicago, Ill.	Ammoniated Bone and Pot- ash.....	3.67	5.72	2.14	3.09	3.75	1.53	.....	27 18
3360	Same.....	White Burley and Black To- bacco.....	2.06	6.94	3.86	3.17	3.85	4.45	.....	31 86
3361	Same.....	Bone and Blood .....	.....	9.28	6.29	5.18	6.29	.....	.....	34 27
3362	Same.....	Bone, Blood and Potash.....	5.31	5.55	2.12	4.25	5.16	7.72	.....	41 95
3312	Baugh & Sons Company, Nor- folk, Va.....	Baugh's Animal Bone and Potash Compound.....	7.15	1.67	3.10	1.78	2.16	.....	1.98	22 51
3284	J. F. Caplinger, Milton, Ky...	Caplinger's Complete Fer- tilizer.....	3.80	4.03	3.13	2.82	3.42	4.96	.....	29 34
3285	Same.....	Caplinger's Corn and Wheat Grower	3.93	4.32	3.08	2.88	3.50	3.37	.....	27 89
3286	Same.....	Kentucky Wonder.....	2.71	4.34	3.29	2.61	3.17	2.29	.....	23 87

TABLE II.—Complete Fertilizers, Superphosphates, Etc. (Continued.)

Station Number.	NAME AND ADDRESS OF MANUFACTURER.	NAME OF BRAND.	POUNDS IN THE HUNDRED.							Estimated Value Per Ton.
			PHOSPHORIC ACID.			Nitrogen.	Equivalent to Ammonia.	POTASH.		
			Soluble.	Reverted.	Insoluble.			From Sulphate.	From Muriate.	
3185	Chemical Co. of Canton, Baltimore, Md.....	Baker's Standard Guano.....	8.06	2.62	2.02	2.87	3.48	.....	3.13	\$29 77
3186	Same.....	Diadem Soluble Bone.....	12.54	2.80	2.16	0.92	1.12	.....	.....	25 78
3376	The Cincinnati Desiccating Co., Cincinnati, O.....	Ohio Valley Phosphate.....	2.09	5.25	3.43	1.90	2.31	2.51	.....	22 16
3377	Same.....	Phoenix Phosphate.....	0.91	5.77	4.73	1.91	2.32	.....	0.88	19 47
3325	The Cleveland Dryer Co., Cleveland, O.....	Buckeye Ammoniated Bone Superphosphate.....	7.50	3.03	2.89	2.90	3.52	.....	0.48	26 92
3326	Same.....	Ohio Seed Maker.....	6.03	4.49	3.49	1.57	1.91	.....	.....	21 98
3327	Same.....	Square Bone	2.48	10.53	9.71	2.41	2.93	.....	.....	31 51
3328	Same.....	XXX Phosphate.....	9.83	5.38	1.61	.....	.....	.....	.....	15 21
3329	Same.....	Horsehead Phosphate.....	7.65	2.96	1.07	.....	.....	.....	.....	10 61
3330	Same.....	Ammoniated Dissolved Bone.	5.97	4.68	3.31	1.57	1.91	.....	.....	22 07
3331	Same.....	Phospho Bone.....	6.69	2.86	2.05	0.96	1.17	.....	1.21	19 21
3332	Same.....	White Burley Tobacco Fertilizer	7.15	2.10	3.98	2.97	3.61		2.82	28 72

Analyses of Commercial Fertilizers.

