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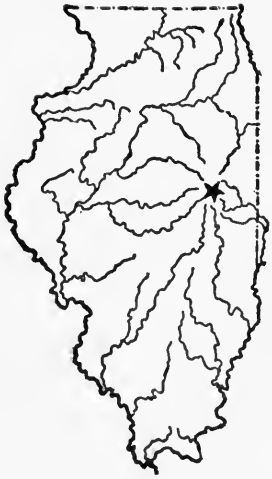
By F. C. Bauer



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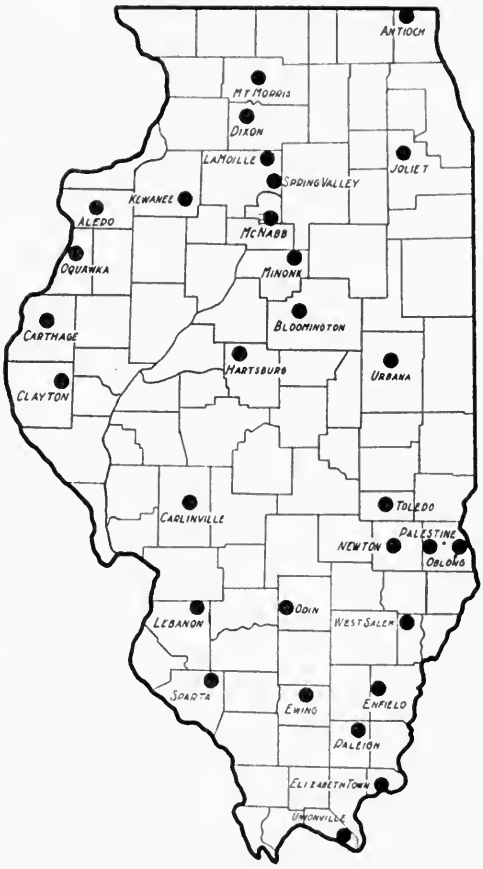


LOCATION OF THE THIRTY EXPERIMENT FIELDS FROM WHICH RESULTS ARE PRESENTED IN THIS BULLETIN

Urbana, Illinois July, 1932

Publications in the Bulletin series report the results of investigations made by or sponsored by the Experiment Station

Crop Yields From Illinois Soil Experiment Fields in 1931

Together With a General Summary for the Rotation Periods Ending in 1931

By F. C. Bauer, Chief, Soil Experiment Fields

VARIATION in crop-producing power is an outstanding characteristic of soils. Not only are variations evident among soils in different locations, but they are to be found also on the same soil in different seasons. Frequently they are quite marked, assuming with some soils a gradual downward trend, with others, a gradual trend upward. Knowledge of the causes of these natural variations and the means of controlling them obviously becomes of fundamental importance in the successful management of farm lands. Indeed the best use of such lands will depend to a large extent on the knowledge that farmers possess concerning their soils and the effects of the cropping and treatment practices they use. Broadly speaking, farmers are interested in the simplest management practices that will give them the most profitable yields.

Soil management and treatment practices properly employed can do much to reduce variation in soil productivity and to uncover latent productivity that may exist. No single system of management or treatment, however, can be expected to give the best results on all soils. Neither can an effective system at a particular time be expected to give the best results on a particular soil for all time to come. Systems of management and treatment must be adapted to the widely differing nature of soils.

In order to test the effectiveness of different systems of soil treatment on the yield of farm crops, the Illinois Agricultural Experiment Station for a number of years has conducted field investigations in many sections of the state on extensive soil types varying widely in productiveness. Some investigations along this line have been in progress at Urbana since 1876; the first of the present outlying soil experiment fields were established in the fall of 1901. Some of the original fields are still in operation; some have been abandoned at one time or another for various reasons. During the crop season of 1931 thirty of these fields were in operation.

The complete records from all the Illinois soil experiment fields up to and including 1924 were reported in Bulletin 273. Subsequent

results have been reported annually in Bulletins 280, 296, 305, 327, 347, and 370. The present bulletin is a continuation of this series. In these publications the crop yields have been presented as a matter of record without comment or discussion. In order, however, to give a better picture of the results as a whole, a general summary for the last rotation period has been included in the last two publications. A similar summary for all rotation periods ending in 1931 is included as Part I of this bulletin. The annual crop yields for 1931 are presented in Part II.

A new feature, presented in Part II, is an acre-yield average of all crop-yield data on each field for each treatment presented in terms of pounds per acre. These figures will enable the reader to readily determine the influence of any particular treatment in terms of all crops as well as for individual crops separately.

An index to fertilizer and treatment materials which will enable the reader to find readily the results obtained for any particular fertilizer has also been added in this publication (pages 244 and 245).

Explanation of Symbols

The following symbols are used to denote the soil treatments applied:

0 = No treatment
M = Manure
R = Crop residues
Le = Legume catch crop
L = Limestone
K = Potash
KCl = Muriate of potash
rP = Rock phosphate
sP = Superphosphate
bP = Bone phosphate
S = Flowers of sulfur
N = Nitrogen
( ) = Tons

The crop residues are chiefly cornstalks and sweet clover plowed down as a green manure. In some cases the second crop of clover and other legume residues have also been plowed down. When legumes are used as a catch crop, they are seeded in small grain to be plowed down the following year for succeeding crops.

All yields except those in parentheses indicate *acre-yields in bushels*; the yields in parentheses indicate *acre-yields in tons.*

Soil Groups Represented[1]

The results reported on pages 246 to 278 are for individual fields arranged alphabetically rather than by location or by soil types. The general character of the soils represented by these fields is indicated by the following classification. The dates given indicate the years in which the various fields were established.

[1]This classification was prepared by Dr. R. S. Smith, Chief in Soil Physics and Soil Survey.

Group No.	Description of soil	Location of field	Year established
1	**Dark soils with heavy, noncalcareous subsoils**		
	Semimature	Bloomington	1902
	Young	Aledo	1910
		Hartsburg	1911
		LaMoille	1910
		Minonk	1910
2	**Dark soils with impervious, calcareous subsoils**		
	Young (due to erosion)	Joliet	1914
3	**Dark soils with noncalcareous subsoils**		
	Semimature	Urbana	1876
	Young	Kewanee	1915
4	**Dark soils with open, noncalcareous subsoils**		
	Semimature	Dixon	1910
		Mt. Morris	1910
	Young	McNabb	1907
5	**Dark soils with impervious, noncalcareous subsoils**		
	Semimature	Carthage	1911
		Clayton	1911
		Lebanon	1910
	Mature	Carlinville	1910
7	**Gray soils with impervious, noncalcareous subsoils**		
	Old (moderately well drained)	Ewing	1910
		Oblong	1912
	Old (poorly drained; slick spots numerous)	Newton	1912
		Odin	1902
		Raleigh	1910
		Toledo	1913
	Old (very poorly drained; slick spots numerous)	Sparta	1916
8	**Yellow soils with noncalcareous subsoils**		
	Mature	Enfield	1912
		Unionville	1911
		West Salem	1912
9	**Brownish yellow soils with open, noncalcareous subsoils**		
	Semimature (due to sedimentation and erosion)	Springvalley	1915
11	**Brownish yellow soils with calcareous subsoils**		
	Young	Antioch	1902
14	**Sandy loams and sands**		
	Mature	Palestine	1919
	Semimature	Oquawka	1915
16	**Hilly land**		
	Mature	Elizabethtown	1917

PART I. SUMMARY OF RESULTS FOR SOIL TREATMENTS FOR ROTATION PERIODS ENDING IN 1931

FROM the summaries on the following pages the reader can get a clearer conception of the influence of soil treatments upon the Illinois soil experiment fields than he can obtain by studying each field or each year independently. A very condensed form is used. The crop yields for a rotation period have been averaged and converted to money values. These money values have in turn been reduced to an annual acre-basis. For a four-year rotation this procedure condenses 16 different crop yields into one figure. Such figures make it possible to see at a glance the relative effect of any particular treatment for the rotation period.

The crop prices on which these figures are based were the after-harvest prices of crops on Illinois farms as reported by the government. Each year's crop yields were figured at the prices for that particular year before the average was computed. An average of these prices for the four-year period ending in 1931, which may be of interest to the reader, gives the following figures: corn, 59 cents; oats, 30 cents; wheat, 87 cents a bushel; mixed hay, $10.80; clover hay, $12.80; and alfalfa, $16.40 a ton.

Where deductions were made for the cost of the treatment applied, crop residues were figured as costing 75 cents an acre annually, and the manure, limestone, rock phosphate and kainit at 75 cents, $3, $15, and $30 a ton respectively. Under average conditions, these prices should cover the cost of application as well as purchase.

With these explanations, attention is directed to the facts brought out in the following tables and text.

Productivity Levels of Illinois Soils

The natural productivity of Illinois soils varies greatly. This is evident from the results obtained from untreated land on the twenty-nine soil experiment fields listed in Table 1. The annual acre-value of the crops grown during the last rotation ranged from $2.34 at Elizabethtown to $33.99 at McNabb, a difference of more than 1,350 percent. These values for the other fields are distributed more or less regularly between these two extremes. If these values are correlated with the soil groups mentioned on page 229, some interesting relationships become apparent. The dark-colored soils, for instance, are on the average about five times as productive as the light-colored soils. Among the dark-colored soils, those having heavy, noncalcareous subsoils tend to be the most productive and those with impervious, noncalcareous sub-

TABLE 1.—UNTREATED LAND: VALUE OF ALL CROPS GROWN ON UNTREATED LAND OF EACH FIELD

(Values represent average annual acre-returns for rotation periods ending in 1931)

Rank	Field	Value
1	McNabb	$33.99
2	Aledo	26.23
3	LaMoille	24.92
4	Kewanee	23.87
5	Dixon	23.36
6	Springvalley	22.64
7	Minonk	22.15
8	Hartsburg	20.91
9	Mt. Morris	19.87
10	Bloomington	18.92
11	Carthage	18.18
12	Clayton	18.12
13	Joliet	15.33
14	Antioch	15.25
15	Carlinville	14.61
16	Palestine	14.33
17	Lebanon	12.81
18	Oquawka	10.80
19	Oblong	7.54
20	Toledo	7.22
21	Enfield	5.13
22	Odin	4.34
23	Sparta	4.31
24	Unionville	3.97
25	Newton	3.93
26	Raleigh	3.18
27	Ewing	2.90
28	West Salem	2.62
29	Elizabethtown	2.34

soils the least productive. The sandy soils occupy an intermediate position, and the old, very poorly drained soils with impervious, non-calcareous subsoils occupy the lowest positions.

Response to Manure Is Variable

In livestock systems of farming, the amount of manure that can be produced and returned to the soil depends upon the productiveness of the soil. If manure is composed of 75 percent moisture and 25 percent dry matter, and it is assumed that one-third of the produce grown is sold and two-thirds fed, and that one-fifth of the manure is lost before it can be returned to the land, then for every pound of produce grown, one pound of manure can be returned to the soil. When manure was applied to the respective experiment fields on this basis, the amount returned annually per acre, when no supplementary treatments were used, ranged from about ¾ ton on the least productive soils to 3¾ tons on the more productive soils, as may be seen from an inspection of Table 2. With supplementary treatments consisting of either limestone, or limestone and phosphates, the amount of manure returned to

TABLE 2.—MANURE: AMOUNTS APPLIED TO SOIL IN THREE SYSTEMS OF LIVESTOCK FARMING AND RETURNS FROM IT WHEN USED ALONE
(For rotation periods ending in 1931)

Rank	Fields	Amounts applied annually per acre			Value when used alone	
		Alone	With limestone	With limestone and phosphate	Ton value	Annual acre value
		tons	*tons*	*tons*		
1	Oquawka	1.34	2.09	2.08	$6.31	$8.46
2	Clayton	2.36	2.99	3.05	3.56	8.39
3	Dixon	2.81	3.13	3.16	2.81	7.89
4	Springvalley	2.65	2.80	3.07	2.61	6.93
5	Aledo	3.52	3.94	3.92	1.95	6.85
6	LaMoille	3.79	3.86	3.77	1.76	6.68
7	Kewanee	2.82	2.97	2.93	2.25	6.34
8	Carthage	2.62	3.09	3.31	2.38	6.25
9	West Salem	1.01[1]	1.28	1.50	5.33[1]	5.39[1]
10	Carlinville	2.32	2.99	3.11	2.31	5.36
11	Lebanon	2.07	2.60	2.55	2.55	5.27
12	Mt. Morris	2.86	3.41	3.31	1.71	4.89
13	Oblong	1.30	2.32	2.46	3.64	4.74
14	Newton	.97	2.01	2.14	4.55	4.41
15	Minonk	3.52	3.44	3.45	1.23	4.34
16	Joliet	2.10	2.42	2.75	2.03	4.27
17	Hartsburg	3.17	3.45	3.42	1.25	3.95
18	Elizabethtown	.79	1.63	2.01	4.49	3.55
19	Raleigh	1.00	1.96	2.13	3.50	3.50
20	Enfield	.88	1.99	2.16	3.00	2.64
21	Ewing	.83	2.29	2.40	3.15	2.62
22	McNabb	3.46	....	....	.61	2.11
23	Toledo	1.00	2.18	2.07	2.05	2.05
24	Sparta	.83	1.16	1.18	2.40	1.99
25	Palestine	1.41	1.41	1.41	1.38	1.94
26	Unionville	.82	1.30	1.30	1.49	1.22

[1]Four tons of limestone were applied in 1912.

the soil on each field was increased, but the extremes in the range of the amounts applied were not greatly different from what they were when no supplementary treatments were used.

The application of manure in the manner described increased the crop yields on all fields. Rather marked variations occurred, however, in the size of the increases on the respective fields. The value of the crop increases where manure was used alone ranged from $1.22 an acre annually at Unionville, on a yellow soil with noncalcareous subsoil, to $8.46 at Oquawka, on a semimature sand soil. In a similar manner the ton-value of the manure ranged from 61 cents at McNabb, on a young, dark-colored soil with an open, noncalcareous subsoil, to $6.31 at Oquawka. The data reveal a tendency for the smaller applications to give the higher ton-values. This is not always true, however, as may be seen from a comparison of the results from the Elizabethtown and Unionville fields. At Elizabethtown an application of about ¾ ton an

acre was worth at the rate of $4.49 a ton, while at Unionville approximately the same amount of manure was worth only $1.49 a ton. In a similar manner 2.36 tons at Clayton were worth $3.56 a ton, but 2.10 tons at Joliet were worth only $2.03 a ton.

These results indicate that some soils are more highly responsive to manure than others, and that this difference in responsiveness exists in both the more productive and the less productive soils.

