

BULLETIN NO 101

January, 1908.

LIBRARY  
A. & M. COLLEGE  
OF  
TEXAS

# Irish Potato Fertilizer Experiments



Postoffice,  
COLLEGE STATION, BRAZOS COUNTY, TEXAS.

# TEXAS AGRICULTURAL EXPERIMENT STATIONS

## OFFICERS.

### GOVERNING BOARD.

(Board of Directors A. & M. College.)

K. K. LEGGETT, President.....	Abilene
T. D. ROWELL, Vice President.....	Jefferson
A. HAIIDUSEK.....	LaGrange
J. M. GREEN.....	Yoakum
WALTON PETEET.....	Dallas
R. T. MILNER.....	Austin
L. L. McINNIS.....	Bryan
W. B. SEBASTIAN.....	Breckenridge

### STATION OFFICERS.

H. H. HARRINGTON.....	LL. D., President of the College and Director
J. W. CARSON.....	Assistant to Director and State Feed Inspector
W. C. WELBORN.....	Vice Director and Agriculturist
M. FRANCIS.....	Veterinarian
E. J. KYLE.....	Horticulturist
JOHN C. BURNS.....	Animal Husbandry
R. L. BENNETT.....	Cotton Specialist
O. M. BALL.....	Botanist
G. S. FRAPS.....	Chemist
C. E. SANBORN.....	Co-Operative Entomologist
N. C. HAMNER.....	Assistant Chemist
E. C. CARLYLE.....	Assistant Chemist
L. McLENNAN.....	Deputy Feed Inspector
A. T. POTTS.....	Deputy Feed Inspector
J. H. RODGERS.....	Deputy Feed Inspector
H. E. HANNA.....	Deputy Feed Inspector
C. W. CRISLER.....	Chief Clerk
W. L. BOYETT.....	Clerk Feed Control
MISS PATTI McCLELLAN.....	Stenographer
W. E. BERRY.....	Stenographer

### STATE SUB-STATIONS.

W. S. HOTCHKISS, Superintendent.....	Troupe, Smith County
S. A. WASCHKA, Superintendent.....	Beeville, Bee County

NOTE—The main station is located on the grounds of the Agricultural and Mechanical College, in Brazos County. The postoffice address is College, Station, Texas. Reports and bulletins are sent free upon application to the Director.

117  
E2.2

# Irish Potato Fertilizer Experiments

W. S. Hotchkiss and E. J. Kyle.

The fertilizer work with the Irish potato at Troupe was first planned in the fall of 1902. The results which were gotten upon harvesting the crop in the spring of 1903 were so opposed, especially in reference to potash, to what had been obtained at a number of stations in different States, it was decided to get out a preliminary report. Bulletin No. 71 contains these results, a summary of which is, as follows:

1. The gray sandy, clay soil, with red subsoil at the Troupe Station responded more profitably to an application of acid phosphate than to any other single fertilizer.

2. In a complete fertilizer, potash over 6 per cent was unprofitable, while unusually large percentages (8 per cent and 10 per cent) of phosphoric acid greatly increased the yield.

3. Cotton seed meal applied only a few days before planting was too slowly available to prove a desirable fertilizer for early potatoes.

The work recorded in the present bulletin is a continuation of that already done, with a view to the further verification of the somewhat unexpected results above given.

Since 1903 this work has been continued each year, with the exception of 1905 when all the potatoes rotted in the ground, on account of the unusually wet weather.

This bulletin, therefore, contains the results gotten from the crops of 1904, '06, '07, together with those of 1903.

In 1904 the land used for the experiment was comparatively new, though two years earlier it had raised a crop of sorghum. The previous season it had "laid out" uncultivated. After being flat-broken six inches deep with a turning plow the soil was thoroughly worked during January, and in February the rows were laid off with a middle burster three and a half feet apart, the fertilizer was applied along the rows by hand and then worked into the soil by running a five-tooth horse hoe along the rows.

Home grown, second crop Triumph potatoes were planted Feb. 25th. They had been cut to two eye pieces about ten days earlier. A good stand was secured on all plats.

