6-1980

Corn Yields from Fertilizer Recommendations Made by Some Soil Testing Laboratories Serving Kentucky

Lloyd W. Murdock
University of Kentucky, lmurdock@uky.edu

William Hendrick
University of Kentucky

UNIVERSITY OF KENTUCKY
COLLEGE OF AGRICULTURE
Lexington, Kentucky 40546

COOPERATIVE EXTENSION SERVICE

AGRONOMY NOTES

Volume 13 No. 2 June 1980

CORN YIELDS FROM FERTILIZER RECOMMENDATIONS MADE BY SOME SOIL TESTING LABORATORIES SERVING KENTUCKY

L. W. Murdock and William Hendrick 1/

One of the most economically important services available to Kentucky farmers is that of soil testing and fertilizer recommendations. Fertilizer purchases on the order of 150 million dollars per year are currently made by farmers in Kentucky. Until about 30 years ago there was no routine, rapid method for analyzing soils to determine fertilizer needs. Since then, as better methods were developed, soil testing laboratories have been set up for routine farmer use. For many years only the soil testing service provided through the University of Kentucky (UK) was readily available to farmers in Kentucky. Even though the University still provides statewide service, many commercial laboratories have been developed which now also serve the state.

As the use of these different laboratories has spread, it is apparent that there are differences in fertilizer recommendations among laboratories. Comparisons of fertilizer recommendations between laboratories for split soil samples have shown differences in kinds and quantities of nutrients recommended. Farmers and dealers question these differences. Which laboratory is right? Do you get a better yield by using one over the other? Is there a difference in cost?

To help answer these questions, two field experiments (Princeton and Henderson, Ky.) were established. Several laboratories tested the same soil and made fertilizer recommendations. Corn was then grown using the different recommendations and yields were determined.

PRINCETON

In 1977, one hundred and five cores were taken at a depth of 7 inches by a standard soil sampler from a half acre plot of Pembroke soil at the experiment station at Princeton. All cores were composited into one sample and mixed three times. The composite was split and sent to four different laboratories at three separate times for analysis. Table 1 shows results obtained from sending a portion of the sample to each lab during three consecutive months in 1977. Analyses compared between laboratories may vary greatly due to different testing methods used by them. All laboratories showed reasonable agreement on the most commonly measured properties (P, K, and pH). All laboratories interpreted their results to indicate that P and K were high and that pH was near neutral.

1/ Extension Soils Specialist and County Agricultural Agent, respectively.

All laboratories were asked to recommend fertilizer necessary for 150 bushels of corn per acre. Each laboratory was given the previous cropping history and other necessary information. Fertilizer was applied according to the recommendations from each laboratory with each specific recommendation being the treatment tested. Each treatment was replicated five times. Pioneer 3369A corn was grown at an average population of 24,000 plants per acre in 1977, 1978 and 1979. The plots for each laboratory remained the same over the three year period, but the plots were resampled and tested each March, and fertilizer recommendations were again requested from each laboratory. Fertilizer was again applied as recommended. Furadan was used with all treatments to control soil insects.

The amount of fertilizer recommended, the yields obtained, and the fertilizer costs for each year are shown in Table 2. Even though each treatment was replicated five times and randomly located through the plot area, variability was great enough that the yields shown were not statistically different.

Based on the statistical analysis of these results, we concluded that there was no relation between the amount of fertilizer applied and the yields obtained. The treatments with the high nitrogen, phosphorus, and potassium recommendations yielded no more than those with lower applications. Apparently, the lowest nitrogen rate (150 lb/ac) was enough to guarantee high yields.

