ROTATION AND NITROGEN EXPERIMENTS WITH CORN AND WHEAT

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Several long-time rotation experiments have been conducted by the Kentucky Agricultural Experiment Station. Earlier results were published by Roberts (1937), Karraker (1936, 1951), and Doll and Link (1957). Results of other recent fertilizer experiments with corn and wheat have been published by Doll (1961, 1962). In this publication, data are reported from two long-time experiments, one at the Western Kentucky Substation in Caldwell county and the other from the Greenville Soil Experiment Field in Muhlenberg county, together with the results of three recent experiments at the same locations.

WESTERN KENTUCKY SUBSTATION

Legume Rotation Experiment

A three-year rotation of corn, wheat, and various legumes and timothy was systematically arranged on three series of plots so that each crop in the rotation was grown every year. This experiment was conducted from 1927 to 1954, inclusive, on Crider silt loam, a residual soil of limestone origin. Soil treatments and legume and timothy management practices are given in Table 1. Ground limestone, where used, was applied at the rate of 2 tons per acre in 1927, again at 1 ton per acre as each series was planted to corn from 1936 to 1938, and again at the rate of 1 ton per acre from 1945 to 1947. From 1927 to 1937, 300 pounds per acre of 16% superphosphate was applied for each corn and each wheat crop; after 1937, 300 pounds of 20% superphosphate was applied. Beginning in 1937, 75 pounds of muriate of potash was applied to each corn and each wheat crop; after 1941, the same amount of 60% muriate of potash was used. On one series of plots where timothy was grown, 100 pounds per acre of sulfate of ammonia was applied to each crop. On one series of plots from which clover hay was harvested, manure was applied for corn at a rate equivalent to 3 tons of manure per acre for each ton of clover hay harvested. During the experiment, 26 corn, 26 hay, and 25 wheat crops were harvested. All corn stover and wheat straw were removed from the plots.

The largest differences in yields were obtained from applications of phosphorus, potassium, and ground limestone, as shown by a comparison of treatments 1, 3, and 4 (Table 1). When a legume was plowed down rather than harvested for hay, yields of both corn and wheat were increased slightly (Treatments 2, 3, 11, 12). Yields were lowest when cowpeas and soybeans were used as the third-year crop. Manure appeared to have about the same effects on corn and wheat yields as plowing down the clover (Treatments 12, 13). Yields obtained from Treatment 14, where timothy was grown, are not representative of yields with a nonlegume hay crop, since volunteer lespedeza was always present on these plots.

Changes in soil nitrogen (Table 2) were not great, but, in general, nitrogen tended to decrease on plots which were not limed or fertilized (Treatment 1) and on plots where cowpeas and soybeans were grown (Treatments 5, 6, 7), and to increase on plots which were fertilized and where lespedeza, alfalfa, or clover were grown.

TABLE 1. - EFFECT OF KIND AND MANAGEMENT OF HAY CROP GROWN IN ROTATION WITH CORN AND WHEAT ON CROP YIELDS AT PRINCETON, KY., FROM 1928 to 1953, INCLUSIVE

Treatment				Average Yield per Acre		
No.	Fertilizer	Hay Crop	Management	Corn, bushels	Wheat, bushels	Hay, cwt
1	----	Lespedeza	Hay	31.9*	7.8*	11.8*
2	P K	Lespedeza	Plowed down	48.7	17.4	--
3	P K	Lespedeza	Hay	42.5	15.1	18.8
4	L P K	Lespedeza	Hay	55.3	19.7	30.1
5	P K	Cowpeas	Hay (with cover crop)	36.0	11.7	22.8
6	P K	Soybeans	Hay (with cover crop)	37.7	12.3	29.0
7	P K	Soybeans	Grain, straw returned	44.4	14.6	2.9**
8	L P K	Sweet clover	Hay (one cutting)	59.5	21.6	26.3
9	L P K	Alfalfa	Hay (one cutting)	56.9	20.8	18.6
10	L P K	Alfafla	Hay	54.0	20.3	22.7
11	L P K	Red and alsike clover	Hay	54.6	22.8	29.0
12	L P K	Red and alsike clover	Plowed down	56.7	24.1	--
13	M L P K	Red and alsike clover	Hay	55.8	23.2	27.9
14	L P K	Timothy***	Hay	45.9	15.6	27.7
15	L P K	Red and alsike clover and timothy	Hay	51.9	18.7	29.4
16	L N P K	Timothy***	Hay	51.1	20.3	31.3

* Yields until 1945.
** Cwt of grain per acre.
*** Volunteer lespedeza always present on these plots.

