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COTTON FERTILIZER EXPERIMENTS IN THE SALT RIVER VALLEY

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*In cooperation with the New Mexico Agricultural Experiment Station and the United States Department of Agriculture, Bureau of Animal Industry.
†In cooperation with United States Department of Agriculture, Bureau of Plant Industry.

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COTTON FERTILIZER EXPERIMENTS IN THE SALT RIVER VALLEY

By

GEORGE H SERVISS AND R. S. HAWKINS

INTRODUCTION

The virgin fertility of many fields of the Salt River Valley has gradually been depleted and yields of crops have decreased. Farmers have been looking for some economical means of restoring their soils to and maintaining them at a productive state. The use of alfalfa-cotton rotation has been very satisfactory in many cases, but this necessitates keeping the land in alfalfa for a longer period than many producers desire. Other legumes also have given good results, which, however, have not been as lasting as have those of alfalfa. Increases in cotton yield following legumes are probably largely due to improved physical condition of the soil rather than to additional plant food supplies in most of the irrigated fields of the Southwest. The use of commercial fertilizers has proved profitable with nearly all crops in the older farming sections of the country. Cotton yields in the South would probably drop to one-half their present level if the use of commercial fertilizers were discontinued. Comparatively few data are available concerning the use of commercial fertilizers under southwestern conditions.

There are three plant food elements that are most likely to be lacking in our soil: nitrogen, phosphorus, and potassium. On the older cotton lands of the country nitrogen has usually been the element of primary importance, and it is the one in which desert soils are most likely to be deficient. Phosphorous comes next, and on many soils it is more important than nitrogen Potash, although ranked last, in some instances may be needed as much as either of the other two elements. Commercial fertilizers supplying nitrogen are ammonium sulphate, nitrate of soda, cyanamid, dried blood, etc. Superphosphates are the more important phosphorous carriers. Potash is generally bought in the form of either muriate or sulphate of potash. Animal manures carry all three of these elements in varying amounts and proportions

The Arizona Agricultural Experiment Station began experiments with fertilizers on cotton in 1920 at the Experiment Station. The results

were negative and in 1923 were discontinued. A more extensive series of tests was begun in 1926; these tests were carried on at the Experiment Station, and also on other farms in the Valley.

The phosphorous and potash used in the tests were applied before planting, and harrowed into the soil. In 1926, the ammonium sulphate was applied in two lots, one-half before the first irrigation after planting, and the other half before the second irrigation. In 1927 and 1928, the ammonium sulphate was applied in one lot about 6 to 7 weeks after planting. This fertilizer was broadcasted between the rows by hand and worked into the soil with the cultivator. In the light of our present knowledge this is probably the best time to apply a readily available nitrogenous fertilizer to cotton in this State.

RESULTS

EXPERIMENTS IN 1920-1922

Table I gives the results obtained at the Experiment Station in 1920 to 1922. None of the various treatments appeared promising. In only two instances were the yields higher than those of the untreated soils, and these two were not profitable. On the whole it seems safe to conclude that in these tests the fertilizers had little effect on crop yields.

TABLE I.—FERTILIZER TESTS WITH PIMA COTTON ON THE SALT RIVER VALLEY EXPERIMENT STATION, 1920 TO 1922.

Fertilizer applied per acre	Yield of lint per acre			
	1920 *Pounds*	1921 *Pounds*	1922 *Pounds*	Average *Pounds*
Barnyard manure, 5 tons	300	214	322	249
No treatment	318	230	190	246
Barnyard manure, 10 tons	214	213	244	234
Barnyard manure 10 tons, superphosphate 300 pounds	280	194	171	215
Superphosphate	249	204	146	200
No treatment	257	214	201	233
Superphosphate 500 lbs., nitrate of soda 200 lbs.	351	193	169	238
Superphosphate, 500 pounds	269	149	169	196
Superphosphate 500 lbs., cottonseed meal 450 lbs.	315	151	115	194
No treatment	293	211	158	221
Superphosphate 500 lbs., nitrate of soda, 200 lbs.	332	180	110	207
Nitrate of soda 200 pounds	228	177	190	198
Nitrate of soda 600 pounds	313	199	267	260
No treatment	225	215	168	203
Cottonseed meal, 700 pounds	238	203	164	202
Complete fertilizer (8-2-2), 200 lbs.	256	265	263	261

TABLE II.—FERTILIZER TESTS WITH PIMA COTTON ON THE SALT RIVER VALLEY EXPERIMENT STATION, 1926.