The 1977 soil tests (Table 1) show high residual levels of phosphorus and potassium in the soil from years of previous fertilization. This apparently was enough to guarantee maximum yields without further additon of either phosphorus or potassium. Laboratory D (UK)(Table 2) did not recommend either nutrient in 1977, 1978 or 1979 and yields obtained from its recommendations were as high as from the other laboratories which recommended much higher rates. There apparently is a philosophical difference in making fertilizer recommendations between laboratories on this point. Laboratory D (UK) takes the view of fertilizing for the crop. Once the soil test is high enough to give maximum yields, no more phosphorus or potassium are recommended until the soil test is lowered to the point that the crop will again respond to additional fertilizer. Laboratories A, B, and C apparently believe in fertilizing the soil. Once the soil test is in the high category, a maintenance amount of phosphorus and potassium is recommended to hold it there. This is to offset the nutrient loss by various means (mainly by crop removal) and maintains the soil test in a high category. There was a difference in the amount of phosphorus and potassium recommended by laboratories A, B, and C as maintenance amounts. Their recommendations were especially variable for potassium.

The secondary and minor nutrients had little effect on yield. Recommendations changed from one year to the next and quantities recommended varied greatly. However, the relative yield ranking of the laboratories did not vary as the recommendations were changed.

There was a considerable difference in the cost of the fertilizer recommended by the different laboratories. Costs increased each year as the cost of fertilizer increased. The most costly recommendations were 90%, 164% and 123% higher than the least costly recommendation in 1977, 1978 and 1979, respectively. Even though corn yields were not increased by additional fertilizer, not all of the extra money spent on the additional fertilizer was lost. The additional phosphorus

TABLE 2. Fertilizer Recommendations, Corn Yields, and Fertilizer Costs Using Four Different Soil Testing Laboratories Over a Three Year Period (Princeton, Ky.).

	FERTILIZER RECOMMENDATIONS (LBS/A) YEARS											
	LAB A			LAB B			LAB C			LAB D (UK)		
Nutrient	77	78	79	77	78	79	77	78	79	77	78	79
Nitrogen	190	185	190	150	170	170	170	211	192	150	150	150
Phosphate	70	60	60	30	65	65	30	60	60	---	---	---
Potash	140	90	80	40	47	25	100	190	100	---	---	---
Magnesium	---	---	---	---	---	---	---	17	17	---	---	---
Sulfur	10	---	10	---	---	---	---	---	---	---	---	---
Boron	1	0.5	0.5	---	---	---	---	1	1	---	---	---
Zinc	3	3	3	4	---	6	---	10	10	25*	---	---

*Zinc applied in 1977 to last for at least a 5 year period.

	CORN YIELDS (BU/A)* LABORATORIES			
Year	A	B	C	D(UK)
1977	77	106	72	102
1978**	47	75	45	66
1979	130	143	124	135

*No significant differences among recommendations (5 reps/tmt).

** Severe droughth

	TOTAL COSTS ($/A)			
Year	Lab A	Lab B	Lab C	Lab D(UK)
1977	$59	$37	$40	$31*
1978	$55	$46	$82	$31*
1979	$62	$53	$76	$34*

*Cost of Zinc amortized over a 5 year period.

TABLE 3. Fertilizer Recommendations, Corn Yields, and Fertilizer Costs Using Two Different Soil Testing Laboratories in 1978. (Henderson County, Ky.).

Nutrient	SOIL TEST RESULTS Lab A	SOIL TEST RESULTS Lab D(UK)	FERTILIZER RECOMMENDATIONS Lab A	FERTILIZER RECOMMENDATIONS Lab D(UK)
pH	5.8	5.9	1.5 T/A	2 T/A
Nitrogen	---	---	180 #/A	150 #/A
Phosphorus	122 #/A	128 #/A	30 #/A	---
Potassium	320 #/A	381 #/A	50 #/A	---
Magnesium	180 #/A	160 #/A	---	---
Calcium	2000 #/A	1450 #/A	---	---
Sulfur	12ppm	---	10 #/A	---
Boron	1ppm	---	0.5 #/A	---
Zinc	3.6ppm	---	---	---
Manganese	35ppm	---	---	---
Iron	70ppm	---	---	---
Copper	1.8ppm	---	---	---

Laboratory	Corn Yields Avg. (4 Reps)	Fertilizer Costs
A	151.6	$44
D(UK)	157.6	$27

and potassium reacts with the soil and increases plant available phosphorus and potassium in the soil, which may be available for use at a later date. Therefore, the extra money spent on these two nutrients might be considered an investment. The investment could be either an advantage or disadvantage depending on fertilizer prices, the financial situation of a producer, the length of time a person will be able to farm the field, soil erosion loss, etc.

