

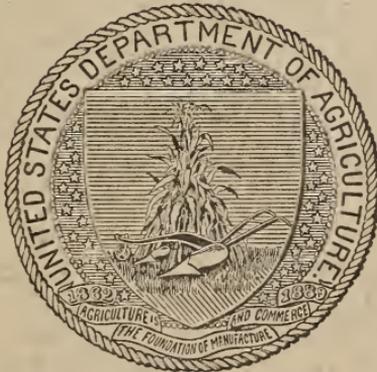
Issued May 9, 1910.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS—BULLETIN No. 65.
MILTON WHITNEY, Chief.

FERTILIZERS FOR POTATO SOILS.

BY

MILTON WHITNEY.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1910.

BUREAU OF SOILS.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., September 17, 1909.

SIR: In order to establish certain fundamental principles regarding the effect and efficiency of fertilizers on potato soils, I have had compiled all the available results of plat tests which have been carried out by the experiment stations.

It is believed that this matter will be of considerable interest to the farmers of this country, and I therefore have the honor to recommend that the article be published as Bulletin No. 65 of the Bureau of Soils.

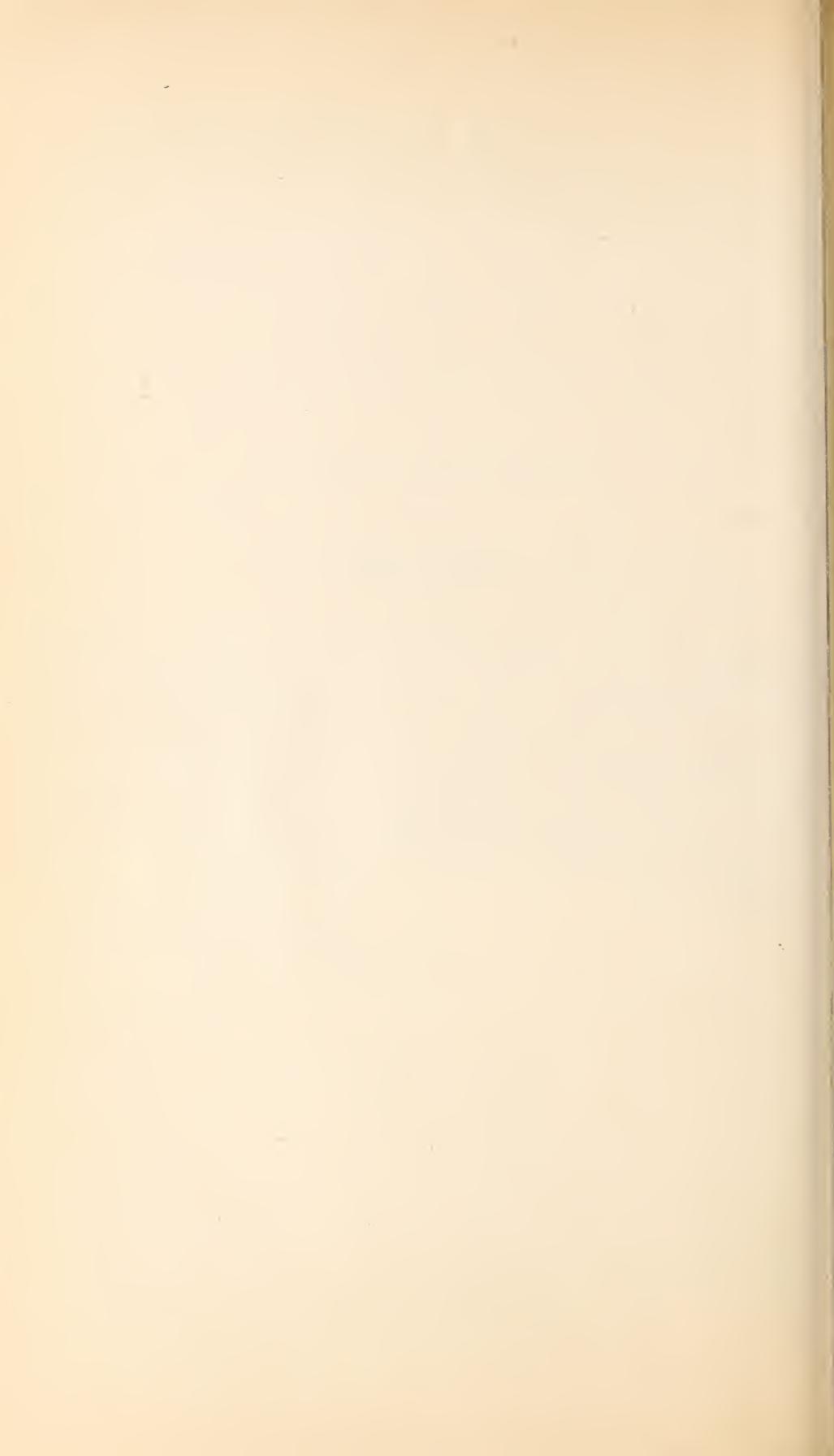
Very respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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FERTILIZERS FOR POTATO SOILS.

INTRODUCTION.

The experiment stations have recorded in their reports and bulletins the results of 1,769 tests of substances applied to potato soils, or soils upon which potatoes were grown.

Each test represents some single substance used alone or some combination of substances, and every result has been taken when the yield of a check or unfertilized plat has been recorded, when the amount of each substance per acre could be determined, and when the yield or increased yield per acre of potatoes could be found. The results have been accepted, whether the plats were located on the station farm or the experiments were carried out by cooperating farmers. No experiments from any source, not accepted and adopted by the stations and recorded in their official publications, are considered in this bulletin.

NUMBER OF EXPERIMENTS.

The number of tests for each year is given in the following table:

Number of individual tests on potato soils arranged by years.

Year.	Number.	Year.	Number.	Year.	Number.	Year.	Number.
1869.....	30	1887.....	54	1895.....	169	1903.....	14
1878.....	9	1888.....	66	1896.....	92	1904.....	25
1881.....	18	1889.....	40	1897.....	107	1905.....	4
1882.....	18	1890.....	150	1898.....	100	1906.....	7
1883.....	33	1891.....	157	1899.....	174	1907.....	28
1884.....	52	1892.....	51	1900.....	106		
1885.....	33	1893.....	117	1901.....	9	Total....	1,769
1886.....	30	1894.....	46	1902.....	30		

The following table shows the number of tests from each of the 23 States from which data have been secured:

Number of individual tests on potato soils arranged by States.

State.	Number.	State.	Number.
New York.....	315	North Carolina.....	36
Ohio.....	290	Wisconsin.....	32
New Jersey.....	250	Maryland.....	31
Michigan.....	152	Illinois.....	26
Maine.....	88	Arkansas.....	26
Indiana.....	80	Rhode Island.....	21
Louisiana.....	75	Massachusetts.....	16
Connecticut.....	65	Colorado.....	13
Texas.....	63	Alabama.....	8
Kentucky.....	60	Minnesota.....	2
Pennsylvania.....	43		
Georgia.....	41	Total.....	1,769
Tennessee.....	36		

YIELDS ON CHECK PLATS.

The investigations have been made under a wide range of soil or of climatic conditions, or both, as measured by the yield of the unfertilized or check plats. Unfortunately, owing to the generally inadequate description of the soils in the reports of these experiments, it was found impracticable to group and analyze the data with relation either to physical or chemical differences in the soils; and the grouping employed—natural productiveness, as evidenced by the yields on the unfertilized plats—was chosen as the best available.

