1994

Using Poultry Manure From Layers as a Supplemental Nitrogen Source for Corn

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Agronomy notes

Vol. 27, No. 4, March 1994

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Objective

The objectives of this study were to try to find an effective inorganic nitrogen (N) fertilizer rate to apply to a corn crop when poultry manure has been used on the field and to see if an N soil test at sidedress time could help predict the amount of N needed.

How It Was Done

The trial was located in Muhlenburg Co. on a Calloway silt loam soil. Duration of the trial was three years (1991, 1992, and 1993). Four rates of fertilizer N (0, 50, 100, and 150 lbs. of N/ac as ammonium nitrate) were sidedressed when the corn was 8 to 12 inches high to the whorl. Manure was spread by truck (with double spinner) about two weeks before planting and incorporated. Fertilizer application of P and K was made by the farmer according to U.K. recommendations. Weed control was excellent except for some Johnsongrass in 1993. The rainfall was excellent for the growing season of 1991 and 1992 with about 15 inches of precipitation. Conditions were dryer in 1993 as indicated by the yield.

Manure History

- Before 1989 - none
- 1989 - 8 tons/ac - according to farm records
- 1990 - 4 tons/ac - according to farm records
- 1991 - none
- 1992 - approximately 1500 lbs/ac on manured plots as measured by small collection pans.
- 1993 - approximately 1500 lbs/ac on manured plots as measured by small collection pans.

Total N added in the manure in 1992 and 1993 was approximately 60 lbs/ac each year as determined by laboratory analysis at the University of Kentucky.

Results

Yields (Table 1) each year were very good and populations at harvest were between 20,000 to 23,000 plants per acre.

Evidently high rates of residual N remained from both fertilizer and manure applied before 1990, because there was little yield increase in 1991 when sidedressed nitrogen rates increased from 0 to 150 lbs/ac. This conclusion is supported by what happened to the yields on the plots that received no manure and no N fertilizer over the next two years. Yields on these plots decreased over the three years from 163 to 115 to 32 bu/ac in 1991, 1992, and 1993, respectively. This probably indicates that the large amount of nitrogen present in the soil at the beginning of the experiment was being decreased.

It is evident from this trial that if the amount of nitrogen applied in the manure is known, the amount of nitrogen needed as fertilizer can be reduced. Evidence of this can be seen by comparing the yields from the treatment receiving manure and no nitrogen with the treatment receiving no manure and 50 lbs/ac nitrogen in both 1992 and 1993.

In 1992, the yields with 50 lbs/ac of nitrogen fertilizer and no manure were identical to with manure and no N fertilizer. This indicates that 50 lbs/ac of N in the manure was available to the crop. The same comparison in 1993 indicates that 35 to 40 lbs. of N/ac was supplied by the manure. In both years, it was estimated (by measuring manure applied and N in manure) that about 60 lbs N/ac was in the manure. If the manure is incorporated into the soil, previous research would predict that about 0.6 of the total N in the manure would be available to the plant. According to what was found in the trial, that would be a safe estimate.

Further evidence can be seen at the higher N rates. In 1992, the yield plateaued at 50 lbs/ac of fertilizer N with manure and 100 lbs/ac without manure. In 1993, yields plateaued at 150 lbs/ac fertilizer N regardless of manure treatment. However, upon close examination it appears that the fertilizer N needed

without manure would only be about 120-125 lbs/ac for maximum yields, which may reflect some residual N from previous manure applications.

Based on this trial, it appears that poultry manure can supply substantial amounts of N. If one knows the amount of manure applied and a laboratory analysis of the N in the manure, a good estimate of the N available to the crop can be made.

Table 1. Effect of different sidedressed N rates on corn yield with and without poultry manure

	Manure Applied, 1991 - 1993				
	1991	1992		1993	
Fertilizer N Rate	None	None	Manured	None	Manured
lbs/A		bu/ac*			
0	163B	115C	157B	32D	70D
50	161B	157B	169A	60C	106C
100	176A	167A	163AB	123B	128B
150	161B	169A	162AB	144A	144A

* Yields with different letters are significantly different at the 0.1 probability level.

Nitrogen in the Soil

The amount of N in the form of nitrate (NO_3) found in the soil has been used to predict the amount of fertilizer N that needs to be added at sidedress time in some states. The top one foot of soil is sampled when the corn is 8 to 12 inches high and if 10 parts per million (ppm) or less of nitrate N (NO_3-N) is found, then a maximum rate of N fertilizer is required. If 25 ppm of NO_3-N is found then no fertilizer N is needed.

The amount of NO_3-N we found at sidedress time in the soil is shown in Table 2. It appears that this test was not a good yardstick to use in recommending additional fertilizer N. In almost every case, the maximum rate of N would have been recommended. However, in 1991, no fertilizer N was required.

Table 2. Effect of manure on soil NO3-N in top foot (ppm) at sidedress time.

Year	None	Manured
1991	11	--
1992	6	12
1993	4	9

Economics

If poultry manure is used by a producer without considering the N available in the manure, it is a significant economic loss. For example, if a producer measures about a ton of