Plowing Under Crop Residues Increases Crop Yields

On farms where little or no livestock is fed, there usually is produced more or less crop-residue material that may be used for soil improvement purposes. Cropping systems are easily devised in which

TABLE 3.—CROP RESIDUES: CROP INCREASES AND VALUES OF INCREASES RESULTING FROM PLOWING DOWN CROP RESIDUES IN ABSENCE OF OTHER SOIL TREATMENT

(Figures represent average annual acre-increases and average annual acre-returns for rotation periods ending in 1931)

Rank	Fields	Increases		Value of crop increases	
		Corn	Wheat	Grain crops only	All crops
		bu.	*bu.*		
1	Bloomington	12.2	13.2	$5.76	$7.17
2	Hartsburg	18.2	3.9	6.66	6.56
3	Minonk	8.6	4.5	4.31	4.26
4	Aledo	6.9	3.6	3.24	3.24
5	LaMoille	6.6	1.3	2.75	2.87
6	Lebanon	11.8	1.3	2.30	2.11
7	West Salem[1]	6.2	.7	2.07	1.97
8	Toledo	4.4	2.3	1.87	1.74
9	Antioch[2]	1.0	6.7	2.86	1.64
10	Mt. Morris	9.1	2.3	3.04	1.31
11	Oblong	4.3	1.7	1.27	1.26
12	Carthage	15.0	2.0	4.37	1.21
13	Oquawka	3.4	.7	1.45	1.07
14	Springvalley	11.9	.4	3.53	1.07
15	Elizabethtown	3.6	.1	.98	1.06
16	Sparta	3.0	.4	1.20	.94
17	Carlinville	.6	1.1	− .06	.90
18	Odin	1.4	1.9	1.25	.89
19	Dixon	3.8	1.5	.97	.81
20	Clayton	7.7	4.7	3.33	.66
21	Newton	1.5	.8	.62	.61
22	Raleigh	3.0	1.1	.64	.55
23	Joliet	2.0	.9	.75	.53
24	Enfield	2.4	.4	.66	.48
25	Unionville	1.4	− .1	.88	.41
26	Ewing	.6	.3	.12	− .02
27	Kewanee	7.6	5.1	2.70	−1.28
28	McNabb	−4.6	−1.8	−1.94	−4.40

[1]Residues used in addition to initial application of limestone.
[2]Residues used in addition to limestone and rock phosphate.

the amount of such material available for soil improvement can be greatly increased. The value of such material, as utilized on the soil experiment fields, is shown by the data in Table 3. This material has consisted chiefly of cornstalks, green-manure sweet clover, second-crop red clover, and soybean chaff grown upon the land and plowed down in the absence of other soil treatments. In the early years the grain straws were also returned.

This system of soil improvement may be rather effective on some soils and less effective on others, judging from the last column in Table 3. The best results have been obtained on those fields where clover, especially sweet clover, will grow without the application of limestone, such as the dark soils with heavy noncalcareous subsoils. The poorest results on the whole were obtained on the less-productive soils, where legumes grow poorly, if at all, without the application of limestone.

Some of the dark-colored soils that will not grow sweet clover without limestone but which will grow good red clover, such as the Kewanee field, do not show high returns for the crop-residues system. This is due, not to the fact that the system has no worth on such soils, but to the fact that in making the comparisons only one clover-hay crop is removed from the residue plot and two are removed from the check plot. This makes it difficult to measure the effects of crop residues on those fields where red clover is grown both as hay and as a residue crop. If the system has worth on such soils, it should be reflected in the grain yields. The fact that the Kewanee field shows increased grain yields in the residue system indicates that the system does have worth on that field.

Limestone Essential on Many Soils

On most experiment fields 4 tons of limestone an acre were applied when the field was established, in addition to either manure or crop residues. Subsequent applications were made at the rate of 2 tons an acre each four years thereafter until 1923, when all applications were discontinued. The total amount applied to the respective fields ranges from 4 to 10 tons an acre, depending upon the age of the field. On most fields a total of 8½ tons an acre has been applied, which is equivalent to about 800 pounds a year.

It will be noted from Table 4 that in both the manure and the crop-residues systems of farming there is a very wide range in the response of the various soils to applications of limestone. It is apparent that some soils are in great need of limestone while others have not as yet developed a great need for it. Such results emphasize the fact that a

TABLE 4.—LIMESTONE: VALUE OF CROP INCREASES RESULTING FROM LIMESTONE WHEN USED IN ADDITION TO MANURE OR CROP RESIDUES
(Values represent average annual acre-returns for rotation periods ending in 1931)

Livestock systems			Grain systems		
Rank	Fields	Values	Rank	Fields	Values
1	Ewing	$13.15	1	Lebanon	$10.27
2	Oquawka	10.18	2	Enfield	9.51
3	Enfield	9.87	3	Clayton	9.47
4	Newton	9.35	4	Oquawka	9.05
5	Raleigh	7.84	5	Aledo	8.90
6	Oblong	7.66	6	Ewing	8.57
7	Sparta	7.64	7	Newton	7.98
8	Toledo	7.29	8	Palestine	7.83
9	West Salem	6.90	9	Sparta	7.82
10	Elizabethtown	6.72	10	Elizabethtown	6.71
11	Carlinville	6.54	11	West Salem	6.60
12	Lebanon	6.38	12	Mt. Morris	6.56
13	Clayton	6.24	13	Carthage	6.39
14	Mt. Morris	5.57	14	Unionville	6.33
15	Unionville	5.43	15	Bloomington	6.02
16	Hartsburg	4.99	16	Toledo	5.76
17	Carthage	4.58	17	Carlinville	5.62
18	Joliet	4.00	18	LaMoille	4.92
19	Kewanee	3.28	19	Raleigh	4.91
20	Aledo	2.68	20	Oblong	4.65
21	Springvalley	2.01	21	Dixon	3.83
22	Dixon	1.47	22	Kewanee	3.32
23	LaMoille	1.11	23	Odin	3.07
24	Minonk	.59	24	Joliet	2.88
			25	Hartsburg	1.51
			26	Springvalley	1.51
			27	Antioch	.73
			28	Minonk	.53

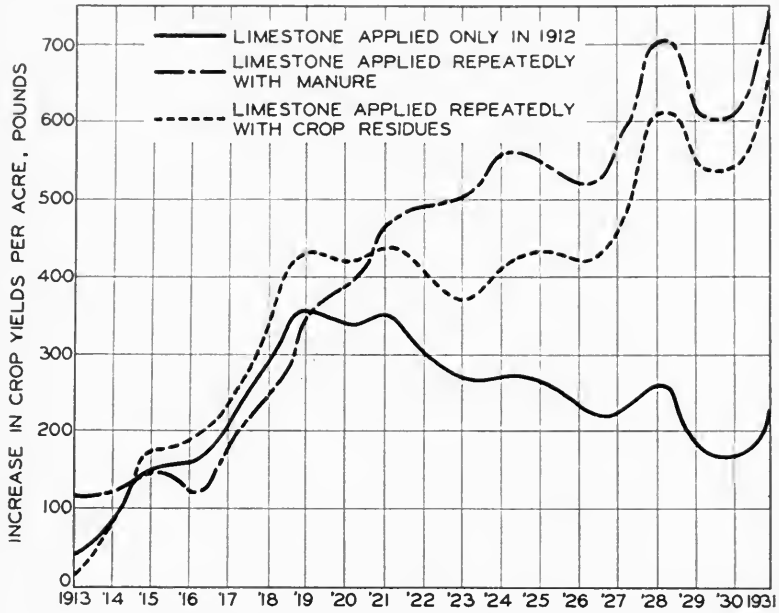
definite soil testing program is needed on every farm. Directions for making the necessary tests are given in Circular 346, "Test Your Soil for Acidity."

Four-Ton Application of Limestone Has Long-Time Effect

When the West Salem field was established in 1912, 4 tons of limestone an acre was applied to each of three plots that were originally designed for crop production without limestone. One of these plots has never received any further treatment; another has received manure alone, and the third has received crop residues only. Similar plots receiving regular applications of limestone were maintained alongside the above plots and continued until 1923, when applications were temporarily discontinued.

The results obtained from these plots are of considerable interest in connection with the lasting effects of a single application of limestone and the time that may be allowed to elapse before additional applica-

tions are made. The results obtained in this experiment are shown graphically below.



INCREASES IN CROP YIELDS FOLLOWING SINGLE AND REPEATED APPLICATIONS OF LIMESTONE, WEST SALEM FIELD, 1913-31

In 1912 a 4-ton application of limestone was made to certain plots in the West Salem field. To one of these plots no limestone was afterward applied. The solid line in the above graph indicates the increases that have occurred in crop yields on this plot in terms of pounds of crops harvested per acre. The greatest increase occurred in 1919, the eighth year, and it is apparent that this one application is still affecting crop yields. The broken lines show the response on two plots where repeated applications of limestone were made up to and including 1923. The crops grown include corn, oats, wheat, and hay in rotation.

The single application of limestone steadily increased crop yields until the eighth year. For the two years following, the increases remained about stationary. Since the ninth year the increases have grown steadily smaller. After nineteen years, however, there is still evidence of a decided influence from this one application, and if increases in yield decline no faster than they have for the last ten years, the influence of the single application will persist for some years yet.

The repeated applications of limestone showed little superiority over the single application until about the eighth year, since which time they have given much better results than the single application.

These results suggest that a second application of limestone on soils of this character might be delayed until about eight years after the

initial application. The increases in crop yield for the repeated applications, even tho none have been made since 1923, still show a steady upward trend.

Some Soils Need Phosphorus

On most Illinois experiment fields 1 ton of rock phosphate an acre was applied in the beginning and 1 ton every four years thereafter until a total of 4 tons was reached. On some fields bone phosphate was applied at the annual rate of 200 pounds an acre until 4,800 pounds were reached. Including all the years of the experiments, rock phosphate has been applied at about the annual acre-rate of 400 pounds, and bone phosphate at the rate of 150 pounds. The results obtained from

TABLE 5.—PHOSPHATE: VALUE OF CROP INCREASES RESULTING FROM PHOSPHATE WHEN USED IN ADDITION TO LIMESTONE AND MANURE OR LIMESTONE AND CROP RESIDUES

(Rock phosphate is used except where otherwise designated. Values represent average annual acre-returns for rotation periods ending in 1931)

Livestock systems			Grain systems		
Rank	Fields	Values	Rank	Fields	Values
1	Elizabethtown	$5.31	1	Bloomington[3]	$13.44
2	Joliet	3.38	2	Bloomington	12.35
3	West Salem	2.71	3	Bloomington[1]	10.01
4	Newton	2.66	4	Joliet	7.60
5	Kewanee	1.96	5	Elizabethtown	7.53
6	Enfield	1.73	6	Antioch[4]	7.34
7	Lebanon	1.57	7	West Salem	4.22
8	Carlinville	1.47	8	Kewanee	3.08
9	Carthage	1.20	9	McNabb[2]	2.69
10	Ewing	1.19	10	Oblong	2.56
11	Clayton	1.12	11	Minonk	2.03
12	Oquawka	1.10	12	Lebanon	2.01
13	Springvalley	1.08	13	Newton	1.99
14	Oblong	.76	14	Raleigh	1.93
15	Aledo	.61	15	Carlinville	1.85
16	Unionville	.35	16	Odin[3]	1.69
17	Palestine	−.01	17	Carthage	1.40
18	LaMoille	−.05	18	Unionville	1.38
19	Dixon	−.11	19	Ewing	1.32
20	Raleigh	−.12	20	Palestine[5]	1.22
21	Sparta	−.16	21	Hartsburg	1.20
22	Palestine[1]	−.22	22	Aledo	.82
23	McNabb[2]	−.31	23	Enfield	.76
24	Minonk	−.33	24	Mt. Morris	.72
25	Toledo	−.54	25	Clayton	.68
26	Mt. Morris	−.63	26	LaMoille	.58
27	Hartsburg	−.70	27	Palestine[6]	.56
			28	Oquawka	.49
			29	Dixon	.38
			30	Toledo	−.04
			31	Sparta	−.27
			32	Springvalley	−1.35

[1]Superphosphate. [2]No limestone. [3]Bone meal. [4]Bone meal over RLK. [5]Superphosphate over LeLK. [6]Rock phosphate over LeLK.

the use of the phosphates during the last rotation period are recorded in Table 5.

In general, better results for the phosphates were obtained in the crop-residues system than in the manure system, probably because the manure functioned to some extent as a source of phosphorus. In both systems there are some fields that have given little or no response to phosphorus, probably because the soil has not yet become deficient in available phosphorus or because some other deficiency is of more importance than the phosphorus deficiency.

These results indicate the desirability of testing the soil for available phosphorus as described in Bulletin 337 of this Station, before making plans to use phosphate fertilizers extensively.

Supplementary Phosphate Studies

Five experiment fields were modified in 1924 in order to determine whether the manner of using rock phosphate and other carriers of this element would affect the results obtained. Those fields represent five widely varying soil types with respect to both productivity and acidity. The average results for the last rotation are recorded in Table 6.

TABLE 6.—PHOSPHATE: VALUE OF CROP INCREASES RESULTING FROM VARIOUS CARRIERS OF PHOSPHORUS WHEN USED WITH LIMESTONE AND WITHOUT LIMESTONE

(Values represent average annual acre-returns for rotation periods ending in 1931)

Phosphate treatment	Basal treatment	Hartsburg (response to limestone slight)	Dixon (response to limestone fair)	Aledo (response to limestone medium)	Raleigh (response to limestone high)	Toledo (response to limestone very high)
Rock phosphate						
Limestone applied						
None.....	M	$1.90	$ .22	$ .66	$1.19	$3.15
None.....	R	1.53	2.35	1.98	1.80	1.72
Light[1].....	RL	−.99	2.13	3.27	3.78	.21
Heavy[1].....	RL	1.92	1.60	.98	3.30	.86
No limestone						
Rock phosphate..	R	1.53	2.35	1.98	1.80	1.72
Superphosphate..	R	.36	−.15	.24	.45	−.46
Heavy limestone[1]						
Rock phosphate..	RL	1.92	1.60	.98	3.30	.86
Superphosphate..	RL	1.67	.06	1.23	3.07	−.06
Bone phosphate..	ML	.12	−.04	.44	1.33	−.19
Continued rock phosphate over residual	ML	1.63	.12	−.88	2.24	.93
rock phosphate...	RL	.72	1.22	.16	1.37	.90

[1]The heavy applications of limestone range from 8 to 10 tons an acre, and the light from 2 to 4 tons an acre.

It is quite evident that none of the carriers used on these fields were highly effective. The results do indicate, however, that the manner of application may have some influence on the responsiveness of the phosphates, especially when used in connection with limestone.

Potash Merits Consideration

The potash used in these experiments was applied at the annual acre-rate of 200 pounds of kainit, or 100 pounds of potassium sulfate or potassium chlorid, ahead of corn and wheat.

The more productive soils have given little or no response to potash, the less productive soils, the best responses (Table 7). At Minonk, on a highly productive soil, potash was applied at a loss. At Ewing, on a soil of low productivity, good crop increases have been obtained.

A careful study of all the experimental data indicates that the favorable results for potash may have been influenced in part by the accompanying treatments. The limestone-sweet-clover treatment especially seems to have increased the effectiveness of the potash on some kinds of soil.

TABLE 7.—POTASH: VALUE OF CROP INCREASES RESULTING FROM POTASH[1] WHEN USED IN ADDITION TO CROP RESIDUES, LIMESTONE, AND PHOSPHATE
(Values represent average annual acre-returns for rotation periods ending in 1931)

Rank	Fields	Values
1	Ewing	$7.62
2	Toledo	6.87
3	West Salem	4.13
4	Enfield	4.07
5	Newton	4.05
6	Oblong	3.89
7	Clayton	3.71
8	Raleigh	3.36
9	Springvalley	3.25
10	Joliet	3.13
11	Bloomington[2]	3.02
12	Unionville	2.97
13	Sparta	2.84
14	Odin[2]	2.75
15	Carthage	2.69
16	Mt. Morris	1.97
17	Carlinville	1.82
18	Elizabethtown	1.75
19	Lebanon	1.72
20	Aledo	1.58
21	Kewanee	1.58
22	Dixon	1.49
23	Oquawka	1.26
24	Palestine[3]	.80
25	LaMoille	.41
26	Hartsburg	− .15
27	Antioch[2]	− .51
28	Minonk	−1.27

[1]Chiefly kainit. [2]Potassium sulfate. [3]Potassium chlorid.

Net Value of Crop Increases

In the livestock systems of farming the naturally less productive soils have tended to give the largest net acre-returns for the various systems of soil treatment (Table 8). In the grain systems of farming such a relationship is not so apparent, some of the more productive fields having given the highest net acre-responses. On the other hand, some of the more productive soils have given little or no net response for any system of soil treatment tried. On the young, dark soil at McNabb, for instance, in both systems of farming, the check plot gave the highest net returns.