The following table gives the individual and average yield of potatoes on the check plats, when more than one such plat has been used and separately rendered:

Yield of potatoes, in bushels per acre, on unfertilized plats when more than one such plat is given.

| Yield. | Yield. | Yield. | Yield. | Yield. | Yield. | Yield. | Yield. | Yield. | Yield. |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Bushels. | Bushels. | Bushels. | Bushels. | Bushels. | Bushels. | Bushels. | Bushels. | Bushels. | <i>Bushels.</i> |
6.5	21.6	35.2	22.5	35.4	72.0	87.0	76.0	104.7	122.8
8.1	24.6	42.7	52.0	47.6	88.5	88.0	113.0	110.5	140.3
7.3	23.1	38.9	60.8	49.5		89.0	114.0	116.2	141.8
			70.0	58.5	80.2			118.0	147.8
				67.8		88.0	101.0	118.7	148.5
11.7	16.7	34.4	51.3	107.5	55.3			119.3	150.5
12.1	20.2	37.7			73.2	89.2		122.7	158.0
	30.7	53.7		61.0	92.8	89.5	100.8	125.3	164.2
11.9	33.3				103.7		100.8	164.7	
		41.9	42.9	56.0		89.3	105.3	116.9	165.2
12.3			43.1	56.1	81.2		110.0	166.2	
16.9	25.2		45.2	67.2				88.7	181.1
			48.2	75.6	73.1	59.5	104.2	101.0	
	5.0	33.8	50.2		89.6	71.5		102.2	154.3
14.6	27.2	45.0	50.5	63.7		79.0		114.2	
	28.3	50.0	52.7		81.3	91.8	86.6	118.7	
	45.0	42.9	54.6			99.6	123.3	120.0	
13.1			54.7	52.8		146.0		121.4	
15.1	26.4		55.7	81.6	62.0			121.5	
16.3			55.7		69.0	91.2	104.9	122.4	162.0
		33.2	58.5	67.2	81.5			131.7	176.4
14.8	11.8	34.0	59.0		84.0			141.5	178.0
	24.7	55.2	62.5		96.5	72.0	96.5	159.5	178.9
	30.3	57.0		57.0	103.5	79.7	101.3	175.7	185.0
12.8	46.2	44.8	52.1	77.5		85.5	110.3	198.9	
15.2					82.8	93.5	112.0	124.5	204.0
21.5	28.2			67.3		95.1		206.0	
21.7						99.8	105.0	209.1	
		27.3			39.0	100.8		106.0	
17.8	31.0	43.1	41.6	74.1	46.2	101.5		106.3	214.2
	33.5	68.9	65.0	78.5	78.2	104.8		136.3	216.4
	35.3			80.0	100.8		73.8	157.7	
15.7	35.8	46.4	53.3		103.0	112.2	98.3		193.5
16.3					103.0	112.2	104.0	126.6	
16.8	33.9	38.3		77.5	145.4	112.3	109.6		
23.2		49.4				118.3	110.1	109.0	
		54.6		63.3	85.4		122.9	155.0	
18.0	25.8		51.4	65.8		99.1	123.8		
	28.2		53.2	71.1	73.6			132.0	170.0
	54.0		54.9	72.0	73.8		106.1	206.7	
17.8			56.9	90.3	77.9	78.0		118.7	211.7
18.6	36.0	40.2	57.3	92.0	78.5	108.3		120.2	
		61.2	57.4	96.4	80.7	114.0	93.0	133.0	196.1
			57.5		86.6		127.0	148.1	
18.2		50.7	58.4	78.7	86.7	99.6		148.2	
	13.1		58.9		87.7		110.0	154.3	
	20.0		64.9		92.5			161.4	
21.5	27.0		68.2	73.3	98.5	75.0		163.8	254.6
22.6	45.8	39.5	68.8	77.3	98.5	105.0	108.8	189.5	272.5
22.6	51.3	48.6	72.5	85.7	103.5	120.0	112.5	199.4	309.5
23.3	61.0	65.2							
22.5	36.5	51.1	60.0	78.8	86.5	100.0	110.6	153.7	278.9

It will be seen from this table that the yields of duplicate plats are not all that could be desired for scientific work of this character. No strict or exact quantitative comparison can be made from observed differences between check and fertilizer treatment when duplicate check plats vary, as do some of these, from 12 bushels to 21.7 bushels; 16.7 to 33.3; 5 to 45; 11.8 to 46.2; 13.1 to 61.0; 27.3 to 68.9; 35.4 to 107.5; 55.3 to 103.7; 39 to 145.4; 59.5 to 146.0; 106.0 to 157.7; 88.7 to 175.7; 118.7 to 199.4 This must be borne in mind in interpreting or applying the results in the following tables, and decidedly less weight should be given to the averages based upon the results from a few experiments than to those based upon a great many. In a great majority of cases these tests have been for single years on the same soil or at most for two or three years.

KINDS AND COST OF THE FERTILIZERS USED.

In the 1,769 tests reported there have been used 34 substances and 108 different combinations of these substances, and there have been many different proportions of the several ingredients in the combinations.

In computing, from a commercial standpoint, the relative efficiency of the several substances which have been used in the fertilizer tests, there must be assigned to each some arbitrary value which will represent, as fairly as possible, the average cost to the farmer in the several States. However, when these values for any reason do not represent local market conditions, the data contained in the subsequent tables are sufficient to enable a recalculation to be made on any new basis of value.

The values used in computing the commercial efficiency of fertilizers in this bulletin are given in the following table:

Valuation of fertilizers used in plat experiments on potato soils.

Ingredient.	Cost per ton.	Ingredient.	Cost per ton.
	<i>Dollars.</i>		<i>Dollars.</i>
Nitrate of soda.....	50.00	Dried blood.....	40.00
Sulphate of ammonia.....	62.00	Tankage.....	26.00
Acid phosphate.....	14.00	Boneblack.....	22.00
Rock phosphate.....	9.00	Ground bone.....	26.00
Floats.....	8.00	Cotton seed.....	16.00
Basic slag.....	12.50	Cotton-seed meal.....	25.00
Sulphate of potash.....	60.00	Cotton-seed hulls.....	4.50
Muriate of potash.....	44.00	Linseed meal.....	38.00
Kainit.....	12.00	Tobacco stems.....	15.00
Carbonate of potash and magnesia.....	(a)	Wheat bran.....	(a)
Sulphate of potash and magnesia.....	(a)	Chip dirt.....	(a)
Cotton-seed-hull ashes.....	34.00	Peat.....	(a)
Wood ashes.....	5.00	Guano.....	50.00
Lime.....	6.00	Manure.....	.50
Gypsum.....	8.00	Hen manure.....	15.00
Salt.....	8.00	Compost.....	.50
Coal ashes.....	(a)	Commercial fertilizers.....	20.00

a Not valued.

VALUE ASSIGNED POTATOES.

For the purposes of this comparative study the value to the farmer of potatoes has been taken as 70 cents per bushel, which is approximately the average farm value for 1908 as given by the Bureau of Statistics in the Yearbook of the Department of Agriculture for 1908, page 651.

TABULATION OF RESULTS.