Before the plants were up the field was harrowed with a spike-tooth harrow, and subsequent cultivation was given every ten days with the five-tooth horse hoe cultivator.

## Notes on Appearance of Plats May 26th:

Plat 1. Plants one-third larger and darker color than check.

Plat 3. Plants one-third larger than check.

" 5. About same size as check.

" 7. Plants two-thirds larger and darker color than check.

" 9. " one-half larger than check.

" 11. " one-half larger than check.

" 13. " but little larger than check.

" 15. " two-thirds larger than check, darker color.

" 17. " two-thirds larger than check, darker color.

(3)  
67809

- " 19. " two-thirds larger than check, darker color.
- " 21. " one-half larger than check.
- " 23. " three-fourths larger than check.
- " 25. " three-fourths larger than check.
- " 27. " two-thirds larger than check.
- " 29. " one-third larger than check.
- " 31. " two-thirds larger than check.
- " 33. " two-thirds larger than check.
- " 35. " two-thirds larger than check.
- " 37. " three-fourths larger than check.
- " 39. " nearly twice larger than check.
- " 41. " slightly larger than check.

On June 24th, the tops were mature and the crop was harvested.

### Harvest Record—Irish Potato Fertilizers at Troupe.

Plat No.	Fertilizer Used	Percent of Plant Food	Pounds Used.	Yield Marketable Bushels Per Acre.	Culls.	Grain marketable.
1	Nitrate of Soda	16 N	94	60	9 1-3 bu	13 bu
2	Check			47	6 bu	
3	Acid Phosphate	14 P	285	50 1-3	6 2-3 bu	5 bu
4	Check			44 1-3	6 bu	
5	Sulphate of Potash	50 K	80	40 1-3	5 1-3 bu	— 7 bu
6	Check			50 3-4	4 2-3 bu	
7	Cottonseed Meal	7 N 3 P 1 ½ K	210	73 1-3	6 bu	21 bu
8	Check			54	4 bu	
9	Nitrate of Soda	4 N	94	82 1-3	11 1-3 bu	26 bu
10	Acid Phosphate	10.5 P	285			
11	Check			59 1-3	5 1-3 bu	
12	Nitrate of Soda	8.6 N	94	82	4 1-3 bu	30 bu
13	Sulphate of Potash	23 K	80			
14	Check			46	7 2-3 bu	
15	Acid Phosphate	11 P	285	60 2-3	4 bu	14 bu
16	Sulphate of Potash	11 K	80			
17	Check			46	7 2-3 bu	
18	Nitrate of Soda	3.3 N	94			
19	Acid Phosphate	8.6 P	285	74 2-3	6 bu	28 bu
20	Sulphate of Potash	8.2 K	80			
21	Check			47	10 1-3 bu	
22	Nitrate of Soda	3.8 N	94			
23	Acid Phosphate	7.7 P	215	90	6 3-4 bu	39 bu
24	Sulphate of Potash	10.2 K	80			
25	Check			59	8 1:3 bu	
26	Nitrate of Soda	3.4 N	94			
27	Acid Phosphate	8.8 P	285	74 2-3	6 2-3 bu	29 bu
28	Sulphate of Potash	6.5 K	59			
29	Check			30	6 bu	
30	Nitrate of Soda	3 N	94			
31	Acid Phosphate	9.5 P	331	51	5 2-3 bu	19 bu
32	Sulphate of Potash	6 K	59			
33	Check			33 1-3	8 bu	
34	Nitrate of Soda	4.6 N	143			
35	Acid Phosphate	8.2 P	285	70 2-3	9 1-3 bu	25 bu
36	Sulphate of Potash	6 K	59			
37	Check			56	3 2-3 bu	
38	Nitrate of Soda	4.2 N	142			
39	Acid Phosphate	8.7 P	331	78 3-4	4 bu	23 bu
40	Sulphate of Potash	5.5 K	59			
41	Check			54	6 2-3 bu	
42	Nitrate of Soda	4 N	94			
43	Acid Phosphate	8.1 P	215	87	5 bu	36 bu
44	Sulphate of Potash	8 K	59			
45	Check			48 1-3	5 bu	
46	Nitrate of Soda	2.7 N	94			
47	Acid Phosphate	10.1 P	400	40 2-3	4 bu	— 14 bu
48	Sulphate of Potash	5.3 K	59			
49	Check			60 2-3	8 bu	
50	Cottonseed Meal	3 N	250			
51	Acid Phosphate	8 P	285	62	3 1-3 bu	11 bu
52	Sulphate of Potash	5.6 K	59			
53	Check			42 1-3	4 2-3 bu	
54	Cottonseed Meal	2.7 N	250			
55	Acid Phosphate	8.4 P	331	63 1-3	6 bu	18 bu
56	Sulphate of Potash	5 K	59			