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		5.88	1.50	2.80	1.23	1.49		1.39	17 71
3237	Crocker Fertilizer & Chemical Co., Buffalo, N. Y.								
3238	Same.....	8.51	2.12	2.66	2.23	2.71	.....	3.49	28 21
3239	Same.....	9.89	0.48	0.63	3.95	4.80	.....	5.72	35 53
3240	Same.....	7.52	2.66	2.33	1.41	1.71	.....	2.04	22 81
3275	Same.....	5.14	2.73	4.71	1.04	1.26	.....	1.34	18 63
3307	The Currie Fertilizer Company, Louisville, Ky.	8.57	1.18	0.86	0.54	0.66	1.46	.....	18 01
3308	Same.....	8.74	0.68	1.30	0.66	0.80	1.87	.....	18 77
3309	Same.....	7.73	3.34	0.46	1.18	1.43	3.71	.....	25 05
3310	Same.....	8.75	0.92	0.86	0.54	0.66	1.46	.....	17 90
3311	Same.....	8.38	1.09	1.66	1.20	1.46	4.00	.....	23 89
3366	Same.....	9.70	1.20	1.66	0.93	1.13	2.85	.....	23 34
3367	Same.....	7.47	3.21	3.97	0.92	1.12	1.64	.....	22 46
3276	Dunn & Backer, Troy, Ind.	6.68	2.47	4.27	2.97	3.61	.....	.....	25 35
3277	Same.....	4.55	1.92	4.44	2.60	3.16	.....	4.74	26 07
3278	Same.....	6.47	2.18	2.99	2.47	3.00	.....	5.70	29 10
3281	Same.....	1.69	4.46	9.36	3.55	4.31	.....	.....	25 72
3282	Same.....	2.24	4.13	9.22	3.28	3.98	.....	3.13	28 77
3297	Same.....	3.98	4.49	2.60	4.65	5.65	.....	7.69	38 67
	Crocker's General Crop Phosphate.....								
	Crocker's Kentucky Tobacco Fertilizer.....								
	Crocker's Special Kentucky Tobacco Fertilizer.....								
	Crocker's NewRival Ammoniated Superphosphate.....								
	Crocker's Ammoniated Practical Superphosphate.....								
	Currie's Kentucky Phosphate.....								
	Currie's BlackDiamond Phosphate.....								
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	Currie's Climax Tobacco Grower.....								
	Currie's Golden Leaf Tobacco Grower.....								
	Currie's Soluble Bone.....								
	Currie's Butchertown Bone.....								
	Clover Leaf Brand No. 1 Grower.....								
	Clover Leaf Brand No. 2 Grower.....								
	Clover Leaf Brand No. 3 Tobacco Grower.....								
	Clover Leaf Brand No. 10 Grower.....								
	Clover Leaf Brand No. 6 Grower.....								
	Clover Leaf Brand No. 4 HighGrade Tobacco Grower								

tilizer 7.15 | 2.10 | 3.98 | 2.97 | 3.61 | | 2.82 | 28 72

TABLE II. - Complete Fertilizers, Superphosphates, Etc. (Continued).

Station Number.	NAME AND ADDRESS OF MANUFACTURER.	NAME OF BRAND.	POUNDS IN THE HUNDRED.							Estimated Value Per Ton.
			PHOSPHORIC ACID.			Nitrogen.	Equivalent to Ammonia.	POTASH.		
			Soluble.	Reverted.	Insoluble.			From Sulphate.	From Muriate.	
33211	Globe Fertilizer Co., Louis- ville, Ky.....	Globe Soluble Vegetable Manure.....	6.49	1.71	1.51	3.64	4.42	4.12	.....	\$30 75
33212	Same.....	Kentucky Standard Tobacco Grower.....	6.93	1.67	1.23	3.66	4.44	3.82	.....	30 82
33213	Same.....	Big Four Tobacco Grower....	7.84	1.38	0.73	2.32	2.82	2.50	.....	24 90
33214	Same.....	Globe Potato Grower.....	7.85	1.48	1.51	3.57	4.33	4.86	.....	33 12
33215	Same.....	Progress Phosphate Corn and Wheat Grower.....	9.27	1.62	1.71	1.82	2.21	1.18	.....	24 13
33216	Same.....	Globe Bone Dust.....	9.22	1.69	1.19	1.36	1.65	1.16	.....	22 25
33217	Same.....	Eagle Corn and Wheat Grower.....	10.48	1.69	1.61	1.81	2.20	2.01	.....	27 00
33218	Same.....	Globe Wheat Grower.....	10.25	1.90	1.65	1.85	2.25	2.09	.....	27 25
33219	Same.....	Bone and Potash.....	10.25	1.78	0.52	0.52	0.63	1.33	.....	20 78
33220	Same.....	Golden Harvest Bone Meal...	8.55	1.99	3.02	2.94	3.57	1.07	.....	28 06
33289	The Jarecki Chemical Co., Sandusky, O.....	Lake Erie Fish Guano.....	11.60	0.89	2.00	1.35	1.64	0.84	.....	24 40