On a large number of the fields the livestock systems of soil treatment have given larger net acre-responses than grain systems. A few of the more productive soils have given much better responses to the grain systems than to the livestock systems.

TABLE 8.—NET VALUE OF INCREASES FROM MOST EFFECTIVE SYSTEMS OF SOIL TREATMENT ON EACH FIELD

(Figures represent annual acre-values of crop increases for rotation periods ending in 1931 after deducting cost of treatment)

Livestock systems				Grain systems			
Rank	Fields	Treatment	Values	Rank	Fields	Treatment	Values
1	Oquawka	ML	$16.32	1	Bloomington	RLbPK	$12.04
2	Ewing	ML	13.89	2	Lebanon	RL	10.37
3	Newton	ML	12.16	3	Aledo	RL	10.16
4	Clayton	ML	11.69	4	Elizabethtown	RLrP	9.66
5	Enfield	ML	10.62	5	Ewing	RLrPK	9.63
6	Oblong	ML	10.19	6	West Salem	RLrPK	8.52
7	West Salem	ML	10.18	7	Clayton	RL	8.21
8	Elizabethtown	MLrP	10.09	8	Oquawka	RL	8.05
9	Toledo	LeML	9.89	9	Enfield	RL	8.01
10	Raleigh	ML	9.33	10	Newton	RL	6.97
11	Carlinville	ML	8.90	11	Sparta	RL	6.75
12	Lebanon	ML	8.84	12	Toledo	RLrPK	6.50
13	Sparta	ML	7.75	13	Antioch	LbP	6.16
14	Carthage	ML	7.69	14	Hartsburg	RL	6.09
15	Mt. Morris	ML	7.06	15	Mt. Morris	RL	5.86
16	Kewanee	ML	6.31	16	LaMoille	RL	5.81
17	Palestine	LeML	6.09	17	Carthage	RL	5.68
18	Dixon	ML	6.08	18	Joliet	RLrPK	5.56
19	Springvalley	ML	5.81	19	Palestine	LeL	5.54
20	Aledo	ML	5.66	20	Unionville	RL	4.73
21	Joliet	ML	5.46	21	Carlinville	RL	4.51
22	Hartsburg	ML	5.33	22	Oblong	RLrPK	4.38
23	Unionville	ML	4.79	23	Minonk	R	3.51
24	LaMoille	M	3.84	24	Raleigh	RL	3.45
25	Minonk	M	1.70	25	Dixon	RL	2.72
26	McNabb	0	0	26	Odin	RL	2.31
				27	Springvalley	RL	.69
				28	Kewanee	RL	.09
				29	McNabb	0	0

TABLE 9.—NET VALUE OF TOTAL CROPS FROM MOST EFFECTIVE SYSTEMS OF SOIL TREATMENT ON EACH FIELD

(Figures represent total annual acre-values for rotation periods ending in 1931 after deducting cost of treatment)

Livestock systems				Grain systems			
Rank	Fields	Treatment	Values	Rank	Fields	Treatment	Values
1	McNabb	0	$33.99	1	Aledo	RL	$36.31
2	Aledo	ML	31.88	2	McNabb	0	33.99
3	Kewanee	ML	29.65	3	LaMoille	RL	32.71
4	LaMoille	M	29.30	4	Bloomington	RLbPK	30.96
5	Clayton	ML	28.82	5	Clayton	RL	26.81
6	Dixon	ML	28.75	6	Dixon	RL	26.72
7	Mt. Morris	ML	28.33	7	Minonk	R	26.19
8	Springvalley	ML	27.86	8	Hartsburg	RL	26.00
9	Carthage	ML	26.06	9	Mt. Morris	RL	25.60
10	Oquawka	ML	25.99	10	Kewanee	RL	24.85
11	Hartsburg	ML	25.30	11	Springvalley	RL	24.82
12	Minonk	M	24.95	12	Carthage	RL	23.56
13	Carlinville	ML	22.03	13	Oquawka	RL	23.25
14	Joliet	ML	20.55	14	Lebanon	RL	23.21
15	Palestine	LeML	20.42	15	Antioch	LbP	21.41
16	Lebanon	ML	19.25	16	Joliet	RLrPK	20.50
17	Oblong	ML	16.86	17	Carlinville	RL	19.86
18	Toledo	LeML	16.32	18	Palestine	LeL	19.87
19	Ewing	ML	15.97	19	Toledo	RLrPK	12.93
20	Newton	ML	15.58	20	Enfield	RL	12.78
21	Enfield	ML	15.03	21	Oblong	RLrPK	12.69
22	West Salem	ML	12.80	22	Ewing	RLrPK	12.39
23	Elizabethtown	MLrP	12.43	23	Elizabethtown	RLrP	12.00
24	Sparta	ML	12.19	24	Newton	RL	11.41
25	Raleigh	ML	11.85	25	West Salem	RLrPK	11.14
26	Unionville	ML	9.01	26	Sparta	RL	10.01
				27	Unionville	RL	8.63
				28	Raleigh	RL	6.83
				29	Odin	RL	6.66

From the farmer's point of view, however, the net value of crop increases is not of so great interest as the total value of the total crop with the cost of the treatment deducted. The importance of viewing the data from this standpoint is brought out in Table 9.

Net Value of Total Yields the Important Consideration

Ranked by net values of total crops, the Illinois soil experiment fields fall into quite a different order than when arranged by net value of crop increases. Even tho the net value of the crop increases for soil treatment may be considerably greater on the less productive soils than on the more productive soils, the net value of the total crops produced on the more productive fields is, of course, much greater. This value for the Aledo field is $36.31 an acre, while at Odin it is only $6.66 (Table 9). The Aledo field is located on a young, dark soil with a

heavy, noncalcareous subsoil, while the Odin field is located on a mature, poorly drained gray soil with impervious, noncalcareous subsoil. It is thus easy to see that from the farmer's point of view, the total acre-production is of much greater importance than the percentage increase that can be obtained for any particular soil treatment. Some soils, it is obvious, will challenge the most skilful farmer.

Changes have been instituted on certain of the Illinois fields in an attempt to ascertain whether other crop rotations or other systems of soil treatment than those already tried will make possible a larger net total production.

The Important Systems of Soil Treatment

An interesting fact about the data recorded in Tables 8 and 9 is that all systems of treatment employed are represented by one or more fields. On some fields the simplest systems have been the most effective; on others, the most complicated systems have given the best results. On the gray, yellow, sandy, hilly, and less productive dark soils, the livestock systems were generally of more value than the grain systems, while on some of the more productive dark soils, such as those represented by the Aledo, LaMoille, Hartsburg and Minonk fields, the grain systems were the most effective.

The fact that no one system of soil treatment will give the best results in all soils is again emphasized by these results. A study of these fields by rotation periods (data not presented here) reveals further that the most effective system for any particular field changes from time to time, tending to go from the simpler to the more complex. A clear lesson from these data is that farmers must be constantly on the alert if they are to make the most economic use of their soils.

Soil Treatment Improves Crop Quality

Crop increases do not measure all the effects of soil treatment; improvement in quality may also be a factor of considerable importance. As an average of the past four years (1928-1931), corn grown without soil treatment on highly productive dark soils with heavy, noncalcareous subsoils required 73.3 pounds of ears at husking time to make a bushel of shelled corn containing 15.5 percent moisture, which is the allowance for No. 2 shelled corn. A corresponding figure for the dark soils with open, noncalcareous subsoils, in northern Illinois, is 81.0 pounds, and for the gray soils with impervious, noncalcareous subsoils, in southern Illinois, 90.8 pounds.

Interpreted in another way these results mean that for every 100 bushels of corn containing 15½ percent moisture taken to market, there

TABLE 10.—EFFECT OF SOILS AND SOIL TREATMENT ON QUALITY OF CORN PRODUCED; Bushels of corn (70 pounds) that need to be husked from the field for every 100 bushels (15½ percent moisture) taken to market
(Figures based on results for rotation periods ending in 1931)

Soil treatment	Dark soils with—					Sandy loams and sands	Gray soils with impervious noncalcareous subsoils	Yellow soils with noncalcareous subsoils	Hilly land
	Heavy noncalcareous subsoils	Impervious noncalcareous subsoils	Noncalcareous subsoils	Open noncalcareous subsoils	Impervious calcareous subsoils				
Number of crops	32	16	4	8	8	4	24	12	4
	bu.	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*
0	104.7	107.5	109.7	115.7	120.0	109.8	129.7	132.6	104.1
M	102.3	106.0	107.1	109.6	109.7	104.6	118.6	109.6	102.6
ML	102.3	104.3	106.1	106.9	107.7	103.1	113.7	109.2	104.5
MLP	102.4	105.0	105.0	108.7	106.7	103.3	113.9	110.7	105.6
0	103.0	108.1	109.1	115.6	121.6	106.6	127.4	135.3	104.1
R	101.7	107.0	108.3	113.3	109.7	104.4	124.0	120.3	109.3
RL	101.3	105.0	106.1	107.6	110.1	103.1	117.6	110.9	107.1
RLP	100.7	105.0	106.7	107.0	108.1	101.6	116.4	110.6	106.1
RLPK	101.5	105.7	106.6	107.3	106.3	105.0	115.0	109.0	103.9

must be husked from the field 104.7 bushels (70 pounds per bushel) in the first case, 115.7 bushels in the second case, and 129.7 bushels in the third case. In other words, the corn grown on the most productive soils was drier and better filled out than the corn grown on the less productive soils. Thus the shrinkage between field and market is much greater for corn grown on the less productive soils than for corn grown on the more productive soils.

The results from experiments conducted on nine groups of soil during the past four years will be found in Table 10. In addition to the influence shown to have been exerted on the quality of the corn by the soil itself (see untreated plots), there is also shown the influence of soil treatment in reducing shrinkage losses. For the most productive soils the influence of treatment was relatively slight, chiefly because there was but little possibility for improvement. For the other kinds of soil, however, there was more or less effect, depending upon the natural level of productivity.

Thus it is shown that shrinkage is markedly less when corn is grown on naturally productive soils or on soils made productive by treatment. In these tests practically no shrinkage occurred on some land while on others the loss was around 25 percent, or a bushel for every four husked. The importance of these facts is easily recognized.

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MINERAL FERTILIZERS

ORGANIC MANURES

PART II. CROP YIELDS FOR 1931

Here are presented, without further discussion, the crop yields from all Illinois experiment fields under operation in 1931. The fields, with minor exceptions that are duly noted, are arranged in alphabetical order.

TABLE 11.—ALEDO FIELD
Rotation: Corn, corn, oats, wheat

Serial plot No.	Soil treatment	Series 100 Second-year corn	Series 200 First-year corn	Series 300 Wheat	Series 400		Average all crops (pounds per acre)
					Oats	Stubble clover (Hubam)	
			WEST HALF				
1	0	62.1	49.9	15.8	64.1	(0)	2 318
2	M	71.2	74.2	28.0	74.7	(0)	3 053
3	ML	71.0	68.2	37.7	78.4	(.68)	3 481
4	MLrP	70.8	69.3	35.2	77.5	(.57)	3 394
5	0	63.0	51.6	19.5	63.4	....	2 404
6	R	69.1	61.7	23.0	68.4	....	2 724
7	RL	77.5	72.9	34.2	69.1	....	3 170
8	RLrP	78.0	74.6	37.3	65.6	....	3 221
9	RLrPK	77.1	70.4	39.8	76.6	....	3 275
10	0	67.4	53.2	18.0	71.3	....	2 528
			EAST HALF				
1	RL	65.7	62.8	26.5	58.8	(0)	2 667
2	MrP	65.5	72.7	29.0	77.2	(0)	2 987
3	MLbP	65.9	72.5	38.2	76.3	(.60)	3 422
4	MLrP	66.8	70.6	40.7	80.0	(.54)	3 446
5	RsP	68.2	57.1	23.8	71.3	....	2 682
6	RrP	71.8	65.5	26.8	74.1	....	2 917
7	RLsP	77.1	67.6	41.3	82.2	....	3 303
8	RLrP	77.5	72.5	40.0	62.5	....	3 200
9	RLrPK	74.6	71.4	41.8	75.9	....	3 279
10	RLrP	72.3	71.4	32.7	69.1	....	3 054

TABLE 12.—ALEDO FIELD: PHOSPHORUS EXPERIMENT
Rotation: Corn, corn, oats, wheat

Serial plot No.	Series 500 Soil treatment	Corn	Series 600 Soil treatment	Corn
1	R	64.7	R	64.4
2	RbP	72.0	RsP	71.1
3	RLbP	71.4	RLsP	71.2
4	RL	72.6	RL	67.3

	Series 700 Soil treatment	Corn	Series 800 Soil treatment	Corn
1	R	63.5	R	62.5
2	RrP	70.9	R, slag P	67.3
3	RLrP	69.3	RL, slag P	66.5
4	RL	69.4	RL	70.3

TABLE 13.—ANTIOCH FIELD
Rotation: Corn, oats, clover, wheat

Plot No.	Soil treatment[1]	Corn	Plot No.	Soil treatment[1]	Corn
1	0	23.9	6	LRbP	16.5
2	LrP	23.7	7	LRK	18.0
3	LRrP	24.7	8	LKbP	16.7
4	LbP	18.2	9	LRKbP	26.4
5	LKrP	16.9	10	RKbP	30.0

[1]Potassium applied in the form of potassium sulfate.

TABLE 14.—BLOOMINGTON FIELD
Rotation: Corn, corn, oats, clover-alfalfa, wheat

Plot No.	North Half Soil treatment[1]	Wheat	South Half Soil treatment[1]	Wheat
1	R	34.2	0	21.0
2	RLbP	48.8	RL	19.3
3	RLrP	42.7	RLsP	47.2
4	RLbP	45.8	RLbP	44.2
5	RLKrP	40.5	RLKsP	47.5
6	RLbP	43.3	RLbP	41.5
7	RLKrP	41.7	RLKsP	47.5
8	RLKbP	42.7	RLKbP	39.0
9	RLKbP	42.2	RLKbP	44.0
10	RKbP	42.5	RKbP	45.8
11	RrP	42.2	RsP	49.0

[1]Potassium applied as potassium sulfate.

TABLE 15.—CARLINVILLE FIELD
Rotation: Corn, oats, wheat, clover-alfalfa

Serial plot No.	Soil treatment	Series 100		Series 200	Series 300	Series 400	Average all crops (pounds per acre)
		Volunteer wheat	Stubble hay (cl.-alf.)	Corn	Oats	Wheat	
1	0	5.5	(.01)	23.7	63.8	25.6	1 310
2	M	10.8	(.08)	15.9	78.3	36.4	1 596
3	ML	23.0	(.35)	8.0	81.6	44.2	1 948
4	MLrP	23.7	(.30)	4.9	79.5	43.8	1 870
5	0	7.8	(.06)	13.1	67.5	26.5	1 267
6	R	10.4	(.06)	10.9	70.3	23.2	1 246
7	RL	21.2	(.26)	11.2	80.5	32.8	1 740
8	RLrP	25.5	(.30)	11.5	84.1	41.9	1 993
9	RLrPK	24.1	(.33)	6.7	88.3	38.8	1 909
10	0	11.3	(.03)	20.2	69.8	26.6	1 424

TABLE 16.—CARLINVILLE FIELD
Rotation: Corn, wheat

Serial plot No.	Soil treatment	Series 500 Wheat	Series 600 Corn	Average all crops (pounds per acre)
1	0	23.0	35.9	1 695
2	9-27-9	38.8	39.7	2 277
3	0-21-9	38.0	44.2	2 378
4	0	41.2	37.6	2 303
5	9-27-9	46.7	42.3	2 584
6	0-21-9	40.8	39.9	2 342
7	0	38.8	48.0	2 509

Note.—In the beginning, Series 500 and 600 were left unplotted. A rotation of wheat and red clover was planned for one of these series for a period of six years, while alfalfa grew on the other for an equal time, after which the alfalfa was to be shifted. Prior to 1921 these plots had each received a total of 12 tons of manure, 8½ tons of limestone, 3 tons of rock phosphate, and approximately 2,500 pounds of kainit an acre. In 1921 these two series were plotted, and, until 1929, were cropped somewhat irregularly without additional fertilization. In 1929 a rotation of corn and wheat (sweet clover) was planned. Fertilizers are being applied as follows: commercial 9-27-9 to Plots 2 and 5, 100 pounds an acre for corn and 150 pounds an acre for wheat; commercial 0-21-9 to Plots 3 and 6, 125 pounds an acre for corn, and 200 pounds an acre for wheat.