Plat No.	Fertilizer Used	Percent of Plant Food	Pounds Used.	Yield Marketable Pounds Per Acre.	Culls.	Grain marketable.
34	Check.....			48 2-3.....	5 1-3.....	
	Cottonseed Meal ..	3 N.....	250.....			
35	Acid Phosphate ..	7.77 P.....	257.....	73.....	7.....	24 bu.....
	Sulphate of Potash.	6 K.....	55.....			
36	Check.....			50 1-3.....	5.....	
	Cotton Seed Meal ..	3 N.....	300.....			
37	Acid Phosphate....	5.2 P.....	200.....	95.....	6 2-3.....	43 bu ..
	Kainit.....	4 K.....	200.....			
38	Check.....			54 2-3.....	3 2-3.....	
39	Manure.....	20 wag lds		91.....	6.....	41 bu. .
40	Check.....			46 2-3.....	6 2-3.....	
41	Ashes.....		80 bu.....	65 2-3.....	8.....	19 bu.....
42	Check.....			46.....	5.....	

By comparing the yield of any fertilized plat with the average yield of the two adjacent check plats, it will be seen that cotton seed meal, when used alone, gave a greater increase in yield than any other single fertilizer. Plat 7 received an application of 210 lbs. of cotton seed meal, and its increase in yield over its check plats was nearly equal to the average increase of the 12 plats that received complete mixtures varying in weight from 390 lbs. to 700 lbs. and averaging over 500 lbs. each; and gave a greater increase in yield than the average of the 15 plats upon which potash was used. Potash when used alone gave very poor results as far as increase in yield was concerned. Nitrate of soda and acid phosphate when used together gave good results. Plat 9.

Plat 37 made the greatest increase over its check plats. This plat received more nitrogen and less potash than any other plat having a complete mixture. Barn lot manure made a good yield, but 25 per cent were scabby and unfit for market.

### EXPERIMENTS IN 1906.

In 1906 duplicate plantings were made which will be referred to as Field A and B.

Field A, had raised a crop of Irish potatoes in 1903, and a crop of castor beans in 1904. During 1905 the land was not cultivated. In November 1905 the field was flat broken with a turning plow running six inches deep. It was thoroughly harrowed with a disc in February and again in March.

Field B, had "laid out" in 1903. A crop of corn was grown on it in 1904 and in 1905 a crop of cowpeas. The pea-vines were partly green when plowed under in October. Plowing was at the same depth as in Field A. In November the land was harrowed with a disc and this culture was repeated in February and again in March. Field A, was planted March 13th; Field B, the following day.

The method of distributing fertilizer and mixing it with the soil, and the subsequent cultivation, was similar to the respective operations of previous years.

Field A.—Notes on Growth, June 4th:

- Plat 1. Made vigorous growth, well matured, very few dark green leaves at this date, leaves half dead.
- Plat 2. Vines more vigorous, about two or three inches taller and probably one-fourth more green leaves, making them three or four days later than Plat 1, in ripeness.
- Plat 3. Vigor about same as Plat 1, but lacks a day or two in ripeness though a marked contrast exists between the rows, the west row being the greenest.
- Plat 4. Three-fourths stand. Growth about the same as Plat 1, but a little later.
- Plat 5. About same as Plat 1.
- Plat 6. Three-fourths stand. Growth superior to above plats; maturity about the same as Plat 2.
- Plat 7. Slightly smaller than Plat 6, maturity about same.
- Plat 8. Three-fourths stand. Growth not equal to Plat 6, but averages a little better than Plat 7.
- Plat 9. Growth one-fourth less and maturity three or four days ahead of 6, 7, or 8. Three-quarter stand.
- Plat 10. Growth strong, about same as plat 6; a very little earlier. Not quite as early as Plat 9.
- Plat 11. Very strong growth; color darker than other plats; three days later than Plat 9.
- Plat 12. Growth about same as check plat (9), and about same degree of maturity.

This plat can hardly be used in comparison as about one-fourth of it is on red clay.

Field B.—Notes on Growth June 4th:

- Plat 1. Growth fairly vigorous; greenish yellow, no dark green leaves.
- Plat 2. One-fourth more vigorous than Plat 1. Half week later.
- Plat 3. Growth one-fourth better than Plat 2, and one-half better than Plat 1.
- Plat 4. Growth one-half better than Plat 1, one week later.
- Plat 5. About same as Pat 1, little better stand.
- Plat 6. Very vigorous, three-fourths larger than Plat 5, one week later. Probably same as 3 and 4.
- Plat 7. Three-fourths stand, growth nearly equal to Plat 6, maturity about the same.
- Plat 8. About a week later than Plat 5, not quite so good a growth as Plat 7.
- Plat 9. Growth, color and ripeness compare well with 1-5.
- Plat 10. Growth slightly superior to 7-8-9. Maturity about same as 6-7.
- Plat 11. Growth about same as plat 10. Maturity two or three days later.
- Plat 12. One-third larger than check plat; maturity half week later.

# IRISH POTATOES FERTILIZERS, 1906.

FIELD A

FIELD B

Plat No.	Fertilizer Used	Per cent of Plant Food	Pounds of Fertilizer Per Acre	Yield		Gain Over Check	Yield		Gain Over Check	Total Gain Over Checks
				Marketable Bushels Per Acre	Culls		Marketable Bushels Per Acre	Culls		
1	Check .....			44 2-3	15 1-3		37 1-3	7		
	7 N									
2	Cotton Seed Meal ...	3 P	200	65	14 2-3	20	52 1-3	7 1-3	12	32
	1.5 K									
3	Acid Phosphate .....	14 P	300	66 2-3	12	22	60	12 2-3	20	42
4	Sulphate of Potash .....	50 K	50	45	13 1-3	0	54	7	14	14
5	Check .....			45	11		43 2-3	10 2-3		
	2.8 N		200							
6	Cotton Seed Meal ...	9.5 P	300	80	23	35	108	9	64	99
	Acid Phosphate .....	6 K								
7	Acid Phosphate .....	12 P	300	68	11	24	72 2-3	12 1-3	29	53
	Sulphate of Potash ...	7.4 K	50							
	5.6 N		200							
8	Cotton Seed Meal ...	2.4 P	50	84	13	40	72	12	28	68
	Sulphate of Potash ...	11 K								
9	Check .....			42	9		44 3-4	10 1-3		
	2.5 N		200							
10	Acid Phosphate .....	8.7 P	300	88 1-2	13	46	92 1-2	10 3-4	48	94
	Sulphate of Potash ...	5 K	50							
	Cotton Seed Meal ...	2.5 N	400							
11	Acid Phosphate .....	8 7 P	600	106	11	62	109	13 1-2	65	127
	Sulphate of Potash ...	5 K	100							
	Cotton Seed Meal ...	2.5 N	100							
12	Acid Phosphate .....	8.7 P	150	59	8 2-3	15	75 1-2	6 2-3	21	36
	Sulphate of Potash ...	5 K	25							

N., Nitrogen; P., Phosphoric acid; K., potash.

NOTE.—The price of fertilizer as in 1906, was as follows: Cotton Seed Meal, \$26.00 per ton; Acid Phosphate, \$20.00 per ton; Sulphate of Potash, \$55.00 per ton.