3290	Same.....	C. O. D. Phosphate.....	14.03	1.00	1.14	.....	.....	.....	15 03
3190	J. B. Jones, Louisville, Ky.....	Tobacco and Potato Grower..	2.66	5.72	2.61	2.03	2.46	7.42	30 54
3364	Same	Bromophyte....	0.40	3.21	0.42	1.34	1.63	.....	0.25 10 25
3365	Same.....	Kentucky Phosphate.....	1.19	6.38	2.60	4.23	5.14	.....	2.40 29 59
3267	The Jones Fertilizing Co., Cincinnati, O	Jones' Reliable	2.71	4.05	4.09	2.31	2.80	1.92	 22 29
3268	Same.....	Jewel Phosphate.....	3.68	3.05	7.66	1.37	1.66	.....	..... 18 05
3269	Same.....	Special Tobacco Grower	3.51	4.12	4.95	2.76	3.35	2.83	 26 78
3270	Same	Acidulated Bone Meal	3.65	4.27	8.07	4.09	4.97	.....	..... 29 45
3271	Same.....	Tobacco and Potato Grower..	4.64	1.22	4.46	4.01	4.87	6.58	 33 68
3272	Same.....	Miami Valley Phosphate.....	3.85	3.76	3.81	2.85	3.46	2.98	 26 71
3343	The Loudenback Fertilizer Co., Urbana O.....	Urbana Ammoniated Bone... Urbana Bone Phosphate and Potash.....	7.04	5.30	3.15	2.74	3.33	.....	3.07 32 13
3344	Same.....	Anchor Brand Complete Fertilizer	6.61	5.41	2.72	2.40	2.91	1.98	0.84 30 37
3314	A. B. Mayer Mfg. Co., St. Louis, Mo	Homestead Corn and Wheat Grower.....	3.04	4.07	3.30	2.74	3.33	0.28	0.80 22 54
3291	Michigan Carbon Works, Detroit, Mich	Homestead Potato Grower ...	8.06	2.18	1.24	2.42	2.94	.....	2.31 26 20
3292	Same	Homestead Tobacco Grower..	7.91	1.76	1.50	2.17	2.63	.....	5.53 28 53
3293	Same	Jarves'Drill Phosphate.....	9.45	0.57	0.75	3.34	4.05	.....	5.13 32 26
3294	Same	Jarves'Tobacco Fertilizer.....	8.00	1.65	0.83	1.38	1.68	.....	1.06 20 03
3295	Same	Jarves'Tobacco Fertilizer.....	6.46	1.51	0.72	2.00	2.43	.....	1.67 20 52

TABLE II.—Complete Fertilizers, Superphosphates, Etc. (Continued).

Station Number.	NAME AND ADDRESS OF MANUFACTURER.	NAME OF BRAND.	POUNDS IN THE HUNDRED.								Estimated Value Per Ton.
			PHOSPHORIC ACID.			Nitrogen.	Equivalent to Ammonia.	POTASH.			
			Soluble.	Reverted.	Insoluble.			From Sulphate.	From Muriate.		
3261	National Fertilizer Co., Nash- ville, Tenn	Acid Phosphate	13.82	2.21	1.01	.....	.....	.....	.....	.....	\$16 03
3262	Same	Acid Phosphate with Potash.	12.03	2.80	1.14	.....	.....	.....	2.74	.....	24 62
3263	Same	Corn Grower.....	10.36	3.50	0.93	1.00	1.21	.....	1.16	.....	24 76
3305	Same	National Tobacco Fertilizer ..	7.77	2.62	2.20	2.61	3.17	.....	3.23	.....	28 67
3306	Same.....	Tobacco Grower.....	8.25	3.01	2.80	2.16	2.62	.....	2.27	.....	27 44
3242	Nolte & Dolch Fertilizer Co., St. Louis, Mo.....	Pure Bone Phosphate	6.19	2.27	2.58	2.28	2.77	.....	2.06	.....	23 58
3303	Same.....	Half and Half Ground Raw Bone and Bone Phosphate..	2.33	5.30	7.94	3.00	3.64	.....	0.77	.....	26 07
3304	Same.....	Half and Half Ground Raw Bone & Phosphate-Potash..	0.87	5.54	8.69	1.87	2.27	.....	0.93	.....	20 99
3245	North - Western Fertilizing Co., Chicago, Ill	Horse Shoe Brand Tobacco Grower	5.48	3.02	1.73	3.89	4.72	3.29	.....	.....	31 00
3246	Same.....	Horse Shoe Brand Challenge Corn Grower.....	4.84	3.51	1.87	3.13	3.80	2.39			26 94
3247	Same.....	Horse Shoe Brand \$26 Phos- phate ..	4.29	2.66	4.26	2.09	2.54	1.69			21 55