Treatment per acre	Pounds of lint per acre	Number of bolls per lb. of seed cotton	Lint index
No treatment	305	189	4.47
	315	191	4.31
Average	310	190	4.39
Barnyard manure 10 tons	263	176.5	4.61
	345	171.5	4.49
Average	304	174.0	4.55
Barnyard manure 10 tons, treble superphosphate 1,000 lbs	235	188.5	4.36
	372	185.3	4.47
Average	308	186.9	4.42
Ammonium sulphate 1,000 lbs	342	188.8	4.54
	315	205.5	4.27
Average	334	197.1	4.41
Ammonium sulphate 600 lbs., treble superphosphate 750 lbs	408	179	4.68
	308	187.8	4.39
Average	358	183.4	4.53
Treble superphosphate 1,000 lbs	356	181	4.51
	351	185	4.29
Average	354	183	4.40

EXPERIMENTS IN 1926*

More extensive experiments were started with the feeling that perhaps the soil at the Experiment Station was not representative of the Salt River Valley as a whole. Accordingly, three different tests were planned, one on the Experiment Station, one on the farm of Mr. Earl Creed located on Camelback Road and Seventh Street, and another on the Arthur Trauscht farm in the Roosevelt School district. The soil at the Experiment Station is heavy† while the soils at the Trauscht and Creed farms are light.

The fertilizers in these tests were applied in very large amounts, primarily to see whether there was any fertilizer to which cotton grown in these soils would respond. Table II gives the results secured at the

*A test was also started on the farm of Mr. Frank Perry but, due to unfavorable soil and climatic conditions, had to be abandoned. Mr. Perry went to considerable trouble in starting the test and the authors wish to acknowledge the excellent spirit of coöperation shown by him.

†This soil is classified as a clay loam. It has a moisture equivalent of about 19.00, and a wilting point of 10.32.

TABLE III.—FERTILIZER TESTS WITH PIMA COTTON ON THE ARTHUR TRAUSCHT FARM, 1926.

Treatment	Plot No.	Pounds of lint per acre				Lint index	Number of bolls per pound seed cotton
		First picking	Second picking	Third picking	Total		
No treatment	1	143	144	48	335	4.66	182
	4	106	144	68	318	4.86	179
	7	86	115	21	221	4.93	175
	10	86	115	62	263	5.11	153
	13	77	153	90	319	5.15	154
	16	110	133	50	293	4.95	156
	19	74	88	36	198	5.05	175
	20	102	148	110	359	5.12	151
	23	74	137	53	264	5.02	155
	26	127	124	57	308	4.94	165
Average		99	130	60	288	4.98	165
Barnyard manure 10 tons	2	94	144	55	293	4.82	163
	11	78	139	80	297	5.08	149
Average		86	142	68	295	4.95	151
Barnyard manure 10 tons, treble superphosphate 1,000 lbs.	3	86	132	80	299	4.64	157
	12	88	139	79	306	5.37	152
Average		87	136	80	303	5.01	155
Ammonium sulphate 600 lbs., treble superphosphate 750 lbs.	5	76	137	57	264	4.58	171
	14	51	143	95	298	5.14	139
	21	55	121	55	232	4.95	150
Average		62	134	69	265	4.89	153

TABLE III—(Continued)

Ammonium sulphate 1,000 lbs	6	95	119	54	268	4 88	154
	15	67	112	62	242	5 09	145
	22	99	137	53	285	5 00	151
Average		87	123	56	265	4 99	150
Treble superphosphate 1,000 lbs	8	84	110	38	232	4 99	158
	17	84	103	34	222	4 85	171
	24	55	115	61	231	5 19	148
Average		74	109	44	226	5 01	159
Potash 1 000 lbs	9	52	133	57	282	5 13	148
	18	78	125	45	248	4 59	162
	25	86	154	69	309	5 22	155
Average		85	137	57	280	4 98	155

Experiment Station. Small increases are noted for the ammonium sulphate, ammonium sulphate combined with treble superphosphate, and treble superphosphate alone, and as a group these fertilizers gave small increases in size of boll and lint index. None of the applications were profitable.