TABLE 2. - EFFECT OF KIND AND MANAGEMENT OF HAY CROP GROWN IN ROTATION WITH CORN AND WHEAT ON NITROGEN CONTENT OF SOIL AT PRINCETON, KY.

Treatment No.	Fertilizer	Hay Crop	Management	Pounds Nitrogen (N) per Acre at Different Depths								
				1926		1936-8		1954-5		Change from 1926 to 1955		
				0-6"	6-18"	0-6"	6-18"	0-6"	6-18"	0-6"	6-18"	Total
1	--	Lespedeza	Hay	2,001	2,406	1,944	2,227	1,915	2,237	- 86	-169	-255
2	P K	Lespedeza	Plowed down	1,928	2,250	1,970	2,311	2,040	2,160	112	- 90	22
3	P K	Lespedeza	Hay	1,956	2,279	1,877	2,213	1,997	2,293	41	14	55
4	L P K	Lespedeza	Hay	2,032	2,336	2,037	2,377	2,119	2,387	87	51	138
5	P K	Cowpeas	Hay (with cover crop)	2,020	2,270	1,874	2,195	1,763	2,287	-257	17	-240
6	P K	Soybeans	Hay (with cover crop)	2,051	2,461	1,930	2,312	1,777	2,380	-274	- 81	-355
7	P K	Soybeans	Grain (straw returned)	2,063	2,465	2,014	2,479	1,930	2,360	-133	-105	-238
8	L P K	Sweet clover	Hay (one cutting)	2,000	2,530	2,033	2,525	2,130	2,753	130	223	353
9	L P K	Alfalfa	Hay (one cutting)	1,986	2,446	2,005	2,479	2,007	2,460	21	14	35
10	L P K	Alfalfa	Hay	1,983	2,339	1,991	2,237	2,047	2,273	64	- 66	- 2
11	L P K	Red and alsike clover	Hay	2,035	2,441	1,984	2,413	2,133	2,320	98	-121	- 23
12	L P K	Red and alsike clover	Plowed down	2,056	2,470	2,100	2,316	2,030	2,627	- 26	157	131
13	M L P K	Red and alsike clover	Hay	1,991	2,423	2,098	2,330	2,283	2,533	292	110	402
14	L P K	Timothy*	Hay	1,951	2,413	2,039	2,260	2,057	2,267	106	-146	- 40
15	L P K	Red and alsike clover & timothy	Hay	1,937	2,385	2,046	2,418	2,197	2,487	260	102	362
16	L N P K	Timothy*	Hay	1,914	2,349	1,946	2,347	2,047	2,473	133	124	257

* Volunteer lespedeza on these plots.

The results from most of the treatments in this experiment were reported in detail by Doll and Link (1957).

Effect of Nitrogen Fertilizer on Corn and Wheat Yields

After the long-time experiment discussed above was terminated, another experiment was conducted on the same soil type from 1955 to 1960, inclusive, in which corn and wheat were grown in a two-year rotation. Two series of plots, each arranged in a Latin square design, enabled each crop to be grown each year. A cover crop of red and Ladino clover and Korean lespedeza was seeded in the wheat each spring, and plowed down the following spring for corn. All corn stover and wheat straw was removed from the plots.

Corn yields, given in Table 3, show a significant response to nitrogen in 1956 and 1957, but after the first two years, no further significant responses were obtained. However, the first 30-pound increment of nitrogen did tend to result in higher yields in 1958 and 1959. The wheat yields, given in Table 4, show a significant response for nitrogen each year. However, part of the yield increases shown for wheat was probably due to residual effects of nitrogen applied to the preceding corn crop. Significant yield increases were obtained for each additional increment of nitrogen except in 1955 and 1959, when no significant increases were obtained when the rate of nitrogen was increased from 30 to 60 pounds of nitrogen per acre. The higher corn and wheat yields obtained in this experiment (Tables 3 and 4) than in the preceding long-time experiment (Tables 1 and 2) can be probably attributed mostly to the higher rates of fertilization, particularly phosphorus (Doll and Link, 1957).

TABLE 3. - EFFECT OF NITROGEN ON YIELD OF CORN FOLLOWING WHEAT AND LEGUME COVER FROM 1956 to 1960, INCLUSIVE, AT PRINCETON, KY.