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3248	Same.....	Horse Shoe Brand Prairie Phosphate.....	4.29	2.49	4.26	2.16	2.62	1.54		21	34
3249	Same.....	Horse Shoe Brand Ky. Corn and Tobacco Grower.....	4.26	2.39	3.88	2.91	3.53	1.58		23	65
3250	Same.....	Horse Shoe Brand Potato Grower.....	4.13	3.52	1.91	3.03	3.68	2.96	.....	26	42
3251	Same.....	Horse Shoe Brand Ky-Ana Phosphate.....	3.74	2.77	3.43	1.14	1.38	.....	.....	14	82
3252	Same.....	Horse Shoe Brand Raw Bone and Phosphate Mixture.....	3.15	4.58	5.69	3.33	4.04	0.84	.....	26	51
3253	Same.....	Horse Shoe Brand High Grade Truck Manure.....	4.68	3.22	1.75	3.74	4.54	2.84	.....	29	01
3254	Same.....	Horse Shoe Brand Quick Acting Phosphate.....	13.24	3.33	1.34	.....	.....	.....	.....	16	57
3210	E. Rauh & Sons, Indianapolis, Ind.....	Special Tobacco Grower.....	5.42	2.55	1.46	4.01	4.87	7.18	.....	35	98
3283	John S. Reese & Co., Baltimore, Md.....	Reese's Pacific Guano.....	0.63	9.09	1.64	1.94	2.36	.....	1.10	22	54
3354	The J. & F. Schroth Packing Co., Cincinnati, O.....	Potato and Tobacco Grower..	2.58	3.85	5.74	5.34	6.48	.....	7.15	39	14
3355	Same.....	Schroth Special	3.21	4.20	5.59	2.73	3.31	.....	2.69	25	96
3356	Same.....	Queen City Phosphate.....	2.84	3.70	5.26	3.03	3.68	.....	1.21	23	85
3241	Wm. Skene & Co., Louisville, Ky.....	Skene's Kentucky Bone Meal and Potash.....	5.54	5.03	3.36	1.41	1.71	4.22	.....	27	33
3313	Southern Fertilizer Co., Rome and Atlanta, Ga.	Island Home Fertilizer.....	9.63	0.50	2.65	2.40	2.91	.....	2.16	26	50
3257	Standard Guano & Chemical Mfg. Co., New Orleans, La.	Standard High Grade Tobacco Grower.....	8.49	1.28	0.87	2.29	2.78	3.88	.....	27	57
3258	Same.....	Standard Corn Fertilizer.....	6.33	2.97	0.46	1.95	2.37	.....	3.06	23	75
3259	Same.....	High Grade Acid Phosphate and Potash.....	8.56	3.14	0.50	.....	.....	.....	3.05	20	29

TABLE II.—Complete Fertilizers, Superphosphates, Etc. (Concluded.)

Station Number.	NAME AND ADDRESS OF MANUFACTURER.	NAME OF BRAND.	POUNDS IN THE HUNDRED.							Estimated Value Per Ton.
			PHOSPHORIC ACID.			Nitrogen.	Equivalent to Ammonia.	POTASH.		
			Soluble.	Reverted.	Insoluble.			From Sulphate.	From Muriate.	
3221	S. W. Travers & Co., Richmond, Va.	Capital Dissolved S. C. Bone.	10.57	1.77	1.37	.....	.....	.....	.....	\$12 34
3222	Same.	Travers' Dissolved Bone Phosphate.....	10.76	2.98	2.16	.....	.....	.....	.....	13 74
3223	Same.	Capital Bone - Potash Com- pound.....	6.56	4.33	1.34	.....	.....	.....	1.88	18 18
3224	Same.	Champion Corn Grower.....	6.00	3.01	1.34	1.01	1.23	.....	2.12	19 36
3225	Same.	Capital Tobacco Fertilizer....	3.94	1.89	1.96	4.12	5.00	.....	4.92	29 46
3226	Same.	National Tobacco Fertilizer....	5.82	2.03	1.60	2.01	2.44	.....	4.58	24 33
3227	Same.	Beef, Blood and Bone Fertil- izer.....	5.87	2.45	2.17	1.96	2.38	.....	2.49	22 59
3228	Same.	Orchilla Guano.....	.....	3.36	11.85	.....	.....	.....	.....	10 47

M. A. SCOVELL, Director.
A. M. PETER.
H. E. CURTIS.

July 1, 1896.