Results from the Trauscht farm are given in Table III. The barnyard manure, and barnyard manure combined with treble superphosphate treatments gave small increases in yields but decreases resulted from the use of the other fertilizers. In this case, the decreases can probably be explained by the poor stands obtained and the lack of uniformity of the soil. The plants on plots treated with ammonium sulphate and ammonium sulphate combined with treble superphosphate had every appearance of being much more heavily fruited than did those on the unfertilized plots. An increase in size of boll was noted but there was no apparent increase in the lint index.

In the experiment on the Earl Creed farm Acala cotton was used instead of Pima, and significant increases are noted for each treatment, except where treble superphosphate was applied. These increases, although not enough to pay for the large quantities of fertilizer applied, show that cotton will respond to commercial fertilizers on certain Salt River Valley soils. There was a definite increase in both size of boll and lint index.

TABLE IV.—FERTILIZER TESTS WITH ACALA COTTON ON THE EARL CREED FARM, 1926.

Treatment per acre	Pounds of lint per acre				Lint index	Number of bolls per pound seed cotton
	First picking	Second picking	Third picking	Total		
Checks (average 9 plots)	282	115	62	459	6.86	77.1
Barnyard manure 10 tons (average 2 plots)	199	193	135	527	7.02	74.0
Barnyard manure 10 tons, treble superphosphate 1,000 lbs. (average 2 plots)	350	125	76	551	6.81	76.1
Ammonium sulphate 500 lbs., treble superphosphate 750 lbs. (average 3 plots)	176	304	162	642	7.08	69.5
Ammonium sulphate 1,000 lbs. (average 3 plots)	118	286	157	561	7.18	70.0
Treble superphosphate 1,000 lbs. (average 3 plots)	184	115	48	347	6.75	75.2

TABLE V.—FERTILIZER TESTS WITH PIMA COTTON ON THE W. J. OSBORN FARM, PEORIA, 1927.

Treatment	Plot No.	Pounds lint per acre				Lint index	Number of bolls per lbs. seed cotton	Profit or loss over cost of fertilizer per acre*
		First picking	Second picking	Third picking	Total			
No treatment	1	87	295	61	443	4.59	181	
	4	73	311	70	439	4.54	177	
	7	69	320	82	471	4.42	184	
	10	48	321	81	450	4.66	177	
	13	75	283	57	416	4.51	188	
	16	74	347	70	491	4.54	197	
	19	64	347	88	499	4.55	187	
	22	73	255	66	394	4.32	193	
	25	95	243	60	398	4.34	197	
	28	88	235	56	380	4.58	179	
Average		75	296	69	440	4.50	186	0.00
Barnyard manure 10 tons	2	91	352	88	531	4.96	160	
	11	73	295	73	441	4.78	185	
	20	79	330	88	498	4.42	191	
Average		81	326	83	490	4.71	179	0.00

*Profit or loss is figured by subtracting the value of the increased yield of lint of the fertilized over the unfertilized plot and subtracting from it the cost of the fertilizer. No consideration is taken of the cost of applying the fertilizer or the cost of picking the increased yield. Neither is the residual effect of the fertilizer taken into consideration. Values were computed on the following basis: lint @ $0.40 per pound, ammonium sulphate @ $4.00 per hundred weight, treble superphosphate @ $4.40 per hundred weight, potash @ $4.00 per hundred weight, and barnyard manure @ $2.00 per ton.

TABLE V.—(Continued).

Barnyard manure 10 tons, treble superphosphate 500 lbs.	3	83	356	73	512	4.53	171	
	12	95	367	72	533	4.78	176	
	21	83	316	82	481	4.66	195	
Average		87	346	75	509	4.68	180	—14.40
Ammonium sulphate 500 lbs.	6	62	413	153	629	5.09	152	
	15	56	386	126	568	4.94	174	
	24	88	333	83	504	4.87	162	
Average		69	378	121	567	4.97	163	30.80
Ammonium sulphate 500 lbs., treble superphosphate 500 lbs.	5	56	399	147	602	5.02	156	
	14	82	417	114	614	4.95	168	
	23	79	330	82	491	4.85	166	
Average		72	382	114	569	4.94	163	9.60
Ammonium sulphate 500 lbs., treble superphosphate 500 lbs., potash 500 lbs.	9	49	407	147	607	4.82	167	
	18	56	417	140	614	4.97	159	
	27	101	337	112	550	4.93	153	
Average		69	388	133	590	4.91	160	— 4.00
Treble superphosphate 500 lbs.	8	55	291	88	434	4.62	176	
	17	73	277	77	426	4.51	199	
	26	99	247	66	412	4.76	175	
Average		75	272	77	424	4.63	183	—28.40