Pounds N per Acre	Corn Yield, Bushels per Acre					
	1956	1957	1958	1959	1960	Average
0	77.3	99.2	77.0	85.7	75.8	83.0
30	84.3	103.8	81.1	92.3	74.9	87.3
60	90.6	101.1	83.5	91.6	75.9	88.5
120	90.0	107.1	88.6	93.6	76.3	91.1
L.S.D. .05	6.1	2.9	ns	ns	ns	

TABLE 4. - EFFECT OF NITROGEN APPLIED TO WHEAT AND PRECEDING CORN ON YIELD OF WHEAT AT PRINCETON, KY., FROM 1955 to 1960, INCLUSIVE

Pounds N per Acre		Wheat Yield, Bushels per Acre						
Corn	Wheat	1955	1956	1957	1958	1959	1960	Average
0	0	15.5	20.7	16.5	24.9	19.7	33.6	21.8
30	15	23.9	36.3	24.2	32.4	29.9	47.4	32.4
60	30	31.8	48.1	26.3	36.0	32.4	54.6	38.2
120	60	36.6	58.0	30.9	45.8	35.7	62.1	44.9
L.S.D. .05		6.1	8.5	4.0	7.0	6.1	5.6	

GREENVILLE SOIL EXPERIMENT FIELD

Lespedeza Rotation Experiment

Korean lespedeza was used as the third-year hay crop in rotation with corn and wheat in an experiment conducted on Zanesville silt loam from 1936 to 1957, inclusive. The plots were arranged systematically, and three series of plots enabled each crop to be grown each year.

The fertilizer and limestone treatments were as follows:

Limestone = 2 tons of ground limestone applied in 1936.

Phosphorus = 50 pounds of P_2O_5 preceding corn and 50 pounds preceding wheat, or 100 pounds total of P_2O_5 per acre for each round of the rotation beginning in 1936. In 1942 this was reduced to 60 pounds of P_2O_5 per acre for each round of the rotation applied before seeding the wheat.

Potassium = 150 pounds of 50% muriate of potash (75 pounds of K_2O) per acre for each round of the rotation, beginning in 1939. Starting in 1942, the amount of K_2O was increased to 90 pounds through the use of a 60% muriate of potash.

The most marked yield differences were due to applications of lime, phosphorus, and potassium (Table 5). The use of rye cover following lespedeza in the third year (Treatment 3) had very little effect on yields of succeeding corn and wheat crops. When wheat was grown in both the second and third years of the rotation (Treatment 4), yields of wheat in the third year were only slightly better than those from the check plots in the second year (Treatment 1), and yields of corn and second-year wheat appeared to be slightly lower (Treatment 4). When lespedeza was cut for hay following wheat harvest in the second year as well as in the third year (Treatment 5), yields of both corn and wheat were lower than those obtained in Treatment 5, although total hay yields were about 50% higher. Seeding timothy with lespedeza (Treatment 6) appeared to increase corn yields slightly when compared with Treatment 5 and did not affect wheat or third-year hay yields, but decreased second-year hay yields. However, yields of both corn and wheat were very low throughout this experiment.

TABLE 5. - EFFECT OF FERTILIZER TREATMENT AND KIND OF ROTATION ON YIELDS OF CORN, WHEAT, AND HAY AT GREENVILLE FROM 1936 to 1957, INCLUSIVE

			Average Yields in Rotations				
			First Year	Second Year		Third Year	
Treatment Number	Fertilizer Treatment	Rotation*	Corn Bu/A	Wheat Bu/A	Hay Cwt/A	Wheat Bu/A	Hay Cwt/A
1	None	C-W-L	15.0	3.2	--	--	17.5
2	L P K	C-W-L	36.4	17.1	--	--	35.3
3	L P K	C-W-Lr	37.7	17.1	--	--	36.2
4	L P K	C-W-WLr	35.2	15.9	--	6.4	34.8
5	L P K	C-WL-Lr	32.2	14.3	24.6	--	27.7
6	L P K	C-WLT-LT	35.4	13.3	16.5	--	25.1

*C = corn, W= wheat, L = lespedeza Hay, T = timothy hay, r = rye cover crop.

The changes in nitrogen content of both the surface and subsoil (Table 6) are also indicative of the low yield levels. Total nitrogen in the top 18 inches decreased on all plots during the experiment; however, on all fertilized plots the nitrogen content of the surface soil tended to increase while that of the subsoil decreased. This was probably due to stimulation of root growth and consequent accumulations of organic matter in the fertilized plow layer.