The following table gives a complete summary of the fertilizer tests on potato soils. The actual experiment was usually performed on one-twentieth or one-tenth acre plats, but the results are uniformly stated in pounds per acre for fertilizers and bushels per acre of potatoes, and this unit is retained in this bulletin.

Results of fertilizer tests with potato soils.

MINERALS SINGLY.

Kind of fertilizer used.	Number of experiments.	Increase to no increase.	Range of crop increase.	Fertilizers per acre.		Average crop increase per acre.		Average gain per acre.
				Used.	Cost.	Bushels.	Dollars.	
		<i>Ratio.</i>	<i>Bushels.</i>	<i>Pounds.</i>	<i>Dollars.</i>	<i>Bushels.</i>	<i>Dollars.</i>	<i>Dollars.</i>
Nitrate of soda.....	55	1.8:1	-68.5 to 64.0	177	4.41	5.5	3.85	- 0.56
Sulphate of ammonia.....	6	0.5:1	-30.3 to 13.0	330	10.23	- 9.0	- 6.30	-16.53
Acid phosphate.....	82	4.5:1	-80.4 to 133.9	332	2.32	18.8	13.16	10.84
Rock phosphate.....	1	0:1	14.6	400	1.80	-14.6	-10.22	-12.02
Floats.....	1	0:1	3.4	400	1.60	- 3.4	- 2.38	- 3.98
Sulphate of potash.....	22	1:1	-58.0 to 92.2	228	6.84	8.0	5.60	- 1.24
Muriate of potash.....	64	2.8:1	-67.1 to 93.1	187	4.11	16.1	11.27	7.16
Kainit.....	14	1.8:1	-39.4 to 50.0	539	3.23	3.7	2.59	- .64
Cotton-seed-hull ashes.....	1	0:1	9.5	80	1.36	- 9.5	- 6.65	- 8.01
Wood ashes.....	16	3:1	-32.5 to 79.8	1,172	2.93	23.2	16.24	13.31
Lime.....	12	1:1	-31.0 to 49.9	1,966	5.90	2.9	2.03	- 3.87
Gypsum.....	6	1:1	-80 to 13.6	433	1.73	-10.5	- 7.35	- 9.08
Salt.....	6	0.5:1	-277 to 10.6	250	1.00	-57.1	-39.97	-40.97
Coal ashes.....	9	1.2:1	-30.8 to 15.9	14,978	.....	α 3.0	α 2.10	.....
Total.....	295	2.04:1	.....	.....	3.82	10.5	7.35	3.53

MIXTURES OF TWO MINERALS.

Nitrate of soda.....	} 50	5.2:1	-38.4 to 85.0	{ 146 289 }	5.67	29.9	20.93	15.26
Acid phosphate.....								
Nitrate of soda.....	} 5	1.5:1	-26.0 to 63.0	{ 179 115 }	7.92	6.0	4.20	- 3.72
Sulphate of potash.....								
Nitrate of soda.....	} 55	4.5:1	-78.6 to 144.0	{ 147 136 }	6.66	24.8	16.36	9.70
Muriate of potash.....								
Nitrate of soda.....	} 1	1:0	13.4	{ 200 400 }	7.40	13.4	9.38	- 1.98
Kainit.....								
Nitrate of soda.....	} 2	2:0	23.3 to 25.0	{ 210 1,300 }	9.15	24.1	16.87	7.72
Lime.....								
Sulphate of ammonia.....	} 8	7:1	- 6.8 to 80.2	{ 141 333 }	6.70	38.4	26.88	20.18
Acid phosphate.....								
Sulphate of ammonia.....	} 1	1:0	36.8	{ 300 200 }	15.30	36.8	25.76	10.46
Sulphate of potash.....								
Sulphate of ammonia.....	} 5	0.25:1	-74.7 to 15.7	{ 220 240 }	12.10	-18.2	-12.74	-24.84
Muriate of potash.....								
Acid phosphate.....	} 14	3.7:1	-12.1 to 106.3	{ 359 138 }	6.65	27.2	19.04	12.39
Sulphate of potash.....								
Acid phosphate.....	} 85	20.2:1	-12.4 to 149.0	{ 286 140 }	5.08	40.0	28.00	22.92
Muriate of potash.....								

α Not included in the averages, as the value of fertilizers is not given.

Results of fertilizer tests with potato soils—Continued.

MIXTURES OF TWO MINERALS—Continued.

Kind of fertilizer used.	Number of experiments.	Increase to no increase.	Range of crop increase.	Fertilizers per acre.		Average crop increase per acre.		Average gain per acre.
				Used.	Cost.	Bushels.	Dollars.	
Acid phosphate.....	13	12.0:1	-10.0 to 50.0	380	5.72	9.6	6.72	1.00
Kainit.....				510				
Acid phosphate.....	3	3:0	77.8 to 116.4	200	6.40	94.0	65.80	59.40
Wood ashes.....				2,000				
Acid phosphate.....	5	4:1	- 7.5 to 23.7	376	7.01	11.3	7.91	.90
Lime.....				1,460				
Rock phosphate.....	1	1:0	40.1	500	8.25	40.1	28.07	19.82
Kainit.....				1,000				
Sulphate of potash.....	2	2:0	26.7 to 29.3	110	5.25	28.0	19.60	14.35
Lime.....				650				
Muriate of potash.....	1	1:0	51.4	320	13.04	51.4	35.98	22.94
Lime.....				2,000				
Muriate of potash.....	1	0:1	— 44.1	600	14.76	-44.1	-30.87	-45.63
Wood ashes.....				625				
Muriate of potash.....	1	0:1	— 46.8	600	13.20	-46.8	-32.76	-45.96
Coal ashes.....				20,000				
Lime.....	1	1:0	13.7	2,000	9.20	13.7	9.59	.39
Gypsum.....				800				
Total.....	254	6.06:1	.....	.....	6.16	29.6	20.72	14.56

MIXTURE OF THREE OR MORE MINERALS.

Nitrate of soda.....	13	12:1	-10.0 to 64.0	215	13.01	36.7	25.69	12.68
Acid phosphate.....				436				
Sulphate of potash.....				153				
Nitrate of soda.....	125	14.6:1	-152.0 to 212.0	223	11.57	46.8	32.76	21.19
Acid phosphate.....				328				
Muriate of potash.....				168				
Nitrate of soda.....	4	4:0	23.4 to 109.1	362	13.24	57.9	40.53	27.29
Acid phosphate.....				350				
Kainit.....				290				
Nitrate of soda.....	1	1:0	52.0	250	a 52.0	a 36.40
Acid phosphate.....				400				
Carbonate of potash-magnesia.				160				
Nitrate of soda.....	1	1:0	61.0	250	a 61.0	a 42.70
Acid phosphate.....				400				
Sulphate of potash-magnesia.				160				
Nitrate of soda.....	1	1:0	9.0	94	8.33	9.0	6.30	- 2.03
Acid phosphate.....				140				
Wood ashes.....				2,000				
Nitrate of soda.....	2	2:1	71.0 to 149.0	150	10.45	110.0	77.00	66.55
Rock phosphate.....				1,000				
Muriate of potash.....				100				
Nitrate of soda.....	9	9:0	5.4 to 146.0	95	6.57	45.6	31.92	25.35
Basic slag.....				323				
Muriate of potash.....				100				
Nitrate of soda.....	2	2:0	51.3 to 76.0	320	24.56	63.6	44.52	19.96
Muriate of potash.....				480				
Lime.....				2,000				
Sulphate of ammonia.....	3	3:0	13.1 to 46.1	233	16.82	24.6	17.22	.40
Acid phosphate.....				300				
Sulphate of potash.....				250				
Sulphate of ammonia.....	53	25.5:1	-15.2 to 121.0	144	9.40	56.6	39.62	30.22
Acid phosphate.....				297				
Muriate of potash.....				130				
Sulphate of ammonia.....	1	1:0	128.4	400	16.30	128.4	89.88	73.58
Acid phosphate.....				300				
Kainit.....				300				

a Not included in the averages, as the value of fertilizers is not given.