By adding the results of the duplicate plats together, it will be seen that potash as a single fertilizer gave considerably the smallest yield. Acid phosphate did slightly better than cotton seed meal, both doing well.

The largest yield was made with a complete fertilizer containing 1100 lbs. The next largest was made by the combination of cotton seed meal and acid phosphate. The fact that this mixture out yielded all complete fertilizers with the exception of one, again goes to prove that nitrogen and phosphoric acid are two elements of plant food most needed by soils similar to that of our Sub-station at Troupe.

#### EXPERIMENTS IN 1907.

The land used in this experiment was old, cotton being grown upon it in 1904, tomatoes in 1905, and cotton again in 1906. The soil was flat-broken during December and thoroughly harrowed during February. On March 6th, rows were laid off with a middle-burster, the fertilizer distributed and thoroughly worked in with a bull-tongue. On the same date home-grown second crop Triumph were planted. The seed were banked up during the winter and were well sprouted when uncovered for planting.

#### NOTES.

All plats were up to a perfect stand March 25th.

#### Notes on Irish Potatoes, May 27th, '07.

- Plat 1. Moderate growth. Vines light green, nearly mature.
- Plat 2. Strong, vigorous growth, dark green foliage. This plat was planted directly over a "back-furrow" and that seems to have given it some advantage throughout the season.
- Plat 3. Strong growth but not as healthy appearing as Plat 2.
- Plat 4. Growth and general appearance about same as check plat.
- Plat 5. No noticeable difference from Plat 1-4.
- Plat 6. Growth strong and vigorous. Foliage dark green. Three-fourths larger than check plats.
- Plat 7. Growth smaller and foliage lighter colored than on Plat 6.
- Plat 8. Compares favorably with Plat 2.
- Plat 9. Only moderate growth.
- Plat 10. Strong, vigorous growth. Foliage dark and healthy.
- Plat 11. Very strong, one-third larger than Plat 10.
- Plat 12. Healthy, about the same as Plat 10.
- Plat 13. About the same as other check plants.
- Plat 14. Very strong, vigorous growth. Foliage dark and healthy.
- Plat 15. About same as Plat 10.
- Plat 16. No noticeable difference from Plat 14.

IRISH POTATO EXPERIMENT, 1907...HARVEST RECORD.

Plat	Fertilizer Used	Percent of Plant Food	Pounds of Fertilizer	Yield Marketable Bushels Per Acre	Culls	Gain Marketable
1	Check			46 bu.	13.3 bu.	
2	Cotton Seed Meal	7. N	200			
		3. P				
		1.5 K		94.6 bu.	12.3 bu.	
3	Acid Phosphate	14. P	300	80 bu.	9 bu.	40 bu.
4	Sulphate of Potash	50. K	50	40 bu.	8.6 bu.	19 bu.
5	Check			21.6 bu.	5 bu.	
		2.8 N				
6	Cotton Seed Meal	9.6 P	200			
	Acid Phosphate	.6 K	300	73.3 bu.	12 bu.	51 bu.
7	Acid Phosphate	12. P	300			
	Sulphate of Potash	7.4 K	50	65.6 bu.	10 bu.	37 bu.
8	Cotton Seed Meal	2.4 P	200			
	Sulphate of Potash	5.6 N	50	88.3 bu.	14.3 bu.	53 bu.
		11. K				
9	Check			35 bu.	13.6 bu.	
10	Cotton Seed Meal	2.5 N	200			
	Acid Phosphate	8.7 P	300			
	Sulphate of Potash	5. K	50	110 bu.	13.3 bu.	75 bu.
11	Cotton Seed Meal	2.5	400			
	Acid Phosphate	8.7 P	600			
	Sulphate of Potash	5. K	100	126.3 bu.	.2 bu.	86 bu.
12	Cotton Seed Meal	2.5 N	100			
	Acid Phosphate	8.7 P	150			
	Sulphate of Potash	5. K	25	97 bu.	10.3 bu.	51 bu.
13	Check			46.6 bu.	6.6 bu.	
14	Nitrate of Soda	3. N	94			
	Acid Phosphate	8. P	285			
	Sulphate of Potash	6. K	60	115.6 bu.	8 bu.	69 bu.
15	Cotton Seed Meal	3.8 N	300			
	Acid Phosphate	6.7 P	200			
	Sulphate of Potash	5.3 K	50	86.3 bu.	10 bu.	40 bu.
16	Nitrate of Soda	3. N	94			
	Acid Phosphate	10. P	331			
	Sulphate of Potash	6. K	50	116.6 bu.	6.3 bu.	72 bu.