TABLE 17.—CARLINVILLE FIELD
Rotation: Corn, wheat

Serial plot No.	Series 700		Series 800	
	Soil treatment[1]	Corn	Soil treatment[1]	Corn
1	LeL (1,000)	42.5	LeL (5,000)	36.6
2	LeL (4,000)	40.8	LeL (20,000)	31.1
3	LeL (2,000)	39.9	LeL (10,000)	42.9
4	LeL (2,000), treble sP	39.5	LeL (10,000), treble sP	43.1
5	LeL (2,000), sP	41.2	LeL (10,000), sP	41.0
6	LeL (2,000), rP	37.6	LeL (10,000), rP	41.4
7	L (2,000)	37.6	L (10,000)	36.1

[1]The figures in parentheses denote total amounts of limestone applied per acre since 1921.

TABLE 18.—CARTHAGE FIELD
Rotation: Corn, oats, clover, wheat

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Wheat	Series 300 Clover	Series 400 Oats	Average all crops (pounds per acre)
	SECTION A					
1	0	44.9	11.3	(.91)	52.5	1 673
2	M	72.1	17.7	(1.25)	53.1	2 324
3	ML	76.8	19.0	(1.93)	57.5	2 785
4	MLrP	77.9	22.0	(1.45)	61.9	2 640
5	0	48.6	14.3	(.72)	52.5	1 675
6	R	58.4	18.3	(.89)	53.8	1 970
7	RL	67.1	20.3	(1.50)	54.4	2 430
8	RLrP	67.6	18.3	(1.46)	53.8	2 381
9	RLrPK	64.3	23.0	(1.63)	60.6	2 545
10	0	51.2	15.3	(1.10)	59.4	1 972
	SECTION B					
1	rP	43.9	18.7	(1.37)	59.4	2 054
2	M+rP	62.7	20.3	(1.43)	52.5	2 318
3	ML+rP	69.9	22.3	(2.00)	59.4	2 789
4	MLrP+rP	78.2	21.0	(1.46)	61.3	2 630
5	rP	49.4	15.3	(.64)	53.8	1 671
6	R+rP	56.0	16.7	(1.15)	58.8	2 079
7	RL+rP	70.9	18.3	(1.61)	59.4	2 548
8	RLrP+rP	68.0	22.0	(1.75)	51.3	2 567
9	RLrPK+rP	68.8	25.7	(1.76)	68.8	2 778
10	rP	46.7	16.3	(1.14)	59.4	1 944

TABLE 18.—*Concluded*

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Wheat	Series 300 Clover	Series 400 Oats	Average all crops (pounds per acre)
		SECTION C				
1	sP	45.5	26.0	(1.44)	58.8	2 217
2	M+sP	63.9	23.0	(1.44)	63.1	2 474
3	ML+sP	76.6	24.0	(1.90)	59.4	2 852
4	MLrP+sP	76.3	22.0	(1.61)	63.8	2 713
5	sP	44.2	22.0	(.76)	62.5	1 829
6	R+sP	55.9	24.3	(.99)	60.0	2 122
7	RL+sP	67.6	22.7	(1.70)	63.1	2 641
8	RLrP+sP	67.8	22.3	(1.80)	55.6	2 629
9	RLrPK+sP	69.7	28.3	(2.10)	58.8	2 921
10	sP	43.9	23.0	(1.21)	58.1	2 030
		SECTION D				
1	5-15-5	38.4	31.3	(1.58)	65.0	2 318
2	M+5-15-5	56.0	27.0	(1.61)	64.4	2 509
3	ML+5-15-5	71.7	25.0	(1.74)	58.1	2 714
4	MLrP+5-15-5	67.2	24.3	(1.79)	68.8	2 751
5	5-15-5	43.1	31.3	(.84)	58.8	1 963
6	R+5-15-5	40.9	28.3	(1.13)	53.8	1 992
7	RL+5-15-5	58.8	24.0	(1.81)	70.6	2 653
8	RLrP+5-15-5	64.2	23.3	(1.75)	64.4	2 639
9	RLrPK+5-15-5	64.7	27.7	(1.90)	70.0	2 831
10	5-15-5	42.9	26.0	(1.19)	68.8	2 136

Note.—For the purpose of studying the relative values of finely processed rock phosphate, superphosphate, and mixed fertilizers when used in addition to different basal soil treatments which have been common to all sections since 1912, these series of plots in 1929 were divided into four sections extending across all plots.

Section A receives the basal treatment only.

Section B receives the basal treatment plus finely processed rock phosphate, 500 pounds per acre for wheat and 250 pounds for corn.

Section C receives the basal treatment plus superphosphate, 200 pounds per acre for wheat and 150 pounds for corn.

Section D receives the basal treatment plus a mixed fertilizer: namely, 250 pounds of 5-15-5 per acre for wheat and 150 pounds for corn. All fertilizers to be drilled in for wheat and hill-dropped for corn.

TABLE 19.—CARTHAGE FIELD
Rotation: Corn, oats, wheat

Serial plot No.	Soil treatment	Series 500 Corn	Series 600		Series 700 Oats	Average all crops (pounds per acre)
			Spring wheat	Stubble hay (sw. cl.)		
1	RL	44.8	9.0	(.91)	48.0	2 284
2	RL, KCl	49.7	13.0	(.91)	56.9	2 551
3	RL, KCl	52.5	16.1	....	46.9	1 803
4	RL	48.1	15.3	....	47.3	1 710

Note.—These series were replotted in the fall of 1930 with the plots extending crosswise of the original plots. A rotation of corn, oats, wheat (sweet clover) will be grown. The fall growth of sweet clover will be removed from Plots 1 and 2, but allowed to stand on Plots 3 and 4.

The soil treatment is as follows: residues (cornstalks and sweet clover green manure) on all plots; limestone to all plots as necessary for successful growth of sweet clover; potassium chlorid to Plots 2 and 3, 100 pounds per acre drilled with wheat and 50 pounds hill-dropped for corn.

TABLE 20.—CLAYTON FIELD
Rotation: Corn, oats, clover, wheat

Serial plot No.	Soil treatment	Series 100 Corn[1]		Series 200 Wheat	Series 300 Clover	Series 400 Oats	Average all plots (pounds per acre)
		North	South				
1	0	....[2]	48.8	27.0	(.99)	43.9	1 934
2	M	....[2]	65.7	31.2	(1.34)	68.9	2 611
3	ML	....[2]	71.5	30.2	(3.31)	68.9	3 661
4	MLrP	....[2]	73.3	33.7	(3.37)	80.5	3 860
5	0	47.2	46.8	28.5	(1.02)	53.4	2 025
6	R	51.2	50.8	29.4	(.73)	53.6	1 944
7	RL	55.2	51.4	30.2	(1.58)	60.3	2 446
8	RLrP	57.4	54.4	35.0	(1.81)	62.3	2 693
9	RLrPK	64.8	64.2	36.5	(2.13)	70.9	3 079
10-W	Cornstalks	46.0	45.8	30.2	(1.40)	51.9	2 209
10-E	0	46.0	45.8	26.8	(1.18)	55.6	2 079

[1]North half of series was plowed on April 15; south half, on May 1.

[2]Plots discontinued because of lack of uniformity due to a draw running across them.

TABLE 21.—CLAYTON FIELD
Rotation: Corn, oats, wheat

Serial plot No.	Soil treatment	Series 500 Corn	Series 600 Wheat	Series 700 Oats	Average all crops (pounds per acre)
1	RL, commercial 5-15-5	64.2	38.0	56.3	2 560
2	RL, home mixed 5-15-5	59.0	34.8	54.1	2 373
3	RL	63.6	33.0	38.8	2 260
4	RL, home mixed 0-15-5	71.4	37.0	55.0	2 660
5	RL, commercial 0-15-0	64.9	37.5	62.5	2 627
6	RL	62.8	33.5	51.3	2 390
7	RL, home mixed 0-0-5	69.9	34.3	64.4	2 677
8	RL, commercial 0-0-50	79.2	34.2	58.4	2 787

Note.—This land grew alfalfa from 1914 to 1920. From 1921 until 1928 a rotation of corn, oats, clover, and wheat was grown. In 1929 these series were laid out and the present rotation (corn, oats, wheat with sweet-clover seeding) was begun. The plan of fertilization is given in the above table:

Residues to consist of cornstalks and sweet-clover green manure plowed down on all plots.

Limestone to be applied to all plots in sufficient amounts to insure the growth of sweet clover.

The additional fertilizers to be applied to Plots 1, 2, 4, 5, and 7 at the rate of 375 pounds per acre per rotation: 250 pounds for wheat and 125 pounds for corn. Plot 8 to receive 225 pounds KCl per acre per rotation: 150 pounds for wheat and 75 pounds for corn.

(See opposite page for Table 22)

TABLE 23.—DIXON FIELD
Rotation: Corn, oats, wheat

Soil treatment	Series 900 Oats	Series 1000 Corn	Series 1100 Wheat	Average all plots (pounds per acre)
L, cornstalks, wheat and oat straw	56.5	48.7	32.3	2 158
L, cornstalks, and wheat straw	54.0	51.5	29.0	2 184
L, cornstalks	53.2	45.0	28.4	1 975
L, cornstalks burned (ash returned)	55.0	48.6	30.0	2 094
L, cornstalks, wheat and oat straw plus sweet clover	51.1	63.3	33.0	2 387
L, cornstalks and wheat straw plus sweet clover	49.5	66.6	35.2	2 075
L, cornstalks plus sweet clover	54.9	60.1	35.8	2 457
L, cornstalks burned (ash returned) plus sweet clover	59.6	38.8[1]	36.2	2 084

Note.—These series were laid out in 1924. A study is being made of the effects of returning to the soil cornstalks burned on the ground or disked in for oats. Oats straw is returned as a top dressing for wheat and wheat straw is plowed down for corn. The effects of sweet-clover green manure, in addition to the different combinations of nonlegume residues, will also be studied.

Limestone has been applied to all plots at the rate of 4,000 pounds an acre, subsequent applications will be made as necessary in order to grow a normal crop of sweet clover.

Each yield given is the average of duplicate tests.

[1]Damaged by moles and ground squirrels.

TABLE 22.—DIXON FIELD
Rotation: Corn, oats, clover, wheat

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Wheat	Series 300 Clover	Series 400 Oats	Average all crops (pounds per acre)
	SOUTH HALF					
1	0	59.6	26.3	(1.47)	48.4	2 347
2	M	73.5	33.7	(2.56)	65.3	3 337
3	ML	76.5	25.0	(2.89)	66.9	3 426
4	MLrP	75.2	26.7	(2.61)	68.8	3 308
5	0	56.4	26.8	(1.84)	53.8	2 544
6	R	64.3	27.0	(.98)	50.3	2 195
7	RL	63.1	28.8	(1.00)	56.6	2 269
8	RLrP	55.4	28.2	(1.32)	51.6	2 273
9	RLrPK	73.4	28.3	(1.86)	54.7	2 820
10	0	61.2	23.5	(2.00)	49.7	2 604
	NORTH HALF					
1	RL	58.8	29.0	(.97)	53.4	2 171
2	MrP	68.5	27.3	(2.62)	68.1	3 224
3	MLbP	68.4	31.2	(2.90)	70.6	3 442
4	MLrP	66.6	31.7	(2.68)	66.9	3 282
5	RsP	55.8	34.3	(1.01)	56.9	2 259
6	RrP	61.2	31.3	(1.18)	56.3	2 364
7	RLsP	73.3	30.3	(1.21)	57.2	2 546
8	RLrP	61.2	30.3	(1.56)	55.6	2 534
9	RLrPK, gypsum	68.3	30.5	(1.92)	69.4	2 931
10	RLrP	54.2	29.8	(1.57)	60.0	2 469

TABLE 24.—ELIZABETHTOWN FIELD
Rotation: Corn, wheat, mixed hay, wheat

Soil treatment	Series 100 Wheat following hay	Series 200 Mixed hay	Series 300 Wheat following corn	Series 400 Corn	Series 500[1] Alfalfa	Average all crops, Series 100-400 (pounds per acre)
0	5.1	(0)	4.2	19.1	(0)	408
M	9.8	(0)	12.5	28.4	(0)	731
ML	25.2	(.26)	34.2	36.6	(.92)	1 532
MLrP	42.4	(.59)	33.9	37.8	(1.47)	1 969
R	2.3	(0)	4.0	19.7	(0)	370
RL	16.2	(.30)	10.0	30.9	(.60)	974
RLrP	38.2	(1.22)	30.0	32.6	(1.17)	2 089
RLrPK	35.8	(2.11)	22.9	35.1	(1.48)	2 427

[1]Series 500 is a permanent alfalfa series.

TABLE 25.—ENFIELD FIELD
Rotation: Corn, oats, mixed hay, wheat

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Wheat	Series 300 Mixed hay	Series 400 Oats	Average all crops (pounds per acre)
1	0	4.7	12.1	(0)	27.8	470
2	M	9.0	20.5	(0)	50.5	837
3	ML	9.2	34.2	(2.04)	70.6	2 226
4	MLrP	10.6	38.8	(2.31)	71.7	2 459
5	0	4.0	13.2	(0)	22.5	435
6	R	6.6	12.6	(0)	27.8	504
7	RL	12.3	22.8	(.89)	55.6	1 403
8	RLrP	16.0	32.2	(1.13)	64.8	1 790
9	RLrPK	21.4	40.6	(1.94)	75.3	2 496
10-W	Cornstalks	8.9	18.2	(0)	42.2	734
10-E	0	7.8	17.2	(0)	33.1	632

TABLE 26.—ENFIELD FIELD
Rotation: Corn, wheat

Serial plot No.	Soil treatment[1]	Series 700 Corn	Series 800 Wheat	Average all crops (pounds per acre)
1-W	L	14.1	12.3	765
1-E	L	9.7	15.8	747
2-W	LrP (2,000), sP (100), sweet clover	13.1	25.7	1 187
2-E	LrP (2,000), sP (100), red clover	8.5	26.2	1 023
3-W	LrP (2,000), sweet clover	11.3	23.7	1 027
3-E	LrP (2,000), red clover	8.5	26.3	1 028
4-W	LrP (2,000), sP (200), sweet clover	10.7	27.0	1 110
4-E	LrP (2,000), sP (200), red clover	13.1	29.5	1 252
5-W	LrP (2,000), sweet clover	9.9	28.3	1 127
5-E	LrP (2,000), red clover	7.4	30.7	1 117
6-W	L, sweet clover	7.4	30.7	1 117
6-E	L, red clover	8.5	28.3	1 088

[1]The figures in parentheses indicate the total applications of phosphates since 1923.