KENTUCKY
AGRICULTURAL EXPERIMENT STATION

OF THE
STATE COLLEGE OF KENTUCKY.

BULLETIN NO. 65.

ANALYSES OF COMMERCIAL FERTILIZERS.

- I. **Official Analyses.**
- II. **Analyses of other Samples.**

LEXINGTON, KENTUCKY.
DECEMBER, 1896.

KENTUCKY Agricultural Experiment Station.

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Address of the Station — LEXINGTON, KY.

NOTICE.

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

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

ADDRESS:

KENTUCKY AGRICULTURAL EXPERIMENT STATION,
LEXINGTON, KY.

BULLETIN NO. 65.

COMMERCIAL FERTILIZERS.

I. OFFICIAL ANALYSES.

Since the publication of Bulletin No. 64, the following analyses have been made for manufacturers in compliance with the fertilizer law, and these fertilizers were legally on sale in the State during the past season, in addition to those reported in the bulletin referred to above.

The values for the "essential ingredients" for 1897 have not been changed, and are as follows:

Soluble and reverted phosphoric acid in mixed fertilizers, 7 cents; in plain acid and unacidulated phosphates, 5 cents per pound.

Insoluble phosphoric acid in mixed fertilizers, $2\frac{1}{2}$ cents; in plain acid phosphates, nothing; in Orchilla guano, 3 cents; in other unacidulated phosphates 2 cents per pound.

Phosphoric acid in fine bone, 4 cents; in medium bone, 3 cents per pound.

Nitrogen in all fertilizers, $17\frac{1}{2}$ cents per pound.

Potash in all fertilizers, from sulphate, 7 cents; from muriate, 6 cents per pound.

TABLE I.—Raw Bone Manures, Etc.

Station Number.	NAME AND ADDRESS OF MANUFACTURER.	NAME OF BRAND.	POUNDS IN THE HUNDRED.						Estimated Value per Ton.
			Phosphoric Acid.			Equivalent to Bone Phosphate.	Nitrogen.	Equivalent to Ammonia.	
			In Fine Bone.	In Medium Bone	Total.				
3422	A. B. Mayer Mfg. Co, St. Louis, Mo	Anchor Brand Pure Bone Meal.....	14.31	7.54	21.85	47.72	3.77	4.58	\$29.17
3408	Nolte & Dolch Fertilizer Co., St. Louis, Mo	Pure Raw Bone Meal.....	14.03	6.54	20.57	44.93	3.53	4.29	27.50
3418	J. F. & W. H. Singer, Nashville, Tenn	Standard Raw Bone Meal..	13.49	8.31	21.80	47.61	3.77	4.58	28.98
3419	Wm. Skene & Co., Louisville, Ky	Skene's Pure Raw Bone Dust or Meal	12.50	8.76	21.26	46.44	3.36	4.08	27.02

TABLE II.—Complete Fertilizers, Superphosphates, Etc.

Station Number.	NAME AND ADDRESS OF MANUFACTURER.	NAME OF BRAND.	POUNDS IN THE HUNDRED.							Estimated Value per Ton.
			Phosphoric Acid.			Nitrogen.	Equivalent to Ammonia.	Potash.		
			Soluble.	Reverted.	Insoluble.			From Sulphate.	From Muriate.	
3404	The Armour Fertilizer Works, Chicago, Ill.....	Armour's Grain Grower.	3.33	2.53	4.36	1.93	2.34	1.68	....	\$19.49
3405	Crocker Fert. and Chemical Co., Buffalo, N. Y.....	Crocker's Wheat and Corn Phosphate.....	7.96	2.64	1.27	2.12	2.57	....	2.30	25.66
3435	The Currie Fertilizer Co., Louisville, Ky.....	Currie's Wheat Grower...	9.84	1.70	0.93	0.59	0.72	2.09	....	21.63
3436	Same.....	Currie's Wheat Special...	10.27	3.23	0.38	....	....	....	....	13.50
3439	The Goulding Fert. Co. Ltd., Pensacola, Fla.....	Goulding's Bone Com- pound.....	9.76	1.36	1.30	1.87	2.27	....	2.13	25.33
3407	The Imperial Fert. Co., Charleston, S. C.....	Farmer's Compound Fer- tilizer.....	6.51	3.81	1.96	....	....	....	2.39	18.30
3423	A. B. Mayer Mfg. Co., St. Louis, Mo.....	Anchor Brand Corn and Wheat Grower.....	2.49	5.52	5.05	3.25	3.95	1.88	....	27.75
3440	Meridian Fert. Factory, Meridian, Miss.....	Standard Home Mixture Guano.....	8.78	2.14	0.31	2.41	2.93	....	3.19	27.72
3459	Mobile Phos. and Chem. Mfg. Co., Mobile, Ala.....	Mobile Standard Guano...	8.39	1.83	2.02	2.05	2.49	....	2.51	25.51
3409	Nolte and Dolch Fert. Co, St. Louis, Mo.....	Phosphate and Potash....	0.61	7.04	2.09	....	....	....	1.31	13.33