EXPERIMENTS IN 1927

The work with fertilizers was continued in 1927. On the basis of previous experiments it was thought advisable to discontinue work on the Station at Mesa. Tests were carried on at the following farms: W. J. Osborn, Peoria; E. L. Smith, Glendale; and, the Southwest Cotton Company, Litchfield Park. The tests at the Osborn and Smith farms were on light soils. The soil at Litchfield Park was fairly heavy.

Table V gives the results secured at the Osborn farm. A significant increase in yield is noted for each treatment except where treble superphosphate was used alone. The three treatments in which ammonium sulphate was used either alone or in combination are quite striking and it was apparently the ammonium sulphate that was responsible for increased yields. Ammonium sulphate alone gave an average gain of 127 pounds of lint per acre, a profit of $30.80 over cost of the fertilizer; ammonium sulphate combined with treble superphosphate gave an increase of 129 pounds, a profit of $9.60; and ammonium sulphate with both treble superphosphate and potash gave a gain of 150 pounds of lint per acre but a loss of $4.00. Barnyard manure gave an increase of 50 pounds of lint just equaling in value the cost of the manure, and barnyard manure combined with treble superphosphate an increase of 69 pounds of lint per acre but a loss of $14.40.

Very similar results were obtained from the tests on the Smith farm, but here even the treble superphosphate alone gave a small increase in yield. However, as on the Osborn farm, apparently it was the ammonium sulphate that was responsible for most of the increase. Ammonium sulphate resulted in an average gain in yield of 132 pounds of lint per acre, a profit of $32.80 over the cost of the fertilizer. Ammonium sulphate combined with treble superphosphate gave a gain of 190 pounds of lint, and a profit of $34.00. Ammonium sulphate with both treble superphosphate and potash increased yields by 131 pounds of lint per acre but at a loss of $9.60. Barnyard manure alone and barnyard manure in combination with treble superphosphate gave increases of 53 and 71 pounds, a profit of $1.20 and a loss of $12.60 per acre respectively.

In these two tests on the Osborn and Smith farms, 10 tons of barnyard manure per acre resulted in increases of 50 and 53 pounds of lint per acre. This is worth approximately $20.00, giving the barnyard manure applied to the soil a value of $2.00 per ton. At this rate a farmer can well afford to apply what manure is produced on his place but he cannot afford to buy it unless he can get it for considerably less than $2.00 per ton for he would have the cost of handling in addition to the

TABLE VI.--FERTILIZER TESTS WITH PIMA COTTON ON THE E. L. SMITH FARM AT GLENDALE, 1927.

Treatment per acre	Plot No.	Pounds lint per acre				Lint index	Number of bolls per lb. seed cotton	Profit or loss over cost of fertilizer
		First picking	Second picking	Third picking	Total			
No treatment	1	124	99	55	277	4.73	171	
	8	82	130	70	282	4.46	178	
	15	20	100	69	189	4.14	180	
Average		75	110	64	249	4.45	176	
Manure 10 tons	2	56	121	104	281	4.60	152	
	9	77	163	83	322	4.38	176	
Average		66	142	94	302	4.49	164	1.20
Barnyard manure 10 tons, treble superphosphate 500 lbs.	3	57	158	101	317	4.68	157	
	10	99	153	72	324	4.58	175	
Average		78	156	86	320	4.63	166	—13.60
Ammonium sulphate 500 lbs.	5	146	182	79	407	4.93	143	
	12	72	170	113	354	4.46	174	
Average		107	176	96	381	4.70	158	32.80
Ammonium sulphate 500 lbs., treble superphosphate 500 lbs.	4	96	222	157	476	5.02	149	
	11	62	191	148	402	4.62	154	
Average		79	207	153	439	4.82	152	34.00
Ammonium sulphate 500 lbs., treble superphosphate 500 lbs., potash 500 lbs.	7	77	190	121	387	4.69	151	
	14	42	202	130	373	4.96	147	
Average		59	196	126	380	4.82	149	— 9.60
Treble superphosphate 500 lbs.	6	103	134	64	300	4.56	169	
	13	60	124	73	256	4.54	180	
Average		81	129	69	278	4.55	174	—10.40

TABLE VII.—FERTILIZER TESTS WITH PIMA COTTON ON THE SOUTHWEST COTTON COMPANY RANCH AT LITCHFIELD PARK, 1927.