Results of fertilizer tests with potato soils—Continued.

MIXTURES OF THREE OR MORE MINERALS—Continued.

Kind of fertilizer used.	Number of experiments.	Increase to no increase.	Range of crop increase.	Fertilizers per acre.		Average crop increase per acre.		Average gain per acre.
				Used.	Cost.	Bushels.	Dollars.	
Sulphate of ammonia.....	2	2:0	20.4 to 29.0	175	12.10	24.7	17.29	5.19
Rock phosphate.....				750				
Muriate of potash.....				150				
Acid phosphate.....	2	2:0	23.8 to 42.5	260	7.07	33.1	23.17	16.10
Sulphate of potash.....				110				
Lime.....				650				
Acid phosphate.....	1	1:0	89.4	640	17.52	89.4	62.58	45.06
Muriate of potash.....				320				
Lime.....				2,000				
Wood ashes.....	1	1:0	26.0	150	1.37	26.0	18.20	16.83
Gypsum.....				100				
Salt.....				150				
Nitrate of soda.....	2	1:1	- 7.3 to 6.0	200	19.52	.7	.49	-19.03
Acid phosphate.....				360				
Sulphate of potash.....				200				
Lime.....	2,000							
Nitrate of soda.....	1	1:0	108.3	320	25.52	108.3	75.81	50.29
Acid phosphate.....				640				
Muriate of potash.....				320				
Lime.....	2,000							
Nitrate of soda.....	2	2:0	2.2 to 29.0	200	19.52	15.6	10.92	- 8.60
Acid phosphate.....				360				
Sulphate of potash.....				200				
Wood ashes.....	2,000							
Total.....	226	17.83:1			10.55	48.5	33.95	23.40

ORGANIC FERTILIZERS SINGLY.

Dried blood.....	2	2:0	1.6 to 5.1	450	9.00	3.3	2.31	- 6.69
Tankage.....	1	1:0	9.5	1,000	10.00	9.5	6.65	- 3.35
Boneblack.....	3	3:0	25.2 to 76.4	300	3.30	43.5	30.45	27.15
Ground bone.....	17	4.7:1	-32.4 to 98.7	438	5.69	14.2	9.94	4.25
Cotton seed.....	6	6.0:0	41.3 to 239.3	3,380	27.04	125.6	87.92	60.88
Cotton-seed meal.....	23	22.0:1	-16.5 to 202.3	566	7.07	41.2	28.84	21.77
Cotton-seed hulls.....	1	0:1	8.3	2,500	5.63	-8.3	-5.81	-11.44
Tobacco stems.....	3	0:3	-19.1 to -3.6	467	3.50	-8.9	-6.23	- 9.73
Chip dirt.....	4	1:1	- 5.6 to 14.8	40,000	.....	a 2.2	a 1.54	.....
Total.....	60	5.7:1	.....	.....	8.50	23.7	16.59	8.09

ORGANIC FERTILIZERS WITH ONE MINERAL.

Dried blood.....	3	3:0	5.0 to 45.9	200	6.57	34.0	23.80	17.23
Acid phosphate.....				367				
Dried blood.....	1	1:0	22.4	300	7.80	22.4	15.68	7.88
Kainit.....				300				
Boneblack.....	1	0:1	43.7	300	14.80	-43.7	-30.59	-45.39
Nitrate of soda.....				460				
Boneblack.....	1	1:0	18.3	200	8.40	18.3	12.81	4.41
Sulphate of ammonia.....				200				
Boneblack.....	21	9.5:1	-16.5 to 88.0	334	8.77	35.8	25.06	16.29
Sulphate of potash.....				170				
Boneblack.....	23	22:1	-10.8 to 102.9	332	7.39	42.0	29.40	22.01
Muriate of potash.....				170				
Boneblack.....	12	12:0	13.0 to 65.0	320	7.36	29.6	20.72	13.36
Kainit.....				640				
Boneblack.....	1	1:0	42.8	300	8.93	42.8	29.96	21.03
Cotton-seed hulls.....				2,500				
Ground bone.....	2	1:1	-16.0 to 73.0	395	8.38	28.5	19.95	3.18
Nitrate of soda.....				130				
Ground bone.....	1	1:0	15.3	200	8.80	15.3	10.71	1.91
Sulphate of ammonia.....				200				

a Not included in the averages, as the value of fertilizers is not given.

Results of fertilizer tests with potato soils—Continued.

ORGANIC FERTILIZERS WITH ONE MINERAL—Continued.

Kind of fertilizer used.	Number of experiments.	Increase to no increase.	Range of crop increase.	Fertilizers per acre.		Average crop increase per acre.		Average gain per acre.
				Used.	Cost.	Bushels.	Dollars.	
Ground bone.....	11	11:0	14.0 to 120.5	Pounds.	Dollars.	Bushels.	Dollars.	Dollars.
Sulphate of potash.....				370 215	11.26	68.1	47.67	36.41
Ground bone.....	2	2:0	56.0 to 75.0	420 260	11.18	65.5	45.85	34.67
Muriate of potash.....				320 1,400	7.66	36.0	25.20	17.54
Ground bone.....	1	1:0	36.0	3,380 338	29.41	151.7	106.19	76.78
Wood ashes.....	6	6:0	51.1 to 263.9	3,380 225	28.39	122.2	85.54	57.15
Cotton seed.....	6	6:0	41.1 to 206.5	460 2,500	10.63	32.7	22.89	12.26
Acid phosphate.....				609 361	10.14	58.5	40.95	30.81
Cotton seed meal.....	2	2:0	31.4 to 34.0	787 100	12.84	15.8	11.06	-1.78
Cotton-seed hulls.....				425 155	8.72	15.4	10.78	2.06
Cotton-seed meal.....	14	13:1	-5.0 to 258.8	493 332	8.15	40.8	28.56	20.41
Acid phosphate.....				200 80	3.86	-9.3	-6.51	-10.37
Cotton-seed meal.....	3	2:1	-20.2 to 55.7	500 600	8.05	33.0	23.10	15.05
Sulphate of potash.....				250 120	5.59	37.4	26.18	20.59
Cotton-seed meal.....	4	4:0	12.1 to 23.5	493 332	8.15	40.8	28.56	20.41
Muriate of potash.....				200 80	3.86	-9.3	-6.51	-10.37
Cotton-seed meal.....	8	8:0	5.0 to 113.0	500 600	8.05	33.0	23.10	15.05
Kainit.....				250 120	5.59	37.4	26.18	20.59
Cotton-seed meal.....	1	0:1	- 9.3	500 80	.....	α 34.0	α 23.80	.....
Cotton-seed-hull ashes.....				.....	.....	.....	.....	.....
Cotton-seed meal.....	2	2:0	27.2 to 38.9	.....	.....	.....	.....	.....
Lime.....				.....	.....	.....	.....	.....
Linseed meal.....	1	1:0	37.4	.....	.....	.....	.....	.....
Acid phosphate.....				.....	.....	.....	.....	.....
Wheat bran.....	1	1:0	34.0	.....	.....	.....	.....	.....
Acid phosphate.....				.....	.....	.....	.....	.....
Total.....	128	15:1	.....	.....	10.68	49.3	34.51	23.83

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS.