TABLE 6. - EFFECT OF FERTILIZER TREATMENT AND KIND OF ROTATION ON SOIL NITROGEN AT DIFFERENT DEPTHS AT GREENVILLE, KY., FROM 1936 to 1955

Fertilizer Treatment	Rotations*	Pounds Nitrogen (N) per Acre						Total Change
		Surface Soil (0-6")			Subsoil (6-18")			
		1936	1955	Change	1936	1955	Change	
None	C-W-L	1,785	1,770	- 15	1,875	1,600	-275	-290
L P K	C-W-L	1,780	1,945	165	1,965	1,650	-315	-150
L P K	C-W-Lr	1,865	1,960	95	2,005	1,745	-260	-165
L P K	C-W-WLr	1,805	1,980	175	1,950	1,690	-260	- 85
L P K	C-WL-Lr	1,805	1,890	85	1,965	1,740	-225	-140
L P K	C-WLT-LT	1,800	1,865	65	2,000	1,645	-355	-290

* C = corn, W = wheat, L = lespedeza hay, T = timothy hay, r = rye cover crop

Nitrogen and Rotation Experiments

In 1956, the lespedeza rotation experiment discussed above was terminated, and a new 3-year rotation experiment in which various rates of nitrogen were applied to corn and wheat grown in two different rotations was initiated on the same plots. The new plots were arranged in a Latin-square design. In the first rotation, corn was grown for the first two years with an unfertilized wheat cover after the first corn crop, and wheat followed by a sweet clover-lespedeza cover crop was the third-year crop. The second rotation was a 3-year rotation of corn, wheat, and red clover-orchardgrass hay. Three series of plots enabled each crop in the rotation to be grown each year.

All plots were limed at the rate of 4 tons ground limestone per acre, and 120 pounds of P_2O_5 and 120 pounds of K_2O per acre were broadcast on all plots each year for the first three years, and at one-half that rate (60 pounds per acre) thereafter. All nitrogen for corn was broadcast prior to seeding, and for wheat, one-half of the nitrogen and all the phosphorus and potassium were applied at seeding; the remainder of the nitrogen was top-dressed in early spring. All crop residues (corn stover and wheat straw) were removed from the plots. Stalk population for corn was 14,000 per acre.

Corn Yields -- The yields of corn following lespedeza (the third year crop in the preceding lespedeza experiment) in 1956, 1957, and 1958 are given in Table 7. Fertilizer nitrogen increased yields significantly in 1956 and 1957, but the higher yields when nitrogen was applied in 1958 were not satistically significant. Average yields showed significant increases in yield for each additional increment of nitrogen. Yields of corn without nitrogen which were about twice as high as those obtained in the preceding experiment (Table 5) were probably due largely to higher rates of phosphorus and potassium applied.

TABLE 7. - EFFECT OF NITROGEN ON YIELD OF CORN FOLLOWING LESPEDEZA AT GREENVILLE, KY.

	Bushels per Acre			
Pounds N per Acre	1956	1957	1958	Average
0	71.1	64.0	101.8	79.0
30	81.7	69.1	109.0	86.6
60	87.4	74.5	110.9	90.9
L.S.D. .05	6.1	5.7	ns	3.7
.01	8.2	7.6	ns	4.9
CV %	8.4	9.0	7.9	8.4

Yields obtained in 1959 and 1960 following either a sweet clover-lespedeza cover crop or a red clover-orchardgrass hay crop are given in Table 8. No significant increases in corn yields were obtained for nitrogen applications following the sweet clover-lespedeza cover crop, although yields tended to be slightly higher each year. However, marked increases were obtained for each additional increment of nitrogen applied to corn following red clover-orchardgrass hay. The highest corn yields were similar for each rotation, indicating that lack of nitrogen was the limiting factor for yields of corn following red clover-orchardgrass.