TABLE 27.—EWING FIELD
Rotation: Corn, oats, mixed hay, wheat

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Wheat	Series 300 Mixed hay	Series 400 Oats	Average all crops (pounds per acre)
	SECTION A					
1	sP, KCl	28.8	15.0	(.20)	58.1	1 193
2	MsP, KCl	41.3	19.3	(.27)	78.8	1 633
3	MLsP, KCl	54.0	50.7	(1.81)	98.1	3 206
4	MLrPsP, KCl	54.3	45.3	(2.04)	91.3	3 190
5	sP, KCl	38.8	12.0	(.28)	62.5	1 363
6	RLsP, KCl	42.1	42.3	(.30)	81.3	2 024
7	RLsP, KCl	44.4	39.7	(.75)	100.0	2 391
8	RLrPsP, KCl	47.8	40.0	(1.09)	87.5	2 514
9	RLrPKsP, KCl	50.5	43.3	(.85)	80.6	2 402
10	sP, KCl	34.0	12.7	(0)	58.1	1 131
	SECTION B					
1	KCl	21.3	8.7	(.23)	42.5	893
2	M, KCl	44.5	19.3	(.37)	60.6	1 583
3	ML, KCl	55.2	45.3	(2.19)	99.4	3 343
4	MLrP, KCl	56.5	54.3	(2.58)	97.5	3 676
5	KCl	23.8	11.0	(.28)	46.9	1 013
6	RL, KCl	40.1	36.3	(.22)	70.6	1 781
7	RL, KCl	42.3	39.3	(.64)	85.0	2 182
8	RLrP, KCl	46.6	46.7	(1.05)	91.3	2 608
9	RLrPK, KCl	54.1	49.3	(1.42)	80.0	2 848
10	KCl	24.8	10.0	(0)	34.4	772
	SECTION C					
1	0	16.6	10.7	(.26)	31.3	772
2	M	46.4	19.0	(.40)	47.5	1 514
3	ML	58.4	48.7	(2.21)	95.6	3 418
4	MLrP	61.8	53.0	(2.46)	96.3	3 660
5	0	18.2	9.7	(.35)	47.5	955
6	R	17.8	10.3	(0)	46.9	779
7	RL	9.1	35.3	(.36)	71.9	1 412
8	RLrP	14.2	41.7	(.46)	94.4	1 809
9	RLrPK	54.3	51.3	(1.31)	91.3	2 915
10	sP	24.0	16.0	(0)	61.3	1 066

TABLE 27.—*Concluded*

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Wheat	Series 300 Mixed hay	Series 400 Oats	Average all crops (pounds per acre)
			SECTION D			
1	$NaNO_3$	16.5	18.3	(.38)	51.3	1 106
2	M (residual)	40.3	25.0	(.45)	48.1	1 549
3	ML (residual)	50.3	47.3	(2.13)	91.3	3 209
4	MLrP (residual)	48.1	52.7	(2.11)	98.1	3 303
5	$NaNO_3$, KCl	28.3	13.3	(.38)	56.3	1 236
6	RL	40.1	34.7	(.41)	69.4	1 841
7	RL	18.4	39.3	(.36)	69.4	1 582
8	RLrP (oat straw)	54.7	42.3	(.77)	93.8	2 536
9	RLrPK (K discontinued)	47.3	49.3	(1.27)	88.1	2 742
10	$NaNO_3$, sP, KCl	37.4	30.3	(0)	66.9	1 476

Note.—In order to study the relative values of different methods of fertilization when added to the basal soil treatments that have been common on these series since 1911, the series in 1929 were divided into four sections extending across all plots.

Section A of each plot receives the basal treatment plus KCl at the rate of 160 pounds per acre for wheat, and 200 pounds for corn; also superphosphate at the rate of 300 pounds per acre for wheat and 150 pounds for corn.

Section B receives KCl as on Section A.

Section C continues under the basal treatment except for Plot 10, which receives superphosphate as on Section A.

Section D of the various plots is treated as follows: Plot 1 receives 100 pounds per acre of $NaNO_3$ as a top dressing for wheat and 100 pounds as a side dressing for corn. On Plots 2, 3, and 4 of this section all soil treatments are discontinued. Plot 5 receives $NaNO_3$ as on Plot 1 and KCl as on Section A. On Plot 7 the sweet-clover catch crop is omitted. On Plot 8 oats straw is plowed down for corn at the rate of 2 tons per acre. On Plot 9 kainit is discontinued. Plot 10 receives $NaNO_3$ as on Plot 1 and KCl and superphosphate as on Section A.

Plot 6 in Sections A, B, and D received a 9-ton application of limestone in 1929. No sweet clover will be seeded on this plot in Sections A and B.

TABLE 28.—EWING FIELD

Rotation: Corn, oats, wheat

Serial plot No.	Soil treatment	Series 500-N Wheat	Series 500-S Oats	Series 600 Corn	Average all crops (pounds per acre)
1	No clover	28.3	63.0	33.3	1 912
2	White biennial sweet clover	32.5	65.5	29.4	1 898
3	Red clover	33.6	62.0	25.2	1 804
4	Hubam clover	35.2	65.5	29.5	1 953
5	Alsike clover	34.4	66.0	29.1	1 935
6	Yellow biennial sweet clover	39.7	72.0	29.1	2 106

Note.—These series were replotted in 1927 from what were formerly Plots A and B. Prior to 1917 fertilizers had been applied as follows: manure 8 tons, limestone 8 tons, rock phosphate 6,000 pounds, and kainit 2,400 pounds per acre. With the exception of limestone used when necessary to grow the clovers, no more fertilizing materials will be added. A study will be made of relative value of different clovers as source of organic manure in a rotation of corn, oats, wheat (clover catch crop).

TABLE 29.—EWING FIELD
Rotation: Corn, oats, wheat

Serial plot No.	Soil treatment	Series 700 Wheat	Series 800 Corn	Series 900 Oats	Average all plots (pounds per acre)
1	Le	7.9	33.5	32.5	1 129
2	LeL	16.7	28.2	35.0	1 233
3	LeLsP (100)	25.8	22.2	56.3	1 531
4	LeLrP (200)	29.7	28.9	61.9	1 793
5	LeL	22.8	43.8	28.1	1 574
6	LeLsP (200)	26.7	37.0	40.0	1 671
7	LeLrP (400)	23.8	33.5	68.8	1 835

TABLE 30.—HARTSBURG FIELD
Rotation: Corn, corn, oats, wheat

Serial plot No.	Soil treatment	Series 100 Second-year corn	Series 200 First-year corn	Series 300 Wheat	Series 400		Average all plots (pounds per acre)
					Oats	Stubble hay (Hubam)	
	WEST HALF						
1	0	63.6	53.7	17.3	39.4	(.38)	2 405
2	M	74.0	65.9	29.7	64.1	(.46)	3 143
3	ML	75.0	71.2	32.5	69.1	(.65)	3 412
4	MLrP	75.4	73.1	34.0	65.9	(.72)	3 479
5	0	61.5	52.8	26.2	45.6	....	2 358
6	R	70.2	69.7	27.5	61.3	....	2 861
7	RL	70.6	67.8	22.5	55.3	....	2 718
8	RLrP	70.6	68.7	25.7	53.8	....	2 765
9	RLrPK	69.3	67.0	27.5	53.1	....	2 946
10	0	59.4	55.6	20.7	49.7	....	2 318
	EAST HALF						
1	RL	70.8	65.7	21.8	42.8	....	2 581
2	MrP	67.2	63.8	34.3	67.5	(.43)	3 104
3	MLbP	72.1	71.6	28.8	68.8	(.69)	3 340
4	MLrP	72.5	73.1	36.7	67.5	(.64)	3 451
5	RsP	67.8	68.2	38.3	54.1	....	2 911
6	RrP	72.7	69.7	34.5	62.2	....	3 009
7	RLsP	72.5	69.5	39.2	57.8	....	3 039
8	RLrP	72.5	72.1	32.0	55.3	....	2 947
9	RLrPK, gypsum	69.5	67.6	33.2	52.2	....	2 834
10	RLrP	67.2	67.2	26.0	53.4	....	2 699

TABLE 31.—HARTSBURG FIELD (SERIES 500)
Rotation: Corn, oats, wheat, clover-alfalfa

Plot No.	WEST HALF		EAST HALF	
	Soil treatment[1]	Corn	Soil treatment[1]	Corn
1	0	70.8	Treble sP	71.8
2	M	66.1	M + treble sP	70.3
3	ML	72.7	ML + treble sP	74.4
4	MLrP	70.6	MLrP + treble sP	65.1
5	0	67.0	Treble sP	73.3
6	R	78.2	R + treble sP	73.5
7	RL	68.5	RL + treble sP	71.2
8	RLrP	68.7	RLrP + treble sP	68.9
9	RLrPK	70.6	RLrPK + treble sP	69.3
10	0	66.3	Treble sP	63.4
11	LeM	58.5	LeM + 5-15-5	61.7
12	LeML	57.9	LeML + 5-15-5	61.5
13	LeMLrP	56.4	LeMLrP + 5-15-5	61.1
14	LeMrP	61.3	LeMrP + 5-15-5	62.1
15	0	56.4	5-15-5	58.1

[1]With the exception of treble sP and 5-15-5 all treatments are residual, the last application being made in 1923.

TABLE 32.—JOLIET FIELD
Rotation: Corn, corn, soybeans, oats, wheat, clover-alfalfa

Serial plot No.	Soil treatment	Series 100 First-year corn	Series 200 Soy-beans	Series 300 Wheat	Series 400 Cl.-alf. hay	Series 500 Oats	Series 600 Second-year corn	Average all crops (pounds per acre)
1	0	33.8	14.2	30.0	(1.20)	58.6	21.6	1 670
2	M	39.1	15.7	29.2	(1.97)	64.7	24.5	2 044
3	ML	41.9	20.5	36.1	(2.23)	67.7	26.2	2 306
4	MLrP	40.3	20.4	34.6	(2.09)	65.8	23.5	2 194
5	0	30.4	17.1	24.6	(1.10)	58.9	21.8	1 584
6	R	32.8	16.5	24.9	(.94)	60.8	22.4	1 569
7	RL	34.9	19.6	25.6	(1.16)	54.7	26.0	1 697
8	RLrP	40.8	22.2	32.0	(2.27)	73.8	28.1	2 335
9	RLrPK	32.8	26.8	34.6	(2.21)	76.9	23.5	2 287
10	0	33.3	22.2	25.5	(1.46)	64.2	23.9	1 840

TABLE 33.—JOLIET FIELD
Rotation: Corn, barley, wheat, legumes

Serial plot No.[1]	Soil treatment	Series 700 Barley	Series 800 Corn	Series 900 Hay	Series 1000 Wheat	Average all plots (pounds per acre)
1	L, red clover	35.6	25.4	(.72)	23.3	1 490
2	LrP, red clover	42.5	29.4	(1.11)	31.7	1 951
3	LrP, gypsum, red clover	40.4	35.3	(1.48)	26.8	2 122
4	L, red clover	31.2	23.9	(.99)	27.3	1 614
5	L, alfalfa	32.3	26.6	(2.03)	26.5	2 177
6	LrP, alfalfa	42.3	27.5	(3.54)	36.8	3 215
7	LrPL (8,000), alfalfa	43.3	29.6	(3.42)	33.2	3 144
8	LrP, KCl, alfalfa	44.2	21.8	(3.66)	36.8	3 215
9	L, KCl, alfalfa	37.3	23.0	(1.83)	29.7	2 132
10	L, alfalfa	34.4	24.7	(2.35)	25.5	2 366
11	L, red clover	36.0	....	(1.16)	....	2 020
12	LsP, red clover	37.1	....	(1.20)	....	2 090
13	LsP, red clover	38.5	....	(1.98)	....	2 905

Note.—In 1924 the rotation on the minor series at Joliet was changed to corn, barley, wheat, and biennial legumes (red clover on Plots 1 to 4 on all series and on Plots 11, 12, and 13 on Series 700 and 900; alfalfa on Plots 5 to 10). All plots had received limestone at the rate of 5,000 pounds an acre prior to 1924. At that time Plot 7 on all series received 8,000 pounds of limestone an acre. Fertilizers as designated above are applied at the following annual acre-rates: rock phosphate 400 pounds, potassium chlorid 100 pounds, gypsum 100 pounds. These fertilizers are applied twice in the rotation, ahead of the wheat and corn crops. Superphosphate is applied for the wheat crop at the rate of 250 pounds an acre. The last crops of clover and alfalfa are plowed down, excepting on Plots 713 and 913, where they are removed as hay.

[1]Plots 11, 12, and 13 appear only in Series 700 and 900.

(See page 260 for Table 34)

TABLE 35.—KEWANEE FIELD
Rotation: Corn, oats, clover, wheat

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Wheat	Series 300 Clover	Series 400 Oats	Average all crops (pounds per acre)
1	0	48.6	21.7	(1.20)	55.9	2 054
2	M	49.2	31.8	(1.53)	73.1	2 798
3	ML	69.9	31.2	(1.54)	72.5	2 799
4	MLrP	68.5	37.7	(1.96)	76.4	3 114
5	0	52.2	23.2	(1.24)	59.2	2 173
6	R	55.4	26.0	(1.11)	68.9	2 270
7	RL	55.0	31.4	(1.27)	75.0	2 478
8	RLrP	59.4	38.8	(1.98)	75.3	3 004
9	RLrPK	58.9	38.9	(2.26)	77.0	3 156
10	0	53.7	22.4	(1.50)	60.9	2 333

TABLE 34.—JOLIET FIELD: SPECIAL PHOSPHORUS STUDIES
Rotation: Wheat, clover

Soil treatment	1928 Wheat	1929 Clover	1930 Wheat	1931 Wheat	Average for 4 years (pounds per acre)
Rock phosphate (degrees of fineness)					
No phosphate	26.3	(2.83)	27.1	9.8	2 413
Rock phosphate, 99% thru 100-mesh screen	29.2	(3.88)	38.2	13.7	3 157
Rock phosphate, 95% thru 100-mesh screen	27.5	(4.11)	36.1	17.0	3 274
Rock phosphate, 90% thru 100-mesh screen	30.6	(4.08)	35.1	14.8	3 248
Rock phosphate, 65% thru 100-mesh screen	29.6	(3.71)	38.0	14.6	3 088
Rock phosphate (rates of application)					
No phosphate	24.5	(2.86)	27.6	9.5	2 354
Rock phosphate (250)	24.1	(3.50)	31.0	10.8	2 739
Rock phosphate (500)	31.5	(3.93)	34.9	15.6	3 195
Rock phosphate (1,000)	28.7	(3.82)	40.0	20.0	3 290
Rock phosphate (2,000)	30.7	(3.84)	44.5	17.3	3 308
Comparison of carriers of phosphorus					
No phosphate	20.8	(2.76)	21.2	7.8	2 127
Rock phosphate (560)	25.2	(3.64)	35.1	7.9	2 843
Bone phosphate (175)	32.7	(3.75)	33.0	9.0	2 996
Superphosphate (280)	32.0	(3.94)	43.1	10.2	3 250
Treble superphosphate (140)	35.4	(3.77)	46.1	10.8	3 270

Note.—This series was laid out in the fall of 1927. It consists of 75 small plots divided into three groups of 25 plots each. Five soil treatments, replicated five times, are studied in each group.

On Plots 1 to 25 inclusive a study is being made of the relative effectiveness of different degrees of fineness of rock phosphate. The original application of the phosphate was at the rate of 1,000 pounds an acre; a subsequent application of 500 pounds an acre was made for the 1930 wheat crop.

On Plots 26 to 50 inclusive a study is being made of the effects of different rates of application of finely ground rock phosphate.

On Plots 51 to 75 a comparison is made of the effects of different carriers of phosphorus when applied in equal money values. All phosphates are applied broadcast immediately after the wheat is drilled.