Dried blood.....	2	1:1	-10.9 to 48.0	75 75 400	6.17	18.5	12.95	6.78
Nitrate of soda.....				340 256 167	12.27	45.2	31.64	19.37
Acid phosphate.....				300 300 300	9.90	40.0	28.00	18.00
Muriate of potash.....	25	7.3:1	- 4.9 to 110.7	280 320 160	13.92	110.3	77.21	63.20
Dried blood.....				280 320 160	12.64	104.0	72.80	60.16
Acid phosphate.....				280 320 640	12.96	60.3	42.21	29.25
Muriate of potash.....	6	6:0	85.8 to 130.8	2,000 600 4,000	57.80	-13.2	-9.24	-67.04
Dried blood.....				100 100 10	1.92	-2.6	-1.82	-3.74
Acid phosphate.....				350 224 181	14.88	50.1	35.07	20.19
Muriate of potash.....	6	6:0	26.4 to 81.0	345 216 180	13.15	44.5	31.15	18.00
Dried blood.....				.....	.....	.....	.....	.....
Boneblack.....				.....	.....	.....	.....	.....
Boneblack.....	40	7:1	-42.0 to 222.0	.....	.....	.....	.....	.....
Nitrate of soda.....				.....	.....	.....	.....	.....
Sulphate of potash.....				.....	.....	.....	.....	.....
Boneblack.....	43	7.6:1	-18.7 to 134.7	.....	.....	.....	.....	.....
Nitrate of soda.....				.....	.....	.....	.....	.....
Muriate of potash.....				.....	.....	.....	.....	.....

α Not included in the averages, as the value of fertilizers is not given.

Results of fertilizer tests with potato soils—Continued.

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS—Continued.

Kind of fertilizer used.	Number of experiments.	Increase to no increase.	Range of crop increase.	Fertilizers per acre.		Average crop increase per acre.		Average gain per acre.
				Used.	Cost.	Bushels.	Dollars.	
		Ratio.	Bushels.	Pounds.	Dollars.	Bushels.	Dollars.	Dollars.
Boneblack.....	16	7:1	-60.0 to 142.6	320	12.36	36.7	25.69	13.33
Nitrate of soda.....				200				
Kainit.....				640				
Boneblack.....	2	2:0	26.7 to 113.7	200	12.80	70.2	49.14	36.34
Sulphate of ammonia.....				200				
Muriate of potash.....				200				
Ground bone.....	10	9:1	-16.0 to 75.0	359	17.05	28.0	19.60	2.55
Nitrate of soda.....				218				
Sulphate of potash.....				231				
Ground bone.....	11	10:1	-15.4 to 79.0	215	9.18	25.3	17.71	8.53
Nitrate of soda.....				122				
Muriate of potash.....				151				
Ground bone.....	8	8:0	22.8 to 120.8	400	17.36	64.5	45.15	27.79
Sulphate of ammonia.....				160				
Sulphate of potash.....				240				
Ground bone.....	10	10:0	24.3 to 92.1	390	15.38	55.4	38.78	23.40
Sulphate of ammonia.....				168				
Muriate of potash.....				232				
Ground bone.....	1	1:0	72.7	400	18.80	72.7	50.89	32.09
Sulphate of potash.....				400				
Gypsum.....				400				
Cotton seed.....	6	6:0	42.9 to 261.1	3,380	30.75	129.7	90.79	60.04
Acid phosphate.....				337				
Kainit.....				225				
Cotton-seed meal.....	3	3:0	33.7 to 136.0	336	11.87	68.0	47.60	35.73
Nitrate of soda.....				168				
Sulphate of ammonia.....				112				
Cotton-seed meal.....	13	12:1	0. to 123.0	668	13.98	45.6	31.92	17.94
Acid phosphate.....				346				
Sulphate of potash.....				107				
Cotton-seed meal.....	10	10:0	36.3 to 101.9	486	12.74	67.9	47.57	34.83
Acid phosphate.....				424				
Muriate of potash.....				168				
Cotton-seed meal.....	13	13:0	5.0 to 206.3	424	9.24	61.0	42.70	33.46
Acid phosphate.....				292				
Kainit.....				316				
Cotton-seed meal.....	1	1:0	15.0	214	8.65	15.0	10.50	1.85
Acid phosphate.....				140				
Wood ashes.....				2,000				
Cotton-seed meal.....	1	1:0	2.9	200	7.01	2.9	2.03	-4.98
Rock phosphate.....				700				
Cotton-seed-hull ashes.....				80				
Linseed meal.....	6	6:0	8.1 to 50.9	250	7.68	27.7	19.39	11.71
Acid phosphate.....				120				
Muriate of potash.....				95				
Guano.....	3	3:0	3.7 to 18.3	483	18.93	10.8	7.56	-11.37
Sulphate of ammonia.....				150				
Muriate of potash.....				100				
Wheat bran.....	6	6:0	24.9 to 57.0	458	a 37.4	a 26.18
Acid phosphate.....				80				
Muriate of potash.....				85				
Peat.....	1	1:0	31.5	50,000	a 31.5	a 22.05
Acid phosphate.....				200				
Sulphate of potash.....				100				
Peat.....	1	1:0	35.0	20,000	a 35.0	a 24.50
Rock phosphate.....				600				
Sulphate of potash.....				120				
Dried blood.....	2	2:0	4.4 to 59.5	75	10.67	31.9	22.33	11.66
Nitrate of soda.....				75				
Acid phosphate.....				400				
Sulphate of potash.....	150							
Dried blood.....	6	6:0	9.9 to 270.0	420	19.35	142.0	99.40	80.05
Nitrate of soda.....				162				
Acid phosphate.....				449				
Muriate of potash.....	171							

a Not included in the averages, as the value of fertilizers is not given.

Results of fertilizer tests with potato soils—Continued.

ORGANIC FERTILIZERS WITH TWO OR MORE MINERALS—Continued.

Kind of fertilizer used.	Number of experiments.	Increase to no increase.	Range of crop increase.	Fertilizers per acre.		Average crop increase per acre.		Average gain per acre.
				Used.	Cost.	Bushels.	Dollars.	
		Ratio.	Bushels.	Pounds.	Dollars.	Bushels.	Dollars.	Dollars.
Cotton-seed meal.....	3	3:0	55.3 to 144.0	338	13.92	101.5	71.05	57.13
Nitrate of soda.....				169				
Sulphate of ammonia.....				113				
Acid phosphate.....				282				
Cotton-seed meal.....	2	2:0	59.0 to 67.4	302	12.76	63.2	44.24	31.43
Nitrate of soda.....				75				
Acid phosphate.....				450				
Muriate of potash.....				180				
Cotton-seed meal.....	2	2:0	49.7 to 87.3	336	25.12	68.5	47.95	23.83
Nitrate of soda.....				378				
Sulphate of ammonia.....				210				
Acid phosphate.....				420				
Kainit.....				336				
Total.....	269	11.8:1			14.08	53.5	37.45	23.42

MANURE AND COMBINATIONS.