TABLE II.—Complete Fertilizers, Superphosphates, Etc.—Continued.

Station Number.	NAME AND ADDRESS OF MANUFACTURER.	NAME OF BRAND.	POUNDS IN THE HUNDRED.								Estimated Value per Ton.
			Phosphoric Acid.			Nitrogen.	Equivalent to Ammonia.	Potash.			
			Soluble.	Reverted.	Insoluble.			From Sulphate.	From Muriate.		
3410	Nolte & Dolch Fert. Co., St. Louis, Mo.	No. 27 Bone Black Fert.	.5 19	3.15	2.21	1.93	2.34	...	...	\$19.55	
3402	Ohio Valley Fert. Co., Owensboro, Ky.	Corn, Wheat and Tobacco Grower	1.15	5.54	7.79	3.20	3.88	2.45	...	27.90	
3438	Read Fert. Co, New York and Charleston, S. C.	Alkaline Bone	8.46	2.59	1.06	...	...	...	2.25	18.70	
3448	Same	Blood and Bone Ammoni- ated Superphosphate	6.03	2.89	1.71	1.87	2.27	...	...	19.90	
3441	Standard Guano & Chem. Mfg. Co., New Orleans, La.	Standard Raw Bone	6.36	2.12	1.15	1.88	2.28	...	2.31	21.80	
3451	S. W. Travers & Co., Richmond, Va.	Wheat Grower National Wheat and Grass Grower.	7.47	2.24	1.79	1.83	2.22	...	2.28	23.64	

II. ANALYSES OF OTHER SAMPLES.

The law regulating the sale of commercial fertilizers in this State provides (Sec. 7) that: "Any agriculturist, 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." In the same section the Director is 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." Under these provisions a number of samples have been analyzed from time to time, and the results of these analyses are published in the following pages.

An examination of the table of analyses will show that, with two exceptions, the fertilizers sampled by farmers, or by the Director, are fairly represented by the samples sent to the Station by the manufacturers. Some are better than the official samples, while a few fall below them — not, however, to such an extent as to show fraud or gross carelessness on the manufacturer's part. The exceptions are:

First: No. 3455. Corn, Wheat and Tobacco Grower, manufactured by the Ohio Valley Fertilizing Co., A. Loeser, Mgr., Owensboro, Ky., where the fertilizer sold was entirely different from what it was represented to be by the tags attached.

Second: No. 3417. Horse Shoe Brand Tobacco Grower, manufactured by North-Western Fertilizing Co., Chicago, Ill., where we found almost two per cent less potash than in the official samples, although having one-half of one per cent more nitrogen; too great a difference to be accounted for on the ground of unavoidable variations in mixing.

Here follows, first, a brief description of each sample, and, second, the analyses in tabular form. For convenience of reference, the "station number" of each sample is given, and all brands of the same manufacturer are arranged together. The names of the manufacturers are placed in alphabetical order in the description of the samples, and following each manufacturer's name are the brands of his make that were analyzed.

It is necessary to compare the analysis of each sample with the "official analysis" on the tags attached to the sacks from which the sample was taken, because it is not possible for manufacturers to make the same fertilizer perfectly uniform from year to year, and any fertilizer is, therefore, liable to vary somewhat in composition; also, because the values assigned to the "essential ingredients" in calculating the "estimated value per ton" are subject to change from time to time. *This is the reason why a tag from one of the packages sampled must be sent with each sample for analysis.*

Description of Samples.