Treatment	Plot No.	Pounds lint per acre			
		First picking	Second picking	Third picking	Total
No treatment	2	98	183	104	385
	4	78	189	124	390
	7	72	195	98	364
	10	53	133	113	299
	13	52	153	120	325
	16	65	137	71	273
	19	55	116	90	260
	22	66	98	86	250
	25	72	144	72	287
	28	60	124	58	242
	31	40	88	52	181
	34	53	116	56	225
Average		65	140	86	290
Barnyard manure 10 tons	1	60	111	97	268
	14	33	139	107	278
	26	49	112	72	233
Average		47	120	92	260
Barnyard manure 10 tons, treble superphosphate 500 lbs	3	75	187	124	386
	15	48	124	104	276
	27	46	107	97	250
Average		56	139	108	304

TABLE VII.—(Continued).

Ammonium sulphate 500 lbs.	6	30	135	120	285
	18	46	113	116	274
	30	36	101	56	194
Average		37	116	97	251
Ammonium sulphate 500 lbs., treble superphosphate 500 lbs.	5	51	147	104	302
	17	34	103	71	208
	29	40	104	49	194
Average		42	118	75	234
Ammonium sulphate 500 lbs., treble superphosphate 500 lbs., potash 500 lbs.	9	48	130	104	282
	21	43	109	88	241
	33	30	97	72	199
Average		40	112	88	241
Treble superphosphate 500 lbs.	8	104	163	91	358
	20	42	113	78	233
	32	48	91	49	189
Average		64	122	73	259
Ammonium phosphate 500 lbs.	12	34	124	131	289
	24	49	121	69	239
	36	34	95	84	213
Average		39	113	95	247
Cyanamid 500 lbs.	11	40	100	169	309
	23	43	105	82	230
	35	35	117	69	221
Average		40	107	107	254

purchase price. It is probable that in Arizona, where an intensively cultivated crop such as cotton is grown, that the residual effect of barnyard manure is slight. The long growing season and the intense heat of summer accelerate the rapid decomposition of organic matter.

Table VII gives the results obtained at Litchfield Park. The yield of fertilized plots, in nearly every case, was lower than that of the unfertilized ones. The soil here was considerably heavier than that at the Osborn and Smith farms, and while it did not produce a high yield of cotton it grew big, healthy-appearing stalks. Evidently some factor, other than fertility, was responsible for the low yield of lint obtained.

EXPERIMENTS IN 1928

The primary object of the 1928 tests was to ascertain the most profitable rate of application of ammonium sulphate.

Two coöperative experiments were laid out, one on the E. L. Smith place at Glendale, but a different field was used than for the 1927 test, and the other on the farm of Mr. O. M Lassen located south of Phoenix on the Baseline Road.

The figures from the Smith farm are given in Table VIII. The application of 250 pounds of ammonium sulphate gave a profit of $18.40, the largest of any; the 150-pound treatment was next with a profit of $17.20; and the 450-pound treatment resulted in a profit of only $4.00. When 142 pounds of treble superphosphate were applied in addition to the ammonium sulphate an actual loss resulted in each instance, varying from $2.25 per acre when combined with 450 pounds of ammonium sulphate to $26.65 per acre where 250 pounds of ammonium sulphate plus 142 pounds of treble superphosphate were applied.

At the Lassen farm (Table IX) the 150- and the 250-pound applications of ammonium sulphate combined with 142 pounds of treble superphosphate returned profits of $10.15 and $14.55 per acre respectively. Increasing the amount of ammonium sulphate to 450 pounds with the treble superphosphate remaining the same gave a loss of $3.45. With ammonium sulphate alone, 450 pounds per acre showed a profit of $11.60, 250 pounds gave a loss of $15.20 per acre, and 150 pounds showed a profit of $2.80.