Manure.....	81	26:1	-16.0 to 240.3	30,513	7.62	53.1	37.17	29.55
Hen manure.....	4	3:1	-9.0 to 48.0	7,000	52.50	22.6	15.82	-36.68
Manure.....	5	4:1	-3.0 to 122.0	14,000	5.01	54.7	38.29	33.28
Acid phosphate.....				216				
Manure.....	1	1:0	225.3	34,128	12.93	225.3	157.71	144.78
Muriate of potash.....				200				
Manure.....	1	0:1	26.7	20,000	6.80	-26.7	-18.69	-25.49
Kainit.....				300				
Manure.....	1	1:0	55.0	24,000	9.50	55.0	38.50	29.00
Wood ashes.....				1,400				
Manure.....	1	1:0	100.9	20,000	19.60	100.9	70.63	51.03
Nitrate of soda.....				500				
Acid phosphate.....				300				
Manure.....	1	1:0	171.3	34,128	19.13	171.3	119.91	100.78
Sulphate of ammonia.....				200				
Muriate of potash.....				200				
Manure.....	1	1:0	12.0	4,000	3.48	12.0	8.40	4.92
Acid phosphate.....				140				
Sulphate of potash.....				50				
Manure.....	1	1:0	85.0	24,000	14.32	85.0	59.50	45.18
Boneblack.....				320				
Sulphate of potash.....				160				
Manure.....	12	12:0	31.3 to 121.0	20,000	11.72	84.4	59.08	47.36
Boneblack.....				160				
Nitrate of soda.....				100				
Sulphate of potash.....				82				
Manure.....	14	13:1	-5.0 to 144.0	30,000	16.53	43.3	30.31	13.78
Boneblack.....				240				
Nitrate of soda.....				150				
Muriate of potash.....				120				
Manure.....	1	1:0	205.0	34,128	21.33	205.0	143.50	122.17
Boneblack.....				200				
Sulphate of ammonia.....				200				
Muriate of potash.....				200				
Manure.....	1	1:0	43.7	400	5.00	43.7	30.59	25.59
Cotton-seed meal.....				200				
Acid phosphate.....				200				
Muriate of potash.....				50				
Compost.....	9	1.25:1	-62.2 to 138.0	21,134	5.28	46.9	32.83	27.55
Total.....	134	11.2:1			10.33	56.6	39.62	29.29

COMMERCIAL FERTILIZERS.

Commercial fertilizers....	403	14.5:1	-45.5 to 162.0	1,138	11.38	41.8	29.26	17.88
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The following table gives a brief summary or recapitulation of the data presented in the last table, giving, by groups of materials, the number of experiments, the actual number of increases and of no increases reported, the ratio between these, and the average increase per acre in bushels:

Actual number of increases and no increases reported with each class of fertilizer.

Fertilizer.	Number of experiments.	Increase.	No increase.	Ratio.	Average gain per acre.
Minerals alone.....	295	198	97	2.04:1	<i>Bushels.</i> 10.5
Mixture of two minerals.....	254	218	36	6.1:1	29.6
Mixture of three or more minerals.....	226	214	12	17.8:1	48.5
Organic fertilizers singly.....	60	51	9	5.7:1	23.7
Organic fertilizers with one mineral.....	128	120	8	15.0:1	49.3
Organic fertilizers with two or more minerals.....	269	248	21	11.8:1	53.5
Manure and combinations.....	134	123	11	11.2:1	56.6
Commercial fertilizers.....	403	377	26	14.5:1	41.8
Total.....	1,769	1,550	221	7.0:1	.....39

EFFECTIVENESS OF SINGLE SUBSTANCES AND MIXTURES.

Notwithstanding what has been said about the wide variations of check plats and the wide variations shown in crop increases with all the fertilizers, the general conclusion that the chances for increased yield and the actual size of the increase are larger with the number of substances used in the mixture, at least up to three substances, seems so consistent and regular that there can be little doubt of correctness.

To examine this point further several of the single fertilizers and their mixtures have been brought together in the following table, showing both the sum of the increases attributable to the single fertilizers and the increases due to their mixtures.

Increase in yield of potatoes due to single fertilizers compared with increase due to mixtures of these fertilizers.

Fertilizer.	Number of experiments.	Increase per acre.	Fertilizer.	Number of experiments.	Increase per acre.
		<i>Bushels.</i>			<i>Bushels.</i>
Nitrate of soda.....	55	5.5	Cotton-seed meal.....	23	41.2
Acid phosphate.....	82	18.8	Acid phosphate.....	82	18.8
		24.3			60.0
Mixture.....	50	29.9	Mixture.....		58.5
Nitrate of soda.....	55	5.5	Dried blood.....	2	3.3
Muriate of potash.....	64	16.1	Acid phosphate.....	82	18.8
		21.6	Muriate of potash.....	64	16.1
Mixture.....	55	24.8			38.2
Acid phosphate.....	82	18.8	Mixture.....	25	45.2
Sulphate of potash.....	22	8.0	Boneblack.....	3	43.5
		26.8	Nitrate of soda.....	55	5.5
Mixture.....	14	27.2	Sulphate of potash.....	22	8.0
Acid phosphate.....	82	18.8			57.0
Muriate of potash.....	64	16.1	Mixture.....	40	50.1
		34.9	Boneblack.....	3	43.5
Mixture.....	85	40.0	Nitrate of soda.....	55	5.5
Acid phosphate.....	82	18.8	Muriate of potash.....	64	16.1
Kainit.....	14	3.7			65.1
		22.5	Mixture.....	43	44.5
Mixture.....	13	9.6	Boneblack.....	3	43.5
Nitrate of soda.....	55	5.5	Nitrate of soda.....	55	5.5
Acid phosphate.....	82	18.8	Kainit.....	14	3.7
Sulphate of potash.....	22	8.0			52.7
		32.3	Mixture.....	16	36.7
Mixture.....	13	36.7	Ground bone.....	17	14.2
Nitrate of soda.....	55	5.5	Nitrate of soda.....	55	5.5
Acid phosphate.....	82	18.8	Sulphate of potash.....	22	8.0
Muriate of potash.....	64	16.1			27.7
		40.4	Mixture.....	10	28.0
Mixture.....	125	46.8	Ground bone.....	17	14.2
Sulphate of ammonia.....	6	-9.0	Nitrate of soda.....	55	5.5
Acid phosphate.....	82	18.8	Muriate of potash.....	64	16.1
Muriate of potash.....	64	16.1			35.8
		25.9	Mixture.....	11	25.3
Mixture.....	53	56.6	Ground bone.....	17	14.2
Boneblack.....	3	43.5	Sulphate of ammonia.....	6	-9.0
Sulphate of potash.....	22	8.0	Muriate of potash.....	64	16.1
		51.5			21.3
Mixture.....	21	35.8	Mixture.....	10	55.4
Boneblack.....	3	43.5	Cotton-seed meal.....	23	41.2
Muriate of potash.....	64	16.1	Acid phosphate.....	82	18.8
		59.6	Sulphate of potash.....	22	8.0
Mixture.....	23	42.0			68.0
Boneblack.....	3	43.5	Mixture.....	13	45.6
Kainit.....	14	3.7	Cotton-seed meal.....	23	41.2
		47.2	Acid phosphate.....	82	18.8
Mixture.....	12	29.6	Muriate of potash.....	64	16.1
Ground bone.....	17	14.2			76.1
Sulphate of potash.....	22	8.0	Mixture.....	10	67.9
		22.2	Cotton-seed meal.....	23	41.2
Mixture.....	11	68.1	Acid phosphate.....	82	18.8
			Kainit.....	14	3.7
					63.7
			Mixture.....	13	61.0

EFFECT OF USING INCREASED AMOUNTS OF FERTILIZERS.