TABLE 36.—KEWANEE FIELD
Rotation: Corn, oats, clover, wheat

Serial plot No.	Soil treatment	Series 500 Corn	Series 600 Wheat	Series 700 Clover	Series 800 Oats	Average all crops (pounds per acre)
1	RrP	59.7	38.8	(1.49)	71.1	2 731
2	RsP	57.9	37.2	(1.53)	72.8	2 714
3	RLrP	60.0	35.9	(1.73)	71.9	2 820
4	RLsP	58.6	42.1	(1.61)	75.5	2 859

TABLE 37.—KEWANEE FIELD: SPECIAL PHOSPHORUS STUDIED
Rotation: Wheat, red clover

Soil treatment	1928 Oats[1]	1929 Clover	1930 Wheat	1931 Wheat	Average for 4 years (pounds per acre)
Rock phosphate (degree of fineness)					
No phosphate	74.7	(4.01)	34.8	15.4	3 354
Rock phosphate, 99% thru 100-mesh screen	82.1	(4.86)	48.6	24.1	4 177
Rock phosphate, 95% thru 100-mesh screen	76.4	(4.53)	46.8	21.5	3 901
Rock phosphate, 90% thru 100-mesh screen	74.8	(4.85)	50.4	19.8	4 077
Rock phosphate, 65% thru 100-mesh screen	76.4	(4.53)	47.1	21.8	3 910
Rock phosphate (rates of application)					
No phosphate	70.7	(3.62)	32.6	17.3	3 124
Rock phosphate (250)	80.6	(4.24)	39.2	19.8	3 650
Rock phosphate (500)	78.7	(4.54)	45.5	23.1	3 929
Rock phosphate (1,000)	76.5	(4.94)	51.6	24.8	4 228
Rock phosphate (2,000)	76.4	(4.94)	52.0	23.6	4 216
Comparison of phosphorus carriers					
None	71.0	(3.51)	30.7	15.7	3 016
Rock phosphate (560)	78.1	(4.50)	43.0	17.4	3 781
Bone phosphate (175)	77.0	(3.97)	39.5	13.6	3 898
Superphosphate (280)	75.9	(4.15)	44.6	12.9	3 545
Treble superphosphate (140)	81.9	(4.31)	49.0	14.1	3 756

Note.—See note for Table 34.
[1]Oats substituted for wheat.

TABLE 38.—LAMOILLE FIELD
Rotation: Corn, corn, oats, wheat

Serial plot No.	Soil treatment	Series 100 Second-year corn	Series 200 First-year corn	Series 300 Wheat	Series 400 Oats	Average all crops (pounds per acre)
1	0	52.1	57.2	16.0	56.3	2 220
2	M	56.5	56.4	29.2	68.8	2 568
3	ML	51.2	53.3	29.7	65.5	2 432
4	MLrP	53.2	58.1	31.3	66.7	2 562
5	0	48.9	54.4	24.6	63.3	2 321
6	R	53.6	55.9	24.2	65.2	2 418
7	RL	55.4	56.3	25.6	63.8	2 458
8	RLrP	58.3	60.1	27.8	63.4	2 583
9	RLrPK	60.4	60.7	27.7	60.9	2 598
10	0	50.6	49.9	15.4	49.2	1 907

TABLE 39.—LAMOILLE FIELD
Rotation: Corn, barley

Serial plot No.	Soil treatment	1930 Series 900 Corn	1930 Series 1000 Barley	1931 Series 900 Barley	1931 Series 1000 Corn	Average for 2 years (pounds per acre)
1	R	71.3	65.6	52.1	20.9	2 703
2	RL	59.2	65.6	41.7	24.7	2 462
3	RLrP	68.0	68.7	50.0	24.7	2 722
4	RLsP	62.7	65.6	50.0	24.4	2 607
5	RLbP	53.3	70.8	42.7	26.8	2 483
6	RL, KCl	60.5	80.1	47.9	28.1	2 777
7	RL, 0-14-4	52.4	61.4	47.9	22.3	2 358
8	RL, 2-14-4	55.2	66.6	42.7	24.8	2 430
9	RL, treble sP	52.1	72.8	41.7	18.8	2 367
10	R	55.7	60.4	38.5	19.7	2 242
11	RL	60.6	67.6	41.7	24.5	2 503
12	RLrP	52.8	66.6	43.8	22.8	2 383
13	RLsP	52.3	64.5	43.8	19.8	2 309
14	RLbP	57.3	68.7	49.0	24.0	2 550
15	RL, KCl	65.9	63.5	46.9	22.7	2 565
16	RL, 0-14-4	66.2	64.5	50.0	21.1	2 596
17	RL, 2-14-4	66.3	68.7	43.8	21.9	2 585
18	RL, treble sP	66.4	66.6	39.6	20.8	2 495
19	R	64.4	58.3	41.7	23.0	2 424

Note.—These series were plotted in 1928. A rotation of corn and barley (alfalfa-sweet clover catch crop on all plots) is grown. Limestone was applied to all plots excepting Nos. 1, 10, and 19. Fertilizers are applied annually at the following acre-rates: rock phosphate 400 pounds to Plots 3 and 12; superphosphate, 250 pounds to Plots 4 and 13; bonemeal, 200 pounds to Plots 5 and 14; KCl, 100 pounds to Plots 6 and 15; 0-14-4, 250 pounds to Plots 7 and 16; 2-14-4, 250 pounds to Plots 8 and 17; treble superphosphate, 112 pounds to Plots 9 and 18.

(See pages 263 and 264 for Table 40)

TABLE 41.—LEBANON FIELD
Rotation: Corn, oats, wheat

Serial plot No.	Soil treatment[1]	Series 500 Corn	Series 600 Oats	Series 700 Wheat	Average all crops (pounds per acre)
1-W	Le	29.4	46.6	30.8	1 662
1-E	LesP	29.4	49.1	37.3	1 819
2-W	LeM	35.5	58.8	30.3	1 896
2-E	LeMsP	35.1	62.5	40.8	2 139
3-W	LeML	44.0	82.8	39.7	2 498
3-E	LeMLsP	41.4	88.1	42.3	2 559
4-W	LeMLrP	44.2	85.0	41.2	2 555
4-E	LeMLrP	38.7	85.9	44.5	2 529

[1]The manure treatment is residual, having been last applied in1921.

TABLE 40.—LEBANON FIELD
Rotation: Corn, oats, wheat, clover-alfalfa

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Cl.-alf.	Series 300 Wheat	Series 400 Oats	Average all crops (pounds per acre)
	SECTION A					
1	0	54.1	(1.19)	22.7	45.0	2 052
2	M	53.2	(1.47)	23.7	59.4	2 310
3	ML	64.2	(3.09)	28.0	65.0	3 384
4	MLrP	54.1	(3.85)	34.7	51.9	3 618
5	0	42.7	(.99)	27.7	61.3	1 998
6	R	50.7	(.68)	32.7	55.0	1 980
7	RL	62.1	(1.37)	37.7	70.0	2 680
8	RLrP	61.7	(2.10)	38.7	83.1	3 159
9	RLrPK	63.8	(2.53)	38.3	75.0	3 335
10	0	43.1	(2.14)	27.3	44.4	2 439
	SECTION B					
1	rP	43.5	(1.02)	24.0	41.9	1 814
2	M+rP	48.2	(1.62)	44.7	57.5	2 660
3	ML+rP	52.8	(3.25)	38.3	60.0	3 419
4	MLrP+rP	57.1	(3.67)	35.0	63.8	3 670
5	rP	44.0	(1.10)	33.0	45.6	2 026
6	R+rP	45.6	(.61)	36.7	48.8	1 879
7	RL+rP	61.3	(2.27)	40.7	70.6	3 168
8	RLrP+rP	63.4	(1.94)	40.0	72.5	3 038
9	RLrPK+rP	60.0	(2.70)	41.0	68.8	3 355
10	rP	33.8	(2.23)	38.3	46.3	2 533
	SECTION C					
1	sP	36.8	(1.46)	27.7	38.1	1 965
2	M+sP	41.4	(1.60)	32.3	55.0	2 304
3	ML+sP	53.2	(3.69)	34.7	53.8	3 540
4	MLrP+sP	55.8	(3.93)	38.0	62.5	3 816
5	sP	38.9	(1.19)	28.3	49.4	1 960
6	R+sP	46.9	(.74)	39.0	50.0	2 011
7	RL+sP	50.7	(2.75)	42.7	76.9	3 340
8	RLrP+sP	56.6	(2.23)	45.0	79.4	3 218
9	RLrPK+sP	57.1	(3.15)	31.0	81.3	3 490
10	sP	27.5	(2.23)	43.0	55.0	2 585

TABLE 40.—*Concluded*

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Cl.-alf.	Series 300 Wheat	Series 400 Oats	Average all crops (pounds per acre)
		SECTION D				
1	5-15-5	25.4	(1.18)	32.7	41.3	1 766
2	M+5-15-5	31.7	(1.64)	37.3	55.6	2 269
3	ML+5-15-5	38.0	(3.36)	43.0	56.3	3 307
4	MLrP+5-15-5	46.1	(3.54)	35.7	59.4	3 426
5	5-15-5	30.0	(1.11)	37.0	51.9	1 945
6	R+5-15-5	35.9	(.56)	40.7	50.0	1 792
7	RL+5-15-5	53.2	(2.23)	45.3	71.9	3 115
8	RLrP+5-15-5	51.6	(1.81)	45.0	73.8	2 892
9	RLrPK+5-15-5	57.1	(2.80)	48.0	71.3	3 490
10	5-15-5	40.1	(2.87)	47.0	61.3	3 191

Note.—For the purpose of studying the relative values of finely processed rock phosphate, superphosphate, and mixed fertilizers when used in addition to different basal soil treatments which have been common to all sections since 1912, these series of plots in 1929 were divided into four sections extending across all plots.

Section A receives the basal treatment only.

Section B receives the basal treatment plus finely processed rock phosphate, 500 pounds per acre for wheat and 250 pounds for corn.

Section C receives the basal treatment plus superphosphate, 200 pounds per acre for wheat and 150 pounds for corn.

Section D receives the basal treatment plus a mixed fertilizer: namely, 250 pounds of 5-15-5 per acre for wheat and 150 pounds for corn.

TABLE 42.—LEBANON FIELD
Rotation: Wheat, potatoes

Serial plot No.	Soil treatment	Series 800 Potatoes	Series 900 Wheat	Average all crops (pounds per acre)
1	LeM	33.7	41.0	2 240
2	LesP	57.7	45.0	3 080
3	LerP	54.7	45.3	3 000
4	LesPK	43.0	43.0	2 580
5	LerPK	24.0	39.0	1 890
6	Le, straw	78.7	35.7	3 430
7	LesP, straw	100.0	38.0	4 130
8	LerP, straw	113.7	34.0	4 430
9	Le, treble superphosphate	71.0	44.3	3 460
10	Le, potassium phosphate	93.3	41.7	4 050

Note.—In 1925 Series 800 and 900 were laid out on land which had received 8,000 pounds of limestone, 2,000 pounds of rock phosphate, and 15 tons of manure an acre in 1911. The land grew alfalfa almost continuously from 1911 to 1925. A rotation of wheat (sweet-clover catch crop) and potatoes is followed. Fertilizers are applied as indicated above. The phosphates are applied annually: rock phosphate 400 pounds, superphosphate 200 pounds, treble superphosphate 100 pounds, and potassium phosphate 200 pounds an acre. Kainit, 200 pounds an acre, is applied for each potato crop. Two tons of manure an acre is applied for potatoes. Straw is applied as a mulch when the potatoes are coming thru the ground.

TABLE 43.—McNABB FIELD
Rotation: Corn, oats, wheat, clover

Serial plot No.	Soil treatment	Series 100 Clover	Series 200 Wheat	Series 300 Oats	Series 400 Corn	Average all crops (pounds per acre)
1	R	(1.40)	40.2	59.6	64.7	2 685
2	RrP	(2.06)	43.0	58.8	68.7	3 105
3	0	(3.11)	36.8	59.6	69.8	3 561
4	MrP	(3.13)	40.7	46.2	64.2	3 443
5	M	(3.16)	41.0	52.1	68.0	3 564

TABLE 44.—MINONK FIELD
Rotation: Corn, corn, oats, wheat

Serial plot No.	Soil treatment[1]	Series 100 Second-year corn	Series 200 First-year corn	Series 300 Wheat	Series 400		Average all crops (pounds per acre)
					Oats	Stubble hay (Hubam)	
			NORTH HALF				
1	N	65.2	50.3	25.0	64.7	(0)	2 510
2	MN	66.0	54.0	29.0	74.7	(0)	2 710
3	MLN	67.8	58.8	27.2	67.2	(.59)	3 010
4	MLrPN	66.8	56.0	27.8	70.3	(.87)	3 132
5	N	59.7	48.6	26.5	67.2	....	2 451
6	RN	66.4	53.2	27.8	64.1	....	2 604
7	RLN	70.4	51.0	22.8	65.3	....	2 564
8	RLrPN	64.8	50.3	24.7	66.3	....	2 511
9	RLrPKN	59.7	51.7	26.8	64.1	....	2 474
10	N	55.3	49.4	24.8	60.0	....	2 318
			SOUTH HALF				
1	0	57.3	53.4	25.0	59.1	(0)	2 397
2	M	60.4	55.2	29.8	69.1	(0)	2 618
3	ML	64.8	60.7	27.5	66.9	(.64)	3 024
4	MLrP	66.4	57.0	30.5	68.1	(.92)	3 440
5	0	55.7	53.9	24.5	58.4	....	2 369
6	R	65.4	55.1	27.8	67.2	....	2 642
7	RL	57.6	56.7	24.2	65.6	....	2 488
8	RLrP	57.0	53.9	22.7	60.0	....	2 372
9	RLrPK	59.2	51.7	27.7	62.2	....	2 465
10	0	49.5	52.2	25.2	59.4	....	2 276

[1]Sodium nitrate was hill-dropped with the first-year corn on the north halves of all plots at the rate of 80 pounds an acre. On June 13 the corn received a side dressing of ammonium sulfate at the rate of 120 pounds an acre. Sodium nitrate at the rate of 200 pounds an acre was applied as a top dressing for the wheat to the north halves of all plots, half the nitrate being applied on April 14 and half on May 11.

TABLE 45.—MT. MORRIS FIELD
Rotation: Corn, oats, clover, wheat

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Wheat	Series 300 Clover	Series 400 Oats	Average all crops (pounds per acre)
1	0	51.4	18.7	(2.35)	50.8	2 582
2	M	52.1	20.9	(2.52)	59.1	2 778
3	ML	72.8	20.7	(2.42)	61.3	3 029
4	MLrP	72.8	21.6	(2.34)	65.6	3 037
5	0	50.4	17.1	(2.14)	41.4	2 362
6	R	54.9	19.5	(1.61)	41.6	2 200
7	RL	60.5	19.7	(1.64)	54.2	2 397
8	RLrP	61.1	21.8	(1.58)	48.1	2 359
9	RLrPK	62.2	22.4	(1.92)	53.0	2 591
10-W	Cornstalks	43.9	21.2	(1.88)	51.3	2 282
10-E	0	45.4	21.7	(2.11)	43.8	2 368

(See opposite page for Table 46)

TABLE 47.—MT. MORRIS FIELD
Rotation: Corn, oats, wheat, hay

Soil treatment	Series 900 Wheat	Series 1000 Oats	Series 1100 Corn	Series 1200 Hay	Average all crops (pounds per acre)
L, timothy	22.0	61.7	52.0	(.73)	1 915
LrP, timothy	24.6	55.1	63.8	(1.13)	2 268
L, red clover	21.5	53.4	74.1	(1.70)	2 639
LrP, red clover	23.2	56.2	64.0	(2.13)	2 757
L, alfalfa	20.6	56.4	70.0	(0)	1 739
LrP, alfalfa	21.8	56.8	68.1	(0)	1 732
L, soybeans	21.5	59.4	67.8	(2.33)	2 912
LrP, soybeans	24.7	59.5	69.7	(2.64)	3 144

Note.—These series were laid out for the purpose of studying the relative influence of different forage crops on subsequent grain yields in a four-year rotation of corn, oats, wheat, and hay grown on limed and limed-phosphated land. All plots have received 2 tons of limestone an acre. Rock phosphate is applied at the rate of 400 pounds per acre for corn and 400 pounds for wheat. Four different forage crops (timothy, red clover, alfalfa, and soybeans) are grown in duplicate in both systems of soil treatment. The forage crops are removed as hay.