The results of the various experiments reported in this publication at first appear somewhat conflicting, but on careful study a few general observations can be given. The soil at the Experiment Station at Mesa is fairly heavy and has usually been very productive. The soil on which the test was conducted at Litchfield Park is also fairly heavy, and, although not producing a large crop of cotton, it would not be classified

as "run down" soil. The tests on the other farms were located on soils with considerably more sand and the plants on the unfertilized plots were somewhat dwarfed. The data obtained from the tests conducted on the Experiment Station and at Litchfield Park indicate that profitable returns cannot be expected at present from the use of commercial fertilizers on heavy soils. With the exception of the Trauscht farm the figures from the tests conducted on the more sandy soils indicate a general response to nitrogen. There is considerable variation between plots, and, with the present information, it would be hard to name any definite amount of nitrogen that would be consistently the most profitable. In general, however, on the lighter soils the application of ammonium sulphate in amounts not to exceed 500 pounds have usually resulted in an increased yield. In some instances the increase has been sufficient to pay a nice profit, while in others it would not nearly pay the cost of the fertilizer.

CONCLUSIONS

1. The use of ammonium sulphate on some of the more sandy soils of the Salt River Valley has usually resulted in an increased yield but not necessarily a profit.

2. The heavier soils did not show any significant increases in yield from the use of commercial fertilizers.

3. Applications of phosphorus alone have not been profitable and applications of phosphorus in combination with other fertilizers have been profitable in only a few instances.

4. The addition of potash has been unprofitable in all cases.

5. If fertilizers are applied it is absolutely essential that good farming methods be practiced. Fertilizer will not correct the deleterious effect of poor farming.

TABLE VIII.—FERTILIZER TESTS WITH PIMA COTTON ON THE E. L. SMITH FARM AT GLENDALE, 1923.

Treatment per acre	Plot No.	Pounds lint per acre				Number of bolls per lb. seed cotton	Profit or loss over cost of fertilizer
		First picking	Second picking	Third picking	Total		
No treatment	1	162	11	30	202	164	
	5	213	19	27	259	174	
	9	181	30	38	248	177	
	13	157	51	43	251	204	
	17	178	92	22	292	181	
	21	219	100	5	324	149	
	25	167	43	5	215	166	
Average		182	49	24	256	175	
Ammonium sulphate 150 lbs., treble superphosphate 142 lbs.	2	143	11	22	175	161	
	10	202	46	19	267	166	
	18	175	89	8	273	174	
Average		173	49	16	238	167	−12.97
Ammonium sulphate 250 lbs., treble superphosphate 142 lbs.	3	146	19	19	184	190	
	11	208	24	8	240	158	
	19	205	54	8	267	173	
Average		186	32	12	230	177	−26.65
Ammonium sulphate 450 lbs., treble superphosphate 142 lbs.	4	181	27	40	248	181	
	12	254	38	27	319	172	
	20	189	170	8	367	142	
Average		208	78	25	311	165	− 2.25

TABLE VIII.—(Continued).

Ammonium sulphate 150 lbs.	6	232	46	30	308	156	
	14	221	70	19	310	163	
	22	202	113	8	324	150	
Average		219	76	19	314	156	17.20
Ammonium sulphate 250 lbs.	7	202	54	24	281	168	
	15	229	65	13	308	168	
	23	278	105	8	391	155	
Average		237	75	15	327	164	18.40
Ammonium sulphate 450 lbs.	8	243	35	11	289	166	
	16	181	89	46	316	191	
	24	262	56	8	326	159	
Average		229	60	22	311	172	4.00

TABLE IX.—FERTILIZER TESTS WITH PIMA COTTON ON THE O. M. LASSEN FARM, 1928.