TABLE 8. - EFFECT OF PRECEDING LEGUMES AND NITROGEN FERTILIZER ON YIELD OF CORN AT GREENVILLE, KY., IN 1959 and 1960

	Bushels per Acre					
	Sweet Clover-Lespedeza Cover Crop			Red Clover-Orchardgrass Hay		
Pounds N per Acre	1959	1960	Average	1959	1960	Average
0	77.6	73.7	75.6	61.1	62.3	61.7
30	79.6	77.3	78.5	67.4	68.6	68.0
60	86.5	78.0	82.3	80.1	78.3	79.2
L.S.D. .05	ns	ns	ns	13.5	8.9	7.7
.01	ns	ns	ns	18.9	ns	10.4
CV %	9.2	10.4	9.8	14.2	9.3	12.0

The yields of corn following corn (second-year corn) grown in the corn-corn-wheat (with sweet clover-lespedeza cover) rotation are given in Table 9. A marked response was obtained for nitrogen each year. Except in 1958, residual effects of nitrogen applied to first-year corn did not significantly effect the yields of second-year corn. In 1958, the yield from plots which received no nitrogen on first-year corn and 30 pounds on second-year corn was higher than that from plots which received 60 pounds of nitrogen for first-year corn and 30 pounds for second-year corn. No significance is attributed to this difference since similar differences were not noted in other years. Each year, the maximum yields of second-year corn were consistently lower than the maximum yields of first-year corn (Tables 7, 8, and 9). The lower yields of second-year corn may have been due to either insufficient fertilizer nitrogen or deterioration of soil structure under the intensive cropping system.

TABLE 9. - EFFECT OF APPLIED AND RESIDUAL NITROGEN ON YIELD OF CORN FOLLOWING CORN AT GREENVILLE, KY., FROM 1957 to 1960, INCLUSIVE

Pounds N per Acre on Corn		Bushels per Acre				
First Year	Second Year	1957	1958	1959	1960	Average
30	0	40.9	25.3	53.1	37.0	39.1
30	30	45.7	70.0	68.8	59.6	61.0
30	60	48.8	75.1	74.5	70.4	67.2
0	30	41.1	72.2	70.0	55.1	59.6
60	30	47.7	55.5	65.0	63.8	58.0
L.S.D. .05		6.3	17.0	7.6	6.1	4.7
.01		ns	23.8	10.7	8.5	6.3
CV %		10.1	20.6	8.4	7.7	13.1

Wheat Yields -- The effect of fertilizer nitrogen on the yield of wheat following corn in the corn-wheat-red clover-orchardgrass rotation is given in Table 10. Nitrogen applications to wheat resulted in yield increases each year. The second 15-pound increment (15 to 30 pounds per acre) resulted in a significant yield increase only in 1957, although the average yields also showed a significant increase as the rate of nitrogen was increased from 15 to 30 pounds per acre. No constant trends were noted due to the residual effects of nitrogen applied to the preceding corn crop.

TABLE 10. - EFFECT OF NITROGEN APPLIED TO WHEAT AND ALSO TO THE PRECEDING CORN ON YIELD OF WHEAT AT GREENVILLE, KY., IN 1957, 1959, and 1960. WHEAT GROWN IN ROTATION OF CORN, WHEAT, AND RED CLOVER-ORCHARDGRASS

Pounds N per Acre		Wheat Yield, Bushels per Acre			
Corn	Wheat	1957	1959	1960	Average
30	0	13.5	23.7	31.2	22.8
30	15	19.5	30.0	34.9	28.0
30	30	23.9	34.0	35.7	31.2
0	30	22.0	33.6	32.5	29.4
60	30	22.6	31.7	33.4	29.2
L.S.D. .05		3.7	4.7	3.1	2.2
.01		5.1	6.6	ns	2.9
CV %		14.1	11.2	7.1	10.4

The yields of wheat grown as the third crop in the corn-corn-wheat rotation are given in Table 11. No residual effects of the nitrogen applied to the preceding corn crops were noted.

TABLE 11. - EFFECT OF NITROGEN ON PRECEDING CORN CROPS ON YIELD OF WHEAT AT GREENVILLE, KY., IN 1959 and 1960. WHEAT GROWN IN ROTATION OF CORN, CORN, AND WHEAT, WITH SWEET CLOVER-LESPEDEZA COVER CROP

Pounds N per Acre			Wheat Yield, Bushels per Acre		
Corn		Wheat	1959	1960	Average
First Year	Second Year				
0	30	30	25.5	26.3	25.9
30	30	30	23.2	26.9	25.1
60	30	30	21.6	27.8	24.7
30	0	30	19.6	25.3	22.4
30	60	30	22.7	28.3	25.5
L.S.D. .05			ns	ns	ns
.01			ns	ns	ns
CV %			13.6	10.8	13.2

Hay Yields -- The yields of red clover-orchardgrass hay in the corn-wheat-red clover-orchardgrass rotation (Table 12) were not affected by nitrogen applications to the preceding corn and wheat crops.