This trial was conducted on a soil showing high levels of P and K. Therefore differences between recommendations are most dramatic. Previous experience indicates that these differences are proportionally lower on soils testing low in phosphorus and potassium.

HENDERSON

Only two of the above laboratories were compared in this trial. The soil (Dekovan silt loam) was thoroughly sampled. The sample was mixed, split, and sent to the two different laboratories. Each laboratory was asked for a complete analysis. Both laboratories were given past history and other required information and asked for a fertilizer recommendation for 150 bu/ac of corn. Fertilizer was added according to the recommendations. Both treatments were replicated four times. Harvested populations for both treatments were almost identical and averaged 22,820.

Amount of fertilizer recommended, yields obtained, and fertilizer costs are shown in Table 3.

Soil test results from the two laboratories were similar. Both indicated that the available phosphorus and potassium were high and showed a need for lime. Laboratory A recommended more nitrogen than laboratory D, (UK). It also recommended a maintenance amount of phosphorus and potassium and small amounts of sulfur and boron. Yields produced from the two fertilizer treatments were not significantly different. The 1978 costs for the fertilizer recommended by Laboratory A was 63 percent higher than that of laboratory D. Although the extra costs did not increase yields, as discussed with the Princeton trial, all of the extra costs are not necessarily lost.

CONCLUSIONS

Field experiments at two locations in Kentucky indicated that soil analyses by different testing laboratories were similar for pH, phosphorus, potassium, calcium, and magnesium. Analysis for minor nutrients were more variable. Fertilizer recommendations for 150 bu/A of corn received from each laboratory varied widely. Corn grown according to the recommendations produced yields that were not statistically different. Differences between fertilizing philosophy probably accounted for most of the wide differences among recommendations. Although a wide difference existed in costs of recommended fertilizer, all of the extra fertilizer costs are not lost since nutrients such as phosphorus and potassium remain in the soil for future use. These trials were conducted on soils with high P and K soil test levels. Past experience indicates that at low P and K soil test levels, these differences in recommendations are much less. Regardless of the laboratory used, soil analysis and yields were similar. However, wide differences can exist in fertilizer recommendations and costs.

Lloyd Murdock
Extension Specialist (Soils)

TABLE 1. Soil Test Results Obtained by Sending Split Samples of the Same Soil to Four Laboratories in Three Consecutive Months in 1977 (Princeton, Ky.).

	LABORATORY											
	A			B			C			D(UK)		
SOIL PROPERTY	Mar.	Apr.	May	Mar.	Apr.	May	Mar.	Apr.	May	Mar.	Apr.	May
Organic Matter (%)	2.8	2.4	2.2	1.6	1.7	1.7	2.1	1.3	1.9	---	---	---
Phosphorus (lb/ac)	38M	59VH	60VH	72	68	116	140H	104H	135H	127H	143H	123H
Potassium (lb/ac)	192VH	159VH	170VH	276	370	380	310G	305G	315G	342H	343H	308H
pH (water)	6.6	6.8	7.0	6.6	6.8	6.7	6.2	6.9	6.5	7.0	6.7	6.7
Calcium (lb/ac)	3100H	3400H	3200H	3320	4220	3860	3950G	3750G	3750G	3050	3350	2520
Magnesium (lb/ac)	180L	160L	180L	250	274	240	145M	135M	165M	120	160	138
Zinc (ppm)	1.9L	1.7L	2.0L	---	0.65	0.49	6P	3P	16G	2.5L	3.1L	2.8L
Sulfur (ppm)	5M	15H	9M	---	18	12	26G	---	---	---	---	---
Boron (ppm)	0.9M	0.9M	1.0M	---	0.9	0.8	0.2L	---	0.2L	---	---	---
Manganese (ppm)	33H	55H	82VH	---	21	31	---	---	---	---	---	---
Iron (ppm)	24H	30H	32H	---	17	20	---	---	---	---	---	---
Copper (ppm)	1.9H	1.3H	1.5H	---	0.8	0.8	---	---	---	---	---	---