In the following table are brought together all available data showing the effects of increasing amounts of fertilizers applied to the soil and the corresponding average increase in crop production attributable thereto:

Increase in yield of potatoes attributable to different amounts of fertilizers.

Name of fertilizer.	Quantity per acre.	Number of experiments.	Range of crop increase.	Average increase per acre.
	<i>Pounds.</i>		<i>Bushels.</i>	<i>Bushels.</i>
Nitrate of soda.....	Below 100	12	- 1.8 to 43.0	18.5
	100 to 149	9	-68.5 to 37.5	- 7.7
	150 to 199	20	-16.3 to 64.0	11.6
	200 to 299	7	-29.3 to 11.5	- 6.9
	300+	7	-59.4 to 27.0	- 5.0
Acid phosphate.....	Below 200	16	- 8.5 to 81.5	14.8
	200 to 299	11	-80.4 to 63.5	1.4
	300 to 399	26	-12.3 to 133.9	25.4
	400 to 499	21	- 3.0 to 53.5	19.6
	500+	14	0.8 to 80.8	26.7
Muriate of potash.....	100 to 149	23	-50.9 to 71.2	8.5
	150 to 199	21	-22.8 to 83.0	27.3
	200 to 299	12	- 9.7 to 93.1	18.3
	300 to 399	4	3.7 to 57.0	33.7
	400+	4	-67.1 to 16.3	-29.5
Cotton-seed meal.....	Below 300	3	-16.5 to 118.0	37.2
	300 to 499	7	10.0 to 32.7	19.5
	500 to 999	8	7.6 to 52.9	36.1
	1,000 to 1,499	3	33.5 to 119.9	81.7
	1,500+	2	62.3 to 202.3	132.3
Manure.....	Below 5,000	3	- 0.4 to 89.0	39.5
	5,000 to 9,999	3	41.7 to 59.1	48.0
	10,000 to 19,999	12	8.7 to 169.0	63.6
	20,000 to 39,999	19	-16.0 to 240.3	68.2
	40,000+	44	-13.6 to 127.0	43.0
Commercial fertilizers.....	Below 300	2	43.1 to 59.8	51.4
	300 to 599	98	-45.5 to 89.5	24.5
	600 to 999	47	-19.5 to 134.6	36.9
	1,000 to 1,499	99	-12.2 to 107.2	39.9
	1,500 to 1,999	75	-13.5 to 151.0	55.2
2,000+	82	-14.4 to 162.0	56.6	

RELATION OF FERTILIZER EFFECT AND NATURAL PRODUCTIVENESS OF THE SOIL.

In the following table are rearranged all available data to show the effectiveness of fertilizers on soils of different productivity as measured by the yield of the unfertilized plats:

Increase in yield of potatoes attributable to fertilizers, arranged in accordance with the actual yield of the "check" plats.

Fertilizer.	Yield of unfertilized plats.	Number of experiments.	Range of increase.	Average increase.
	<i>Bushels.</i>		<i>Bushels.</i>	<i>Bushels.</i>
Nitrate of soda.....	10.0 to 19.9	4	1.5 to 30.8	10.3
	20.0 to 29.9	4	- 2.5 to 23.6	11.8
	30.0 to 39.9	6	-18.7 to 14.0	0.2
	40.0 to 49.9	3	- 5.1 to 17.6	5.0
	50.0 to 59.9	6	-22.4 to 42.9	3.8
	60.0 to 69.9	8	-16.3 to 27.0	5.2
	70.0 to 79.9	5	-10.9 to 64.0	16.0
	80.0 to 89.9	7	-29.3 to 41.3	2.5
	90.0 to 99.9	2	-22.0 to 9.6	- 6.2
	100.0 to 119.9	5	-16.0 to 37.5	15.4
	120.0 to 139.9	1	18.8	18.8
	140.0 to 149.9	0		
	150.0+	5	-68.5 to 42.3	-10.8
Acid phosphate.....	10.0 to 19.9	6	1.0 to 20.3	8.3
	20.0 to 29.9	11	0.4 to 53.5	17.0
	30.0 to 39.9	6	- 6.8 to 23.0	5.9
	40.0 to 49.9	3	0.9 to 8.3	5.2
	50.0 to 59.9	8	-17.7 to 33.5	3.4
	60.0 to 69.9	7	-21.7 to 43.4	14.6
	70.0 to 79.9	8	- 3.0 to 80.8	29.8
	80.0 to 89.9	10	-12.3 to 110.8	24.7
	90.0 to 99.9	2	- 5.8 to 3.8	- 1.0
	100.0 to 119.9	10	-14.2 to 112.3	29.0
	120.0 to 139.9	1	81.5	81.5
	140.0 to 149.9	2	5.4 to 88.0	46.7
	150.0+	9	-80.4 to 133.9	20.4
Muriate of potash.....	10.0 to 19.9	4	- 2.8 to 11.8	3.9
	20.0 to 29.9	5	3.7 to 46.2	17.0
	30.0 to 39.9	6	- 9.5 to 47.3	26.0
	40.0 to 49.9	3	1.4 to 44.1	28.6
	50.0 to 59.9	6	-16.0 to 71.2	11.0
	60.0 to 69.9	7	- 9.7 to 57.0	13.7
	70.0 to 79.9	4	- 0.9 to 66.7	28.3
	80.0 to 89.9	8	- 1.9 to 83.0	24.0
	90.0 to 99.9	2	- 0.8 to -0.3	- 0.6
	100.0 to 119.9	8	- 7.8 to 46.1	14.4
	120.0 to 139.9	1	41.2	41.2
	140.0 to 149.9	1	42.9	42.9
	150.0+	10	-67.1 to 93.1	- 3.3
Nitrate of soda and acid phosphate.....	10.0 to 19.9	5	- 1.2 to 28.4	12.0
	20.0 to 29.9	4	- 0.9 to 70.9	27.2
	30.0 to 39.9	6	- 0.4 to 49.6	28.4
	40.0 to 49.9	3	3.0 to 16.4	9.8
	50.0 to 59.9	6	- 8.7 to 24.5	19.7
	60.0 to 69.9	5	- 6.4 to 85.0	33.1
	70.0 to 79.9	4	7.3 to 68.3	41.2
	80.0 to 89.9	4	22.0 to 63.2	34.9
	90.0 to 99.9	1	29.2	29.2
	100.0 to 119.9	5	15.7 to 79.2	43.3
	120.0 to 139.9	1	47.5	47.5
	140.0 to 149.9	0		
	150.0+	6	-38.4 to 78.0	39.0
Nitrate of soda and muriate of potash.....	10.0 to 19.9	3	- 6.0 to 16.4	4.6
	20.0 to 29.9	3	0.4 to 50.2	23.0
	30.0 to 39.9	4	-25.7 to 59.4	19.2
	40.0 to 49.9	3	5.9 to 79.9	47.1
	50.0 to 59.9	9	- 8.7 to 41.6	15.7
	60.0 to 69.9	4	- 6.3 to 81.0	26.1
	70.0 to 79.9	4	- 2.5 to 65.2	29.0
	80.0 to 89.9	7	17.9 to 72.0	32.8
	90.0 to 99.9	1	23.2	23.2
	100.0 to 119.9	5	23.1 to 72.0	43.9
	120.0 to 139.9	3	17.9 to 144.0	95.0
	140.0 to 149.9	0		
	150.0+	6	-78.6 to 38.4	-20.2

Increase in yield of potatoes attributable to fertilizers, arranged in accordance with the actual yield of the "check" plats—Continued.