TABLE 12. - EFFECT OF NITROGEN APPLIED ON THE PRECEDING CORN AND WHEAT ON THE YIELD OF RED CLOVER-ORCHARDGRASS HAY AT GREENVILLE, KY., FROM 1958 to 1960, INCLUSIVE

Pounds N per Acre		Hay Yield, Cwt per Acre			
Corn	Wheat	1958	1959	1960	Average
30	0	88.3	84.7	70.9	81.3
30	15	80.8	81.9	69.8	77.5
30	30	79.7	81.5	79.0	80.1
0	30	79.4	86.5	82.2	82.7
60	30	83.6	84.4	73.0	80.3
L.S.D. .05		ns	ns	ns	ns
.01		ns	ns	ns	ns
CV %		8.3	4.3	23.9	15.7

Two-year Rotation with Corn and Wheat

A two-year rotation of corn and wheat followed by a sweet clover-lespedeza cover crop was conducted from 1952 to 1960, inclusive, on Zansville silt loam. Adequate rates of phosphorus and potassium were applied to all plots. Corn was thinned to a uniform population of 10,500 stalks per acre. All corn stover and wheat straw was removed from the plots.

Corn yields were increased in six of the nine years by the first 25-pound increment of nitrogen, but additional nitrogen applications did not further increase yields except in 1958 (Table 13). These results are similar to those given in Table 8 for corn following a sweet clover-lespedeza cover.

TABLE 13. - EFFECT OF NITROGEN ON YIELD OF CORN GROWN IN ROTATION WITH WHEAT FOLLOWED BY SWEET CLOVER-LESPEDEZA COVER CROP

Pounds N per Acre	Corn Yield, Bushels per Acre									
	1952	1953	1954	1955	1956	1957	1958	1959	1960	Average
0	28.8	38.7	67.3	51.9	75.5	72.7	75.0	64.8	48.3	58.1
25	33.7	43.2	67.3	53.3	81.5	85.6	74.4	76.5	60.0	63.9
50	35.5	45.3	63.6	53.4	82.8	86.3	79.2	75.1	62.7	64.9
75	33.2	36.6	60.1	53.2	83.9	88.4	81.3	69.2	60.5	62.9

Wheat yields, given in Table 14, show a response for the first 15-pound increment of nitrogen, but very little increase for additional nitrogen. These results are similar to those given in Table 10 for yields of wheat following corn.

TABLE 14. - EFFECT OF NITROGEN APPLIED TO WHEAT AND THE PRECEDING CORN CROP ON YIELD OF WHEAT GROWN IN ROTATION WITH CORN AND FOLLOWED BY A SWEET CLOVER-LESPEDEZA COVER

Pounds N per Acre		Wheat Yield, Bushels per Acre*							
Corn	Wheat	1952	1953	1954	1955	1957	1959	1960	Average
0	0	14.3	25.0	23.2	13.1	14.5	20.2	21.2	18.8
25	15	23.5	36.0	35.6	18.4	18.1	24.4	29.7	26.5
50	30	26.6	38.0	37.6	18.9	20.5	27.5	28.4	28.2
75	45	31.3	41.9	36.9	21.1	24.6	39.0	27.8	31.8

*No yields obtained in 1956 or 1958.

CONCLUSIONS

The results of the long-time rotation experiments indicate that even though the nitrogen content of the soil may be maintained or even slightly increased when moderate rates of fertilizers are applied, adequate phosphorus and potassium must be applied to properly limed soils and must be supplemented by proper amounts of fertilizer nitrogen if optimum yields are to be obtained. The removal of corn stover and wheat straw from the plots in these experiments undoubtedly influenced the degree of response to fertilizer nitrogen, particularly with respect to second-year corn. Data reported by Doll, Miller, and Todd (1962) indicate that appreciable quantities of nitrogen are removed in corn stover and wheat straw.

Experiments with nitrogen fertilizer for corn indicate that approximately 30 pounds of N should be applied for corn following a good legume crop. For second-year corn (corn following corn), much higher rates would be necessary, since yields given in Table 9 indicate that 60 pounds of nitrogen was not enough for optimum yields. In summarizing the results of numerous field experiments, Doll (1962a) concluded that 100 to 120 pounds of nitrogen would be necessary for optimum yields of continuous corn.

When wheat was grown following corn, consistent yield increases were obtained. Very little residual effect of nitrogen applied to preceding corn was noted (Tables 10 and 11). Based on a summarization of the results of all wheat experiments, the optimum rate of nitrogen fertilization seems to have been between 30 and 45 pounds per acre.

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