Cotton seed meal when used alone gave better results than any other single fertilizer (See plat 2). Potash again gave the smallest yield, (See Plat 4). It will be seen by referring to the notes, that Plat 2 was directly over a back-furrow but it is hardly probable that this effected it to any great extent.

Acid phosphate alone gave good results; (See Plat 3) Acid phosphate and cotton seed meal combined, although giving an increase of yield, did not give as satisfactory results as usual, (See Plat 6). This may have been due to soil variation. The fact that its check plat (5) adjoining it gave such a decidedly smaller yield than any other check plat and that it yielded less than either acid phosphate or cotton seed meal alone would lead to this suspicion.

While potash apparently tended to increase the yield where a complete fertilizer was used, its failure to give beneficial results when used alone (Plat 4) or in combination with acid phosphate (Plat 7) or with cotton seed meal (Plat 8) does not justify the conclusion.

### SUMMARY

The total results show that nitrogen gave very beneficial results throughout the four years, whether used in the form of cotton seed meal or nitrate of soda. When used in a complete fertilizer the results show that there was very little difference between the nitrate of soda and cotton seed meal. The average yield of the nitrogen plats as against the check plats shows an increase of 21 bushels in favor of the nitrogen.

Acid phosphate alone gave good results three out of four years and increase enough to be slightly profitable the other year. The average increase in yield in trial over the average yield of the check plat exceeds 23 bushels. Nitrogen and phosphoric acid combined averaged as much in the four years as the varying amounts of nitrogen and phosphoric acid combined with potash. Averaging the nitrogen plats as against nitrogen-phosphoric acid plats, the latter exceed the former in average yield for four years by about 20 bushels.

Comparing the acid phosphate plats with the acid phosphate-potash plats shows that the latter out-yielded the former by an average of only 6-10 of a bushel for the four years.

Averaging the check plats as against the potash plats, the latter out-yielded the former by an average of four bushels in the four years—about enough to pay for the potash.

During the four years, potash gave comparatively negative results. The total results would hardly justify its use so far as yield is concerned. The fact has been demonstrated, however, that potash has some influence on the keeping and carrying quality of fruits and vegetables; and as the potato is grown almost exclusively for early shipping, the use of a small amount of potash is probably advisable.

Since it has been demonstrated that nitrogen is one of the elements most lacking in the soil, it is very advisable, when possible, to turn under a crop of cowpeas on the land in advance of planting the potato crop. The potatoes are harvested so early in the season there is plenty of time to grow a good crop of peas for turning under during the fall.

Judging from the beneficial results obtained from both sources of nitrogen, and from the fact that it takes some time for cotton seed meal to become available, nitrate of soda being available at once, it would seem that the best possible results would be to use some of both elements. If this is done, the fertilizer could be applied just before planting, instead of ten days in advance, as is now recommended for cotton seed meal.

The nitrate of soda would supply the nitrogen at the beginning of growth, and, about the time it was giving out, the cotton seed meal would become available and carry the crop on to maturity. While we have not yet tried this mixture, the indications are that it will prove most satisfactory. The following formula is therefore recommended for all sandy East Texas soils:

1,000 lbs. Acid phosphate, 14 per cent.

700 lbs. Cotton seed meal.

200 lbs. Kainit.

100 lbs. Nitrate of soda.

This formula will give 8 per cent acid phosphate, 3.20 per cent nitrogen, 1.7 per cent potash. In case no nitrate of soda or potash is available, the following is suggested: 1,200 lbs. acid phosphate; 800 lbs. cotton seed meal. From 400-600 lbs. of such formula should be used per acre.