A. D. ADAIR & McCARTY BROS., Atlanta, Ga.

No. 3466. Furman High Grade Fertilizer. Sent by N. B. Riley, Allensville, Ky. Tag sent corresponded to No. 2973.

THE ARMOUR FERTILIZER WORKS, Chicago, Ill.

No. 3454. Bone Meal, sent by Milton Tate, Kirk, Ky. Tag sent corresponded to No. 3357.

No. 3464. Same brand, sent by J. W. Wright, McQuady, Ky. Tag sent corresponded to No. 3357.

No. 3465. Same brand, sent by G. M. Slaughter, Hodgenville, Ky. Tag sent corresponded to No. 3357.

GLOBE FERTILIZER Co., Louisville, Ky.

No. 3456. Globe Wheat Grower, sent by W. M. Darby, Cave Spring, Ky. Tag sent corresponded to No. 3218.

R. H. HOSKENS, Louisville, Ky.

No. 3468. Champion Raw Bone Meal, sampled by A. M. Peter, from stock of Cassell & Co., Louisville, Ky. Tags corresponded to No. 3035.

J. B. JONES, Louisville, Ky.

No. 3463. Raw Bone Meal, sent by J. W. Wright, McQuady, Ky.
Tag sent corresponded to No. 3208.

THE JONES FERTILIZING Co., Cincinnati, O.

No. 3207. Pure Raw Bone Meal, sent by Hugh Jenkins, Glendale, Ky. Tags corresponded to No. 2998.

No. 3353. Miami Valley Phosphate, sent by Robt. T. Marshall, Mt. Carmel, Ky. Tag sent corresponded to No. 3272.

MOBILE PHOSPHATE & CHEMICAL MFG. Co., Mobile, Ala.

No. 3460. Mobile Standard Guano, sent by Howard Cornelius, Russellville, Ky. Tag sent corresponded to No. 3042.

NORTH-WESTERN FERTILIZING Co., Chicago, Ill.

No. 3417. Horse Shoe Brand Tobacco Grower, sent by C. M. Hanna, Cropper, Ky. Tag sent corresponded to No. 2868.

No. 3453. Horse Shoe Brand Raw Bone, sent by J. F. McGary, Kirk, Ky. Tag sent corresponded to No. 3243.

No. 3462. Same brand, sent by F. P. Strickler, Elizabethtown, Ky. Tag sent corresponded to No. 3243.

No. 3467. Same brand, sampled by A. M. Peter from stock of H. C. Smith, Louisville, Ky. Tags corresponded to No. 3243.

OHIO VALLEY FERTILIZING Co., Owensboro, Ky.

No. 3455. Corn, Wheat and Tobacco Grower, sent by Lonnie Rhodes, Kirk, Ky. Tag sent corresponded to No. 3402.

WM. SKENE & Co., Louisville, Ky.

No. 3352. Skene's Complete Plant Food or Perfect Tobacco and Potato Grower, sent by Elijah Coons, Mt. Sterling, Ky. Tag sent corresponded to No. 2960.

SWIFT & COMPANY, Chicago, Ill.

No. 3351. Bone Tankage and Potash, sent by P. D. Taylor, La-Grange, Ky. Tag sent corresponded to No. 3299.

No. 3568. Bone and Potash, sent by James Tweddell, Elizabethtown, Ky. Tag sent corresponded to No. 3302.

TABLE III.