Fertilizer.	Yield of unfertilized plats.	Number of experiments.	Range of increase.	Average increase.
	<i>Bushels.</i>		<i>Bushels.</i>	<i>Bushels.</i>
Acid phosphate and muriate of potash.....	10.0 to 19.9	9	2.0 to 112.4	31.2
	20.0 to 29.9	6	5.3 to 64.6	21.3
	30.0 to 39.9	9	- 4.3 to 75.4	29.1
	40.0 to 49.9	3	0.2 to 61.4	37.9
	50.0 to 59.9	12	-12.4 to 27.9	19.3
	60.0 to 69.9	6	29.9 to 149.0	80.2
	70.0 to 79.9	5	4.0 to 77.3	40.3
	80.0 to 89.9	13	14.1 to 134.7	53.1
	90.0 to 99.9	4	11.1 to 75.0	39.3
	100.0 to 119.9	12	15.4 to 94.0	57.3
	120.0 to 139.9	3	37.7 to 88.0	65.9
	140.0 to 149.9	0		
	150.0+	4	0.8 to 37.7	17.5
Nitrate of soda, acid phosphate, and muriate of potash.....	10.0 to 19.9	9	- 0.3 to 74.0	48.1
	20.0 to 29.9	3	6.4 to 100.2	41.6
	30.0 to 39.9	17	14.4 to 92.0	63.2
	40.0 to 49.9	3	11.5 to 83.9	59.1
	50.0 to 59.9	18	-10.7 to 75.6	27.8
	60.0 to 69.9	11	13.2 to 160.0	59.5
	70.0 to 79.9	7	- 3.2 to 86.6	30.1
	80.0 to 89.9	9	10.6 to 171.0	48.5
	90.0 to 99.9	7	23.2 to 157.0	88.8
	100.0 to 119.9	10	-15.2 to 109.0	51.3
	120.0 to 139.9	10	14.2 to 212.0	92.9
	140.0 to 149.9	1	54.7	54.7
	150.0+	18	-32.9 to 75.0	35.6
Sulphate of ammonia, acid phosphate, and muriate of potash.....	10.0 to 19.9	5	28.5 to 118.8	81.1
	20.0 to 29.9	5	20.4 to 38.7	31.4
	30.0 to 39.9	9	1.1 to 105.0	28.4
	40.0 to 49.9	0		
	50.0 to 59.9	3	31.5 to 41.7	35.7
	60.0 to 69.9	2	22.5 to 54.3	38.4
	70.0 to 79.9	0		
	80.0 to 89.9	5	40.4 to 95.7	62.7
	90.0 to 99.9	5	25.2 to 121.0	80.3
	100.0 to 119.9	10	22.1 to 110.1	71.5
	120.0 to 139.9	4	39.5 to 105.0	81.6
	140.0 to 149.9	5	31.0 to 71.0	59.4
	150.0+	2	-15.2 to - 3.8	- 9.5
Boneblack, nitrate of soda, and muriate of potash.....	10.0 to 19.9	0		
	20.0 to 29.9	0		
	30.0 to 39.9	3	45.0 to 164.7	119.3
	40.0 to 49.9	4	12.2 to 16.7	14.8
	50.0 to 59.9	5	62.0 to 141.0	88.3
	60.0 to 69.9	3	10.0 to 71.2	46.0
	70.0 to 79.9	10	-10.5 to 101.2	38.7
	80.0 to 89.9	7	-18.7 to 65.0	28.5
	90.0 to 99.9	0		
	100.0 to 119.9	0		
	120.0 to 139.9	3	16.1 to 35.1	26.7
	140.0 to 149.9	4	47.1 to 48.6	47.8
	150.0+	4	1.3 to 26.0	13.6
Manure.....	10.0 to 19.9	4	11.0 to 72.1	40.2
	20.0 to 29.9	4	12.4 to 43.3	31.9
	30.0 to 39.9	7	34.5 to 240.3	100.7
	40.0 to 49.9	4	1.6 to 77.6	24.0
	50.0 to 59.9	7	23.0 to 127.0	79.5
	60.0 to 69.9	7	20.6 to 109.5	59.9
	70.0 to 79.9	9	5.7 to 70.3	43.0
	80.0 to 89.9	12	- 0.4 to 162.0	62.5
	90.0 to 99.9	4	2.6 to 169.0	88.7
	100.0 to 119.9	8	-16.0 to 88.0	34.1
	120.0 to 139.9	3	9.3 to 17.6	12.3
	140.0 to 149.9	7	-13.6 to 91.0	22.1
	150.0+	10	- 9.0 to 61.5	33.8
Commercial fertilizers.....	10.0 to 19.9	36	- 0.2 to 79.5	25.2
	20.0 to 29.9	51	- 2.2 to 62.8	27.0
	30.0 to 39.9	1	67.0	67.0
	40.0 to 49.9	22	- 5.5 to 131.0	41.7
	50.0 to 59.9	25	-13.5 to 41.7	12.8
	60.0 to 69.9	9	34.1 to 142.9	59.7
	70.0 to 79.9	28	-17.8 to 162.0	71.7
	80.0 to 89.9	51	-19.5 to 136.0	51.3
	90.0 to 99.9	35	-14.4 to 90.2	33.4
	100.0 to 119.9	59	-39.5 to 89.7	40.5
	120.0 to 139.9	36	2.9 to 90.8	50.9
	140.0 to 149.9	1	26.0	26.0
	150.0+	59	-45.5 to 119.7	47.4

SUMMARY.

It appears from the published records that in twenty-three States the experiment stations have made 1,769 tests of substances applied to all sorts of soils.

The variations of yield on unfertilized check plats in the same field and the variation of the increases attributable to fertilizers on different soils and in different seasons are large, nevertheless it appears:

(1) That the chances to obtain an increase in crop and the actual increase in bushels are larger with two or three substances mixed than with single substances.

(2) There is little indication of any significant difference in productivity due to different amounts of fertilizers used.

(3) There is little indication of any significant difference in effectiveness of fertilizers on soils of different natural productivity as measured by the yield of check plats, such differences as are shown indicating a somewhat greater efficiency of some of the fertilizers on the more productive soils.

The data contained in the station reports does not permit one to judge of the cumulative effect of the continued use of fertilizers on the same soil for a long series of years.

It appears that in general the results indicate a very profitable use of fertilizers in the growing of potatoes.

As these results have been obtained from a large number of soils, with a considerable range of productivity, over a number of years, these general conclusions, besides others of a qualitative value which can be drawn from the tables, can, in the absence of any more specific knowledge of any particular soil, be safely followed as a guide to the immediate selection of fertilizers for a potato soil.