Treatment per acre	Plot No.	Pounds lint per acre				Number of bolls per lb. seed cotton	Profit or loss over cost of fertilizer
		First picking	Second picking	Third picking	Total		
No treatment	1	89	113	43	246	187	
	5	100	113	38	251	184	
	9	76	116	35	227	174	
	13	78	119	32	229	183	
	17	105	92	30	227	175	
	21	121	146	24	292	177	
	25	94	109	32	235	166	
Average		95	115	33	244	176	
Ammonium sulphate 150 lbs., treble superphosphate 142 lbs.	2	113	138	43	294	177	
	10	119	170	35	324	194	
	18	154	89	38	281	179	
Average		129	132	39	300	182	10.15
Ammonium sulphate 250 lbs., treble superphosphate 142 lbs.	3	105	148	40	294	183	
	11	132	143	54	329	178	
	19	127	140	43	310	173	
Average		121	144	46	311	178	14.55
Ammonium sulphate 450 lbs., treble superphosphate 142 lbs.	4	92	138	32	261	191	
	12	100	170	32	302	170	
	20	138	152	24	324	163	
Average		110	157	29	296	173	— 3.45

TABLE IX.—(Continued.)

Ammonium sulphate 150 lbs.	6	89	116	35	240	183	
	14	97	130	30	256	163	
	22	94	167	40	302	168	
Average		93	138	35	266	171	2.80
Ammonium sulphate 250 lbs.	7	62	124	35	221	172	
	15	111	146	22	278	175	
	23	103	135	32	270	177	
Average		92	135	30	256	175	— 5.20
Ammonium sulphate 450 lbs.	8	111	140	35	286	161	
	16	127	162	40	329	173	
	27	138	194	22	354	160	
Average		125	165	32	323	168	11.60

APPENDIX

NITROGEN FERTILIZERS

Ammonium sulphate—This is a by-product of the manufacture of coke and contains about 20.5 percent nitrogen.

Ammo-phos (crude ammonium phosphate)—Manufactured in two grades, one analyzing 10.7 percent nitrogen and 47 percent available phosphoric acid and the other 16.5 percent nitrogen and 20 percent available phosphoric acid.

Dried blood—Made from the blood of animals killed in slaughter houses. Contains from 9 to 14 percent nitrogen and small amounts of phosphoric acid and potash.

Cottonseed meal—The lower grades are often used for fertilizer.

Analysis—

Nitrogen..... 5.7 to 7.4 percent
Phosphoric acid..... 2.5 percent
Potash ..... 1.7 percent

Cyanamid—A compound made by the electrical fixation of atmospheric nitrogen, containing from 20 to 24.7 percent nitrogen.

Guano—Deposits of the droppings of birds, bats, etc., containing from 0.4 to 9 percent nitrogen, 12 to 26 percent phosphoric acid, and .1 to 3.5 percent potash, the analysis depending largely upon the amount of leaching to which the material has been exposed.

Leunosalpeter—A new fertilizer material containing about 25.9 percent ammonia.

Nitrate of soda (Chile saltpeter)—Contains about 16 percent nitrogen.

Barnyard manure—Contains all three fertilizing elements in varying amounts depending on kind of animal and feed. Average cow manure in Arizona contains about 1.5 percent nitrogen, 0.5 to 1 percent phosphoric acid, and 2.00 percent potash. In addition, the large amount of organic matter contained has a very desirable effect upon the physical structure of the soil and is a source of humus.

PHOSPHOROUS FERTILIZERS

Superphosphate (Acid phosphate)—The most common material used in supplying phosphorus to soils. Contains 14 to 18 percent available phosphoric acid and 50 to 65 percent gypsum.

Double superphosphate—Similar to superphosphate but carrying from 40 to 44 percent available phosphoric acid and no gypsum.

Treble superphosphate—Same as double superphosphate.

Amo-phos—See under nitrogen fertilizers.

Guano—See under nitrogen fertilizers.

POTASSIUM FERTILIZERS

Muriate of potash (Potassium chloride)—Usually contains about 50.5 percent potash.

Sulphate of potash (Potassium sulphate)—Contains about 49 percent potash.

FACTORY-MIXED FERTILIZERS

These are fertilizers mixed at the factory to contain varying amounts of nitrogen, phosphorus, and potash. Some of these are very good where more than one element is needed. In buying, care should be taken to get one of high analysis, for by so doing the handling cost per unit of plant food is reduced. Do not buy a fertilizer merely because it is branded a "cotton fertilizer." Insist that the analysis of the material appear on the bag or container. In buying commercial fertilizers the County Agricultural Agent should be consulted In the light of our present knowledge any cotton fertilizer used in this country should contain a high percentage of nitrogen.