POUNDS IN THE HUNDRED.													
NAME OF BRAND.	WHERE SAMPLED.	Station Number.	Phosphoric Acid.						Nitrogen.	Equivalent to Ammonia.	Potash.		Estimated Value per Ton.
			In Fine Bone.	In Medium Bone.	Available.	Insoluble.	Total.	From Sulphate.			From Muriate.		
Furman High Grade Fertilizer.	Official, 1895.....	2973	.....	..	9.48	2.58	12.06	2.43	2.95	.....	2.59	\$ 26.18	
	Allensville.....	3466	.....	.....	9.43	2.98	12.41	2.65	3.22	.....	2.40	26.85	
Bone Meal.	Official, 1896.....	3257	25.41	2.12	.....	.....	27.53	2.74	3.33	.....	.....	31.19	
	Kirk	3454	20.41	5.33	.....	.....	25.74	3.24	3.93	.....	.....	30.87	
	McQuady	3464	20.76	4.16	.....	.....	24.92	3.44	4.18	.....	.....	31.15	
	Hodgenville.....	3465	23.41	1.08	.....	.....	24.49	3.43	4.16	.....	.....	31.39	
Globe Wheat Grower.	Official, 1896.....	3218	....	.....	12.15	1.65	13.80	1.85	2.25	2.09	.....	27.25	
	Cave Spring	3456	.....	.....	11.75	2.00	13.75	1.97	2.39	2.59	.....	27.98	
Champion Raw Bone Meal.	Official, 1895	3035	22.36	.....	.....	.....	22.36	3.70	4.49	.....	.....	30.84	
	Louisville.	3468	22.13	.....	.....	.....	22.13	3.83	4.65	.....	.....	31.11	
Raw Bone Meal.	Official, 1896.....	3208	15.42	6.79	.....	.....	22.21	3.68	4.47	.....	.....	29.29	
	McQuady.....	3463	14.14	7.81	.....	.....	21.95	3.33	4.04	.....	.....	27.66	

Pure Raw Bone Meal.	Official, 1895.....	2998	7.88	14.07	.....	.....	21.95	3.89	4.72	.....	.....	28.36
	Glendale	3207	14.61	5.68	.....	.....	20.29	3.90	4.73	.....	.....	28.75
Miami Valley Phosphate.	Official, 1896.....	3272	.....	.....	7.61	3.81	11.42	2.85	3.46	2.98	.....	26.71
	Mt. Carmel.	3353	.....	.....	6.99	6.56	13.55	2.81	3.41	2.03	.....	25.75
Mobile Standard Guano.	Official, 1895.....	3042	.....	.....	10.48	1.30	11.78	2.12	2.57	.....	1.73	24.82
	Russellville....	3460	.....	.....	10.24	2.03	12.27	1.99	2.42	.....	2.63	25.49
H. S. B. Tobacco Grower.	Official, 1895.....	2868	.....	.....	8.81	2.88	11.69	3.53	4.29	3.17	.....	30.57
	Cropper	3417	.....	.....	6.52	4.61	11.13	4.09	4.97	1.18	.....	27.41
H. S. B. Raw Bone.	Official, 1896	3243	15.84	7.62	.....	.....	23.46	4.22	5.12	.....	.....	32.01
	Kirk	3453	12.94	10.37	.....	.....	23.31	3.99	4.84	.....	.....	30.54
	Elizabethtown....	3462	10.55	12.73	.....	.....	23.28	4.14	5.03	.....	.....	30.57
	Louisville.	3467	12.14	11.35	.....	.....	23.49	3.89	4.72	.....	.....	30.14
Corn, Wheat and Tobacco Grower.	Official, 1896	3402	.....	.....	6.69	7.79	14.48	3.20	3.88	2.45	.....	27.90
	Kirk,	3455	10.43	6.69	.....	.....	17.12	3.30	4.01	.....	.....	23.90
Skene's Complete Plant Food.	Official, 1895	2960	.....	.....	6.85	3.90	10.75	3.27	3.97	12.34	.....	40.27
	Mt. Sterling	3352	.....	.....	10.56	3.65	14.21	4.91	5.96	12.16	.....	50.82
Bone Tankage and Potash.	Official, 1896.....	3299	15.51	1.86	.....	.....	17.37	4.84	5.88	.....	3.49	34.66
	LaGrange,	3351	13.52	2.09	.....	.....	15.61	4.59	5.57	5.95	.....	36.47
Bone and Potash.	Official, 1896.....	3302	23.20	1.77	.....	.....	24.97	2.80	3.40	.....	3.04	33.07
	Elizabethtown....	3568	23.39	2.25	.....	.....	25.64	2.70	3.28	.....	2.69	32.74

In the preceding table we have given in the first column the name of the brand, next, where the sample was taken; then the "station number," and, lastly, the analysis and valuation. The same order is preserved in the table as in the description of the samples, hence it is not necessary to repeat the name of the manufacturer. In the case of each brand, the official analysis is first given, in *bold-faced type*, for comparison. This official analysis is the same as the analysis that was on the tag attached to the sack from which the sample was taken.

M. A. SCOVELL, *Director*.

A. M. PETER, }
H. E. CURTIS, } *Chemists*.

December 31st, 1896.

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