TABLE 46.—MT. MORRIS FIELD
Rotation: Corn, barley, clover-alfalfa, alfalfa

Serial plot No.	Soil treatment[1]	Series 500 Barley	Series 600 Alfalfa	Series 700 Corn	Series 800 Cl.-alf.	Average all crops (pounds per acre)
1	0	35.4	(2.57)	59.5	(2.90)	3 988
2	M	38.7	(3.32)	58.4	(3.17)	4 525
3	ML	44.8	(3.74)	64.8	(4.46)	5 547
4	MLrP	43.5	(4.22)	55.4	(4.26)	5 536

[1]Treatments residual since 1921.

TABLE 48.—NEWTON FIELD
Rotation: Corn, oats, wheat, mixed hay

Serial plot No.	Soil treatment	Series 100 Mixed hay	Series 200 Wheat	Series 300 Oats	Series 400 Corn	Average all crops (pounds per acre)
1	0	(.23)	.2	21.9	19.9	571
2	M	(.38)	3.5	43.1	43.3	1 191
3	ML	(.72)	34.8	62.5	54.7	2 151
4	MLrP	(1.02)	47.8	66.6	50.9	2 475
5	0	(.21)	.3	16.9	17.5	490
6	R	(.46)	.5	18.8	18.2	527
7	RL	(.68)	17.2	40.9	31.1	1 358
8	RLrP	(.70)	35.5	44.7	31.9	1 686
9	RLrPK	(1.02)	44.8	61.6	38.9	2 222
10-N	Cornstalks	(.31)	1.0	23.1	21.6	657
10-S	0	(.29)	.3	16.3	17.3	522

(See page 268 for Table 49)

TABLE 50.—NEWTON FIELD
Rotation: Wheat, soybeans, redtop

Serial plot No.	Soil treatment	Series 1100-N Soybeans	Series 1100-S Redtop[1]	Series 1200 Wheat	Average all crops (pounds per acre)
1	LeLrP	(1.75)	....	32.7	1 820
2	LeL	(.87)	....	26.0	1 100
3	LeLrP	(.71)	....	30.0	1 073
4	LeL	(.84)	....	26.7	1 093
5	LeLrP	(.79)	....	30.5	1 137

Note.—Prior to 1923 these series were used in plant-breeding projects and all plots had received uniform soil treatment. From 1923 to 1926 wheat, soybeans, and timothy were grown. In 1927 the rotation was changed to wheat (sweet clover), soybeans, and redtop, the redtop to occupy a given series for three years while wheat and soybeans are grown alternately on the other two series. The plan of fertilization is as follows: Limestone in sufficient amounts to grow sweet clover. Rock phosphate: Plot 1 received an application sufficient to bring the phosphorus content of the surface soil up to 2,000 pounds per acre by analysis. Plot 3 receives phosphate at the annual acre-rate of 200 pounds (400 pounds applied for wheat and 600 pounds for redtop). Plot 5 receives phosphate at the annual acre-rate of 400 pounds (800 pounds for wheat and 1,200 pounds for redtop).

[1]Redtop failed to make a crop; growth was clipped but not removed from plots.

TABLE 49.—NEWTON FIELD
Rotation: Corn, wheat, sweet clover-redtop mixture

Serial plot No.	Soil treatment	Limestone fineness (meshes per inch)	High-calcium lime				Dolomitic lime			
			Series 500 Corn	Series 700 Sw. cl.[1]	Series 900 Wheat	Average all crops (pounds per acre)	Series 600 Corn	Series 800 Sw. cl.[1]	Series 1000 Wheat	Average all crops (pounds per acre)
1	RrPK		42.7	0	21.2	1 220	43.7	0	21.3	1 242
2	RrPKL	4 down	53.2	.50	36.7	1 736	52.6	.32	38.5	1 758
3	RrPKL	4 to 10	49.0	.77	35.5	1 640	55.1	.12	39.2	1 814
4	RrPKL	10 down	47.3	.37	36.0	1 610	36.1	.12	36.7	1 410
5	RrPKL	50 down	44.0	.33	37.2	1 571	25.4	.23	40.2	1 282
6	RrPKL	Burnt	37.8	.30	34.7	1 405	31.5	.25	38.7	1 366
7	RrPK		38.5	0	22.7	1 172	30.4	0	21.8	1 004
8	RrPKL	4 down	39.9	.37	41.8	1 589	31.5	.30	40.0	1 394
9	RrPKL	4 to 10	43.7	.22	40.0	1 620	31.3	.22	40.2	1 392
10	RrPKL	10 down	42.9	.26	43.0	1 666	29.4	.20	42.2	1 396
11	RrPKL	50 down	41.0	.25	44.5	1 660	32.3	.33	43.3	1 476
12	RrPKL	Burnt	42.9	.29	43.8	1 683	29.8	.47	41.8	1 402
13	RrPK		39.5	0	20.3	1 144	30.6	0	21.2	994
14	RrPKL	4 down	51.3	.25	39.8	1 759	37.2	.22	43.2	1 542
15	RrPKL	4 to 10	48.6	.22	41.5	1 742	39.7	.16	38.7	1 518
16	RrPKL	10 down	46.5	.27	44.3	1 760	33.0	.21	43.5	1 490
17	RrPKL	50 down	46.1	.22	40.7	1 678	35.7	.16	41.8	1 506
18	RrPKL	Burnt	48.8	.55	38.7	1 695	43.7	.25	41.5	1 651
19	RrPK		39.7	0	18.8	1 118	42.5	0	18.7	1 167

Note.—Lime materials have been applied in amounts equivalent to pure calcium carbonate as follows: to Plots 2 to 6, 500 pounds an acre a year; to Plots 8 to 12, 1,000 pounds; to Plots 14 to 18, 2,000 pounds. The total amounts applied since 1913 are 3 tons, 6 tons, and 12 tons respectively. No more will be applied until there appears to be need for it.

[1]Sweet clover and redtop were seeded but only the sweet clover survived.

TABLE 51.—OBLONG FIELD
Rotation: Corn, oats, mixed hay, wheat

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Wheat	Series 300 Mixed hay	Series 400 Oats	Average all crops (pounds per acre)
	SOUTH HALF					
1	0	23.9	13.2	(0)	27.2	750
2	M	45.4	18.7	(0)	48.1	1 300
3	ML	53.9	34.2	(1.26)	68.1	2 404
4	MLrP	33.4	43.3	(1.37)	65.9	2 265
5	0	16.9	6.8	(0)	34.4	614
6	R	21.3	9.7	(0)	40.3	766
7	RL	26.2	23.8	(.49)	73.4	1 554
8	RLrP	28.7	37.8	(.48)	60.9	1 697
9	RLrPK	39.5	45.3	(1.37)	64.4	2 433
10	0	17.7	13.2	(.08)	47.2	860
	NORTH HALF					
1	RLsP	16.9	43.5	(0)	43.8	1 239
2	MLrP	38.5	43.2	(.50)	54.4	1 869
3	MLbP	45.2	44.2	(1.78)	52.5	2 603
4	MLrP	38.7	46.3	(1.61)	65.0	2 564
5	Rl, under-acidulated P	14.6	36.7	(.70)	53.1	1 530
6	RLrP	16.7	34.5	(.13)	49.1	1 211
7	RLbP	25.4	39.0	(.50)	56.6	1 643
8	RLrP	31.1	38.7	(.40)	62.2	1 713
9	RLrPK	41.6	45.5	(1.23)	65.9	2 408
10	RL, potassium P	38.2	37.2	(.67)	64.7	1 942

(See page 270 for Table 52)

TABLE 53.—ODIN FIELD
Rotation: Corn, soybeans, wheat, sweet clover-redtop

Serial plot No.	Soil treatment[1]	Series 100 Corn	Series 200 Wheat	Series 300 Soybeans	Series 400 Redtop seed	Average all crops (pounds per acre)
1	0	19.7	19.6	10.6	4.64	744
2	R	21.5	20.1	11.6	5.50	795
3	RL	19.3	37.2	13.9	6.93	1 061
4	RLbP	17.4	49.1	12.8	6.75	1 194
5	RLbPK	37.0	44.9	26.8	8.50	1 637
6	0	14.8	13.2	7.2	3.86	527
7	R	16.6	18.4	7.6	7.32	648
8	RL	20.8	39.7	10.4	4.18	1 057
9	RLbP	18.7	48.2	11.4	7.43	1 181
10	RLbPK	37.7	44.8	25.0	3.03	1 584

[1]Potassium applied as potassium sulfate.

TABLE 52.—OBLONG FIELD
Rotation: Corn, oats, wheat

Serial plot No.	Soil treatment	Series 700 Wheat	Series 800 Oats	Series 1000 Corn	Average all crops (pounds per acre)
1	White biennial sweet clover	50.0	38.8	39.3	2 147
2	Red clover	54.0	48.8	40.1	2 349
3	Alsike clover	54.3	51.9	46.1	2 501
4	No clover	51.7	47.5	47.8	2 430
5	White biennial sweet clover	43.0	47.5	31.7	1 958
6	Red clover	61.3	48.8	35.5	2 409
7	Alsike clover	54.3	41.3	38.0	2 236
8	No clover	51.3	40.0	36.3	2 131

Note.—From 1912 to 1920, Series 700, 800, 900, and 1000 were operated as single plots and grew a rotation of potatoes, corn, soybeans, and alfalfa with regular applications of manure, limestone, rock phosphate, and kainit. In 1921 the rotation was changed to corn, oats, legumes, and wheat. Since that time no fertilizing materials have been used except sweet clover as a green-manure crop.

In 1926 the series were divided into 8 plots each, and until 1931 a rotation of corn, oats, wheat, and legumes was grown. Legumes were seeded as indicated in the above table, and occupied the ground as a regular crop. Where practical, the sweet clover was removed as a hay crop in the fall of the first year and clipped or harvested as seed during the second year. Only one crop of red and alsike clover was removed, the fall growth being plowed down. The volunteer vegetation on Plots 4 and 8 was plowed under.

In 1931 Series 900, being very poorly drained and lacking in uniformity, was dropped from the experiment and a rotation of corn, oats, and wheat will be grown with the legumes seeded as before, and the growth on all plots plowed down as green manure.

TABLE 54.—ODIN FIELD
Rotation: Corn, wheat

Serial plot No.	Soil treatment	Light lime			Heavy lime		
		Series 500 Wheat	Series 600 Corn	Average all crops (pounds per acre)	Series 700 Wheat	Series 800 Corn	Average all crops (pounds per acre)
1	LeLKbP	50.5	29.2	2 332	49.3	30.2	2 326
2	LeLK	27.5	27.5	1 595	42.5	29.8	2 110
3	LeLKsP	46.7	24.5	2 086	47.7	33.2	2 360
4	LeLKrP	50.5	17.5	2 005	49.2	30.0	2 315
5	LeLK	27.3	16.3	1 277	29.7	27.5	1 660
6	LeLK, slag P	46.3	15.8	1 832	46.5	16.3	1 851

TABLE 55.—ODIN FIELD
Sweet-clover rotation studies

Rotation	Soil treatment	Corn	Soy-beans	Wheat	Sweet clover	Average all crops (pounds per acre)
Three-year rotation[1]	RLbP.....	28.9	15.2	50.0	....	1 843
Four-year rotation[2]	RLbP.....	46.5	11.2	53.6	3.89	1 681

[1]Corn, soybeans, wheat (sweet-clover catch crop).
[2]Corn, soybeans, wheat, sweet clover.

TABLE 56.—OQUAWKA FIELD
Rotation: Corn, soybeans, rye, clover-alfalfa, wheat, alfalfa

Serial plot No.	Soil treatment	Series 100 Soy-beans	Series 200 Corn	Series 300 Alfalfa	Series 400 Wheat	Series 500 Cow-peas[1]	Series 600 Rye	Series 600 Stubble clover	Average all crops (pounds per acre)
1	0.....	6.0	12.5	(0)	13.1	(1.11)	10.8	(0)	882
2	M.....	9.5	13.9	(0)	16.2	(1.58)	15.7	(0)	1 198
3	ML.....	16.2	15.3	(3.29)	25.9	(1.43)	20.3	(1.70)	3 132
4	MLrP.....	17.0	15.0	(3.41)	28.4	(1.50)	19.0	(1.70)	3 237
5	0.....	9.3	13.7	(0)	11.3	(1.26)	8.5	(0)	834
6	R.....	9.7	11.6	(0)	12.4	(1.46)	11.6	(0)	924
7	RL.....	19.5	8.9	(2.94)	22.8	(1.53)	15.6	(0)	2 143
8	RLrP.....	16.5	9.5	(2.69)	20.4	(1.55)	13.0	(0)	1 994
9	RLrPK.....	18.3	6.8	(3.18)	18.8	(1.57)	12.1	(1.30)	2 563
10-W	Cornstalks...	8.0	18.8	(0)	10.7	(1.33)	9.8	(0)	1 022
10-E	0.....	8.0	20.0	(0)	11.3	(1.28)	7.5	(0)	1 000

[1]Cowpeas grown as a substitute for clover-alfalfa.

TABLE 57.—PALESTINE FIELD
Rotation: Corn, oats, clover-alfalfa, wheat, alfalfa

Serial plot No.	Soil treatment	Series 100 Alfalfa	Series 200 Corn	Series 300 Wheat	Series 400 Cl.-alf.	Series 500 Oats	Average all crops (pounds per acre)
1	LeL.....	(2.49)	43.3	42.3	(1.96)	51.6	3 099
2	LeLM.....	(2.93)	44.6	45.5	(2.08)	48.4	3 360
3	LeLMsP.....	(2.75)	43.5	40.5	(1.93)	55.3	3 199
4	LeLMrP.....	(2.94)	44.8	47.5	(1.97)	55.0	3 386
5	LeL.....	(3.08)	44.4	41.5	(2.04)	46.9	3 343
6	LeL, KCl.....	(2.97)	43.1	28.8	(2.25)	45.9	3 211
7	LeLsP, KCl....	(3.43)	46.5	47.5	(2.27)	56.3	3 733
8	LeLrP, KCl....	(2.84)	44.4	43.2	(1.70)	66.6	3 257
9	LeLrP, kainit...	(3.39)	38.7	41.3	(1.86)	58.8	3 405
10	0.....	(1.49)	27.5	31.8	(.83)	48.8	1 930

TABLE 58.—PALESTINE FIELD
Rotation: Corn, wheat, alfalfa

Serial plot No.	Soil treatment	Series 600 Wheat	Series 700 Alfalfa	Series 800 Corn	Average all crops (pounds per acre)
1	LeLsP	41.6	(3.94)	7.6	3 599
2	LeLrP	43.7	(3.54)	11.6	3 449
3	LeL	36.3	(3.74)	14.9	3 499
4	LeL, flowers of sulfur	43.2	(3.30)	11.6	3 278
5	LeLrP, flowers of sulfur	37.9	(3.52)	14.2	3 369
6	LeL	41.1	(3.47)	10.3	3 328
7	LeL, gypsum	36.3	(3.49)	13.2	3 297
8	LeLrP, gypsum	41.6	(3.41)	13.2	3 372

(See opposite page for Table 59)

TABLE 60.—RALEIGH FIELD
Rotation: Corn, oats, mixed hay, wheat

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Wheat	Series 300 Mixed hay	Series 400 Oats	Average all crops (pounds per acre)
			WEST HALF			
1	0	6.3	7.2	(0)	23.4	383
2	M	25.4	12.5	(0)	42.5	883
3	ML	35.1	35.8	(1.73)	72.2	2 471
4	MLrP	35.5	40.5	(1.68)	84.4	2 619
5	0	13.5	7.3	(0)	26.9	514
6	R	16.5	9.2	(0)	24.4	563
7	RL	23.7	18.7	(.37)	52.8	1 217
8	RLrP	22.4	30.3	(.58)	74.1	1 651
9	RLrPK	24.9	42.3	(1.39)	75.3	2 281
10	0	7.6	8.3	(0)	32.5	491
			EAST HALF			
1	RL	9.1	20.8	(.31)	54.7	1 035
2	MrP	17.7	27.3	(0)	63.1	1 163
3	MLbP	27.5	44.3	(2.29)	62.2	2 690
4	MLrP	24.7	43.7	(2.18)	52.2	2 506
5	RsP	11.0	18.3	(0)	49.4	824
6	RrP	13.3	22.3	(0)	56.9	976
7	RLsP	18.6	39.2	(.69)	53.1	1 618
8	RLrP	14.8	40.5	(1.24)	80.6	2 080
9	RLrPK, gypsum	17.5	45.7	(1.28)	69.7	2 125
10	RLrP	11.2	17.8	(.85)	71.2	1 419

TABLE 59.—PALESTINE FIELD
Corn-vetch experiment

Plot No.	Soil treatment	Corn	Plot No.	Soil treatment	Corn
901	Le	18.5	905	LerP (400)	21.2
902	LesP (100)	24.3	906	LeL	29.1
903	LerP (200)	24.1	907	LeLsP (100)	29.5
904	LesP (200)	20.6	908	LeLrP (200)	26.8

Note.—This experiment was planned to study effects of vetch green manure on the following corn crop. Temporarily a single-crop system is planned. Corn with a catch crop of hairy vetch is grown. The vetch is seeded in the corn late in August and the growth plowed under the following spring.

