



University of Kentucky
UKnowledge

Agronomy Notes

Plant and Soil Sciences

4-1991

Nitrogen Fertilizer Use by a High Yielding No-Till Corn Crop

Kenneth L. Wells
University of Kentucky

H. B. Rice
University of Kentucky

William O. Thom
University of Kentucky, william.thom@uky.edu

Right click to open a feedback form in a new tab to let us know how this document benefits you.

Follow this and additional works at: https://uknowledge.uky.edu/pss_notes

 Part of the [Agronomy and Crop Sciences Commons](#)

Repository Citation

Wells, Kenneth L.; Rice, H. B.; and Thom, William O., "Nitrogen Fertilizer Use by a High Yielding No-Till Corn Crop" (1991).
Agronomy Notes. 95.
https://uknowledge.uky.edu/pss_notes/95

This Report is brought to you for free and open access by the Plant and Soil Sciences at UKnowledge. It has been accepted for inclusion in Agronomy Notes by an authorized administrator of UKnowledge. For more information, please contact UKnowledge@lsv.uky.edu.

AGRONOMY NOTES

Vol. 24, No. 3, April 1991

NITROGEN FERTILIZER USE BY A HIGH YIELDING NO-TILL CORN CROP

K. L. Wells, H. B. Rice, and W. O. Thom

At the present time there is public concern about the effect which nitrogen (N) fertilizer use by farmers has on groundwater quality. This has resulted in research efforts to describe what happens to nitrogen fertilizer after it is applied to a crop. We have conducted a study for the past 3 years which enables us to make a reasonable estimate of how much fertilizer N is taken up by a high yielding corn crop. And, depending on whether the corn is harvested for silage or grain, we have estimated how much of the fertilizer N is removed from the field. Such an evaluation provides a good picture of the extent to which fertilizer N is utilized by the crop and its potential as a groundwater pollutant.

Experimental Description

This experiment was a fertilizer N response study conducted on a deep, well drained Pope silt loam soil located on the University of Kentucky's Robinson Substation at Quicksand, Kentucky. Corn (Pioneer 3233 in 1988 and Pioneer 3140 in 1989 and 1990) was no-till planted at 24,900 seeds/A in early May of each year. These varieties have tolerance to gray leaf spot (*cercospora*), a yield-damaging leaf blight known to be present at this site. Initial soil test levels in the surface 3 inches of soil were: pH 5.6, very high phosphorus (P),

and very high potassium (K). Plots were top-dressed with P and K fertilizer each year to ensure high levels of soil P and K, and were limed in the winter of 1989. Soil test levels of the surface 3 inches sampled in February, 1991, after this study were: pH 6.4, very high P, and medium K. Ammonium nitrate was used to apply 80 and 160 lbs N/A either all broadcast at time of planting or all broadcast 4-5 weeks after planting when corn was about 18 inches tall. All treatments were replicated 3 times. Weed control during all 3 years was good. Entire plant samples (including ears) were sampled at maturity each year to measure above-ground yield (silage). Grain yields were also measured at the same time. This occurred in early October each year at which time corn plants retained around 25% green color and grain moisture content was around 25%.

Results of the Study

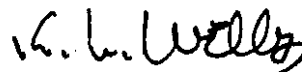
Tables 1 and 2 show silage and grain yields as influenced by rate of N and the time it was applied. There were substantial yield increases to N rates which would economically justify use of the 160 lb/A rate. And at the 160 lb N/A rate, yield levels of both silage and grain would be considered excellent. Although there was no significant effect of delaying N applications on silage

yield and total N content of plants, grain yield was significantly increased by this practice at the 80 lb N rate, but not at the 160 lb N rate. Total N analysis and dry matter weight of whole plants at harvest time enabled calculation of seasonal N uptake by the crop. These data are shown in Table 3. Since there is always some N naturally present in soil, not all N taken up by the crop comes directly from the fertilizer N applied. In order to account for this, total N uptake by plants grown at the 0-N rate was subtracted from total N uptake by plants grown at the 80 or 160 lb N rates. Although not absolutely accurate, this difference provides a reasonable estimate of the amount of fertilizer N taken up by crop. Table 4 shows this estimation. Two points are apparent from these data. First, there was considerable variation among the 3 years tested. Second, a sizeable amount of the N fertilizer applied can be accounted for by crop uptake. At the 160 lb N/A rate, this represented a range of 60% to 100%, with an average of about 70%. Based on past research, this would be considered excellent crop utilization of fertilizer N.

And, just because 30% of the fertilizer N is not accounted for by crop uptake doesn't necessarily mean that it ends up in groundwater. Although not directly measured in this study, it is well documented that sizeable amounts of N are tied up (immobilized) by soil microbes, particularly in no-till. This is reflected in a higher total N content in the surface inch or two in no-till fields. Because of this, the amount of fertilizer N (applied at the rates we tested) which could potentially enter groundwater would be small or negligible.

Silage and Grain Removal of N

The measurements of total N uptake (Table 3) reflect uptake and removal of N similar to that which would result in silage production. If only the grain is removed from the field, some of the fertilizer N taken up will be recycled back to the soil in the form of stalks, leaves, etc. Although we did not measure N content of the grain, it can be estimated on the assumption that corn grain contains about 8.5% protein and 1.36% N. From this, we can estimate that if only the grain were harvested, at the 160 lb N rate, fertilizer N removal from the field would be about 85 lbs, with the remaining 30 lbs fertilizer N taken up, being slowly recycled to the soil in plant residues.



Extension Soils Specialist

3.

Table 1. Corn Silage Yield as Influenced by N-Rate and Time of Application.

N Rate	N Applied At Planting				N Applied 4-5 Weeks After Planting			
	1988	1989	1990	Avg.	1988	1989	1990	Avg.
lbs/A	----- Tons silage/A ^{1/} -----							
0	7.7	8.7	10.9	9.1	--	--	--	--
80	16.8	23.2	19.5	19.8	18.3	20.0	20.7	19.7
160	16.8	27.7	26.1	23.5	17.7	20.0	27.2	21.6

^{1/}at 65% moisture.

Table 2. Corn Grain Yield As Influenced by N-Rate and Time of Application.

N Rate	N Applied At Planting				N Applied 4-5 Weeks After Planting			
	1988	1989	1990	Avg.	1988	1989	1990	Avg.
lbs/A	----- -Bu/A ^{1/} -----							
0	48	29	43	40	--	--	--	--
80	108	129	105	114	128	130	113	124
160	122	181	153	152	140	152	166	153

^{1/}at 15.5% moisture.

OFFICIAL BUSINESS
 PENALTY FOR PRIVATE USE, \$300

Table 3. Total N Uptake At Harvest.

N Rate	N Applied At Planting				N Applied 4-5 Weeks After Planting			
	1988	1989	1990	Avg.	1988	1989	1990	Avg.
lbs/A	----- Lbs N/A -----							
0	51	48	49	49	--	--	--	--
80	121	138	78	112	139	129	98	122
160	157	219	145	174	166	153	160	160

Table 4. Estimated Seasonal Uptake of Fertilizer N^{1/}.

N Rate	All N Applied At Planting				All N Applied 4-5 Weeks After Planting			
	1988	1989	1990	Avg.	1988	1989	1990	Avg.
lbs/A	----- Lbs N/A -----							
80	70	90	29	63	88	81	49	73
160	106	171	96	124	115	105	111	110

^{1/}Total N uptake from N treatments minus N uptake from O-N treatments.