An initial application of 6,000 pounds of limestone an acre was made to Plots 6, 7, 8. The figures in parentheses represent annual acre-applications of phosphates.

TABLE 61.—SPARTA FIELD
Rotation: Corn, soybeans, oats, wheat

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Wheat	Series 300 Oats	Series 400 Soybeans	Average all crops (pounds per acre)
	SECTION A					
1	0	10.1	13.7	11.9	3.1	541
2	M	17.9	18.7	17.5	2.6	790
3	ML	27.9	37.3	52.5	5.7	1 560
4	MLrP	28.2	40.7	47.5	7.7	1 630
5	0	12.8	8.0	3.1	3.4	375
6	R	14.4	10.3	10.6	3.2	490
7	RL	21.2	38.7	36.3	8.1	1 288
8	RLrP	20.1	39.3	35.6	9.4	1 298
9	RLrPK	27.8	29.0	53.8	7.9	1 373
10	0	8.5	13.0	16.3	4.1	505
	SECTION B					
1	sP, KCl	14.2	21.0	48.1	3.7	1 079
2	M, KCl	18.8	20.7	50.0	3.1	1 181
3	ML, KCl	33.8	44.7	58.1	6.1	1 803
4	MLrP, KCl	32.0	46.0	36.2	8.7	1 708
5	KCl	15.8	7.0	10.0	4.6	475
6	R, KCl	16.9	13.0	15.6	3.7	612
7	RL, KCl	32.1	35.3	40.0	10.1	1 450
8	RLrP, KCl	30.3	45.3	41.9	11.1	1 605
9	RLrPK, KCl	31.0	41.3	46.9	8.6	1 558
10	sP, $NaNO_3$, KCl	32.7	20.7	18.1	4.1	974

Note.—In 1929 each series was divided into two equal longitudinal sections designated as Section A and Section B respectively. The plots in *Section A* will continue under original plan of fertilization. In *Section B* additional fertilization is as follows: potassium chlorid to all plots, 150 pounds an acre drilled with wheat and 50 pounds hill-dropped for corn; superphosphate (20%) to Plots 1 and 10, 250 pounds an acre drilled for wheat and 125 pounds hill-dropped for corn; sodium nitrate to Plot 10, at the acre-rate of 100 pounds in the spring as a top dressing for wheat and 100 pounds as a side dressing for corn at time of second cultivation.

TABLE 62.—SPARTA FIELD
Rotation: Corn, cowpeas, timothy-vetch, wheat

Serial plot No.	Soil treatment[1]	Series 500 Wheat	Series 600 Corn	Series 700 Cowpeas	Series 800 South Timothy	Series 800 North Timothy-vetch	Average all crops (pounds per acre)
1	Le	24.8	20.7	(.71)	(.03)	(.21)	1 077
2	LeM	27.7	20.7	(1.09)	(.05)	(.21)	1 315
3	LeML	31.3	27.5	(1.17)	(.24)	(.53)	1 630
4	LeMLrP	43.3	24.1	(1.10)	(.49)	(.83)	1 868
5	LeMLrPK	42.2	19.0	(1.23)	(.56)	(1.00)	1 903
6	Le	36.0	9.3	(.33)	(.21)	(.47)	1 008

[1]Manure residual since 1927.

TABLE 63.—SPARTA FIELD
Nitrate studies

Soil treatment	Plot E Corn	Plot F Wheat	Average all crops (pounds per acre)
LeL, $NaNO_3$	23.4	38.8	3 638
LeL	24.1	36.9	3 564

TABLE 64.—SPRINGVALLEY FIELD
Rotation: Corn, oats, clover, wheat

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Wheat	Series 300 Clover	Series 400 Oats	Average all crops (pounds per acre)
1	0	23.9	32.5	(.32)	40.9	1 310
2	M	49.7	42.3	(1.41)	50.3	2 441
3	ML	60.0	41.2	(2.18)	75.3	3 148
4	MLrP	55.4	42.0	(2.10)	66.3	2 988
5	0	35.7	41.0	(1.61)	44.1	2 275
6	R	41.6	37.7	(1.23)	58.8	2 232
7	RL	30.2	42.0	(.77)	54.4	1 870
8	RLrP	28.3	41.5	(.11)	50.3	1 476
9	RLrPK	44.0	41.0	(.73)	57.8	2 059
10	0	38.0	34.2	(.36)	48.4	1 610

TABLE 65.—SPRINGVALLEY FIELD
Rotation: Corn, corn, oats, alfalfa

Serial plot No.	Soil treatment[1]	Series 500 Alfalfa	Series 600 Oats	Series 700 First-year corn	Series 800 Second-year corn	Average all crops (pounds per acre)
1	0	(4.32)	58.8	51.6	45.0	3 982
2	M	(4.56)	59.7	37.4	54.1	4 036
3	ML	(4.43)	55.6	38.7	53.9	3 959
4	MLrP	(4.71)	59.4	37.8	53.9	4 116

[1]Treatments residual since 1922.

TABLE 66.—TOLEDO FIELD
Rotation: Corn, oats, mixed hay, wheat

Serial plot No.	Soil treatment[1]	Series 100 Corn	Series 200 Wheat	Series[2] 300 Mixed hay	Series 400 Oats	Average all crops (pounds per acre)
	SECTION A					
1	RL, KCl	62.1	45.7	(.21)	35.6	1 942
2	LeMrP, KCl	64.2	47.0	(0)	43.1	1 949
3	LeMLbP, KCl	76.5	49.7	(1.07)	51.3	2 761
4	LeMLrP, KCl	71.4	55.0	(1.00)	51.9	2 740
5	RsP, KCl	41.8	31.3	(.22)	34.4	1 430
6	RrP, KCl	46.1	35.3	(.23)	28.1	1 516
7	RLsP, KCl	47.8	51.0	(.61)	28.1	1 964
8	RLrP, KCl	46.1	51.7	(1.00)	39.4	2 240
9	RLrPK, gypsum, KCl	55.8	46.0	(1.31)	45.0	2 486
10	RLrP, KCl	30.0	42.3	(.30)	43.8	1 555
	SECTION B					
1	RL	49.0	32.7	(0)	28.1	1 453
2	LeMrP	60.4	40.3	(0)	48.8	1 840
3	LeMLbP	71.8	39.0	(1.08)	41.3	2 458
4	LeMLrP	70.2	47.3	(.98)	44.4	2 543
5	RsP	27.5	27.3	(.12)	17.5	1 020
6	RrP	27.5	31.3	(.15)	13.8	1 060
7	RLsP	16.1	45.7	(.68)	21.3	1 403
8	RLrP	15.2	46.3	(1.05)	39.4	1 735
9	RLrPK, gypsum	56.6	54.7	(1.10)	46.9	2 590
10	RLrP	15.6	36.7	(.29)	35.6	1 201

TABLE 66.—*Concluded*

Serial plot No.	Soil treatment[1]	Series 100 Corn	Series 200 Wheat	Series[2] 300 Mixed hay	Series 400 Oats	Average all crops (pounds per acre)
			SECTION C			
1	Le	39.3	24.7	(0)	21.3	1 090
2	LeM	52.0	25.3	(0)	34.4	1 383
3	LeML	58.7	36.7	(.88)	56.9	2 234
4	LeMLrP	63.0	46.3	(.80)	46.3	2 372
5	0	15.6	14.0	(0)	14.4	543
6	R	21.1	19.0	(0)	16.3	710
7	RL	20.3	30.3	(.79)	20.0	1 252
8	RLrP	18.6	40.3	(.90)	40.0	1 555
9	RLrPK	61.3	54.7	(.88)	55.0	2 556
10	0	19.4	19.3	(0)	25.6	766
			SECTION D			
1	R, KCl	54.1	19.3	(0)	26.3	1 258
2	LeM, KCl	58.3	28.7	(0)	36.3	1 536
3	LeML, KCl	72.3	37.3	(.75)	47.5	2 327
4	LeMLrP, KCl	69.3	58.0	(.90)	60.6	2 775
5	RL, 5-15-5	32.1	26.0	(0)	32.5	1 100
6	R, straw	34.2	28.7	(0)	13.8	1 019
7	RL, straw	39.7	39.3	(.62)	23.8	1 646
8	RLrP, straw	35.9	42.7	(.58)	33.1	1 682
9	RLrPK, straw	64.7	53.3	(.87)	39.4	2 316
10	RL	15.6	22.7	(0)	37.5	863

Note.—In order to make more detailed studies of the response of this soil type to different methods of fertilization, each series, in 1930, was divided into four equal strips extending east and west across all plots. Beginning at the north these strips will be designated as Sections A, B, C, and D respectively.

Section A of all plots receives the basal treatment (original north half) plus KCl, 100 pounds per acre broadcast ahead of wheat and corn.

Section B continues under basal treatment (original north half).

Section C continues under basal treatment (original south half).

Section D receives basal treatment (original south half) with additional fertilization as follows: crop residues to Plots 1, 5 and 10; wheat and oats straw returned to Plots 6, 7, 8 and 9; limestone (as needed to grow clovers) to Plots 5 and 10; KCl to Plots 1, 2, 3 and 4, 100 pounds per acre broadcast ahead of wheat and corn.

[1]The application of gypsum was discontinued in 1931.

[2]Sections 300A and 300D received the basal treatments only.

TABLE 67.—UNIONVILLE FIELD
Rotation: Corn, soybeans, oats, wheat

Serial plot No.	Soil treatment	Series 100 Corn	Series 200 Wheat	Series 300 Oats	Series 300 Stubble clover	Series 400 Soybeans	Average all crops (pounds per acre)
			WEST HALF				
1	0	18.6	14.7	22.2	(0)	5.7	1 064
2	M	33.4	20.3	23.4	(0)	6.3	1 685
3	ML	48.0	31.3	49.4	(.14)	10.7	2 394
4	MLrP	47.8	33.3	52.8	(.22)	11.3	2 827
5	0	18.2	17.2	15.3	....	3.8	692
6	R	19.9	16.8	12.2	....	3.3	679
7	RL	42.7	25.5	32.8	....	6.7	1 343
8	RLrP	40.6	30.7	36.3	....	6.8	1 421
9	RLrPK	53.9	31.7	52.5	....	6.7	1 750
10	0	20.5	10.3	17.8	....	1.7	1 094
			EAST HALF				
1	L	21.3	18.8	27.8	(0)	7.5	1 483
2	MLrP	30.0	24.3	38.4	(0)	11.0	2 132
3	ML, KCl	36.3	34.2	41.9	(.17)	15.4	2 638
4	MLrP, KCl	37.8	35.8	47.8	(.20)	16.3	3 257
5	LsP	15.0	24.0	31.3	....	8.3	945
6	L, $NaNO_3$	23.5	25.0	28.4	....	8.3	1 057
7	RLsP, KCl	45.9	27.2	45.9	....	11.5	1 590
8	RLrP, KCl	46.5	26.2	46.6	....	9.8	1 563
9	RLrP, kainit	48.6	30.5	48.8	....	9.3	1 668
10	LsP, $NaNO_3$	34.0	33.5	38.4	....	4.8	1 939

TABLE 68.—UNIONVILLE FIELD
Rotation: Wheat, cowpeas, timothy

Serial plot No.	Soil treatment[1]	Series 500 Timothy	Series 700 Wheat	Series 800 Cowpeas Seed	Series 800 Cowpeas Hay	Average all crops (pounds per acre)
1	0	(.19)	11.4	4.5	(.61)	762
2	MLrP	(2.01)	42.2	11.0	(2.00)	3 678
3	RLrP	(1.86)	31.2	10.2	(1.62)	2 943
4	RLrP, kainit	(1.94)	36.6	11.0	(1.92)	3 308
5	RLrP, shale	(1.58)	36.4	10.0	(1.38)	2 698
6	RLrP, common salt	(1.54)	37.1	10.9	(1.70)	2 900
7	RLrP, Omaha K	(1.70)	32.2	12.2	(1.78)	2 960
8	0	(.40)	17.2	5.4	(.76)	1 118

[1]Manure residual since 1927.

TABLE 69.—UNIONVILLE FIELD: SERIES 600
Rotation: Continuous alfalfa

Plot No.	Soil treatment[1]	Alfalfa	Plot No.	Soil treatment	Alfalfa
1	0	(0)	5	RLrP, shale	(1.65)
2	MLrP	(1.62)	6	RLrP, common salt	(2.05)
3	RLrP	(1.25)	7	RLrP, Omaha K	(1.85)
4	RLrP, kainit	(1.97)	8	0	(0)

[1]Manure residual since 1927.

TABLE 70.—URBANA, MORROW PLOTS
Rotation studies

Section of plot	Soil treatment	Plot 3 (Continuous corn) Corn	Plot 4 (Corn and oats rotation) Corn	Plot 5 (Corn, oats, and clover rotation) Corn
NW	0	22.0	34.1	42.3
SW	MLrP	49.1	59.3	57.8
NE	0	27.6	32.9	48.5
SE	MLbP	49.3	56.4	60.5

TABLE 71.—WEST SALEM
Rotation: Corn, oats, wheat, mixed hay, wheat

Soil treatment	Series 100 Oats	Series 200 Corn	Series 300 Wheat	Series 400 Mixed hay	Series 500 Wheat	Average all crops (pounds per acre)
0	26.6	12.3	7.5	(0)	4.0	446
ML[1]	46.7	46.3	17.3	(.60)	20.1	1 506
ML	67.2	45.9	25.5	(1.32)	23.2	2 056
MLrP	85.8	50.4	38.4	(1.90)	38.9	2 801
L[1]	42.3	12.7	11.0	(.31)	17.6	880
RL[1]	48.9	18.3	11.4	(.38)	15.4	992
RL	61.6	25.6	17.2	(.94)	18.2	1 482
RLrP	83.1	33.4	34.8	(1.06)	32.3	2 134
RLrPK	88.1	48.7	42.6	(1.75)	39.3	2 793

[1]Initial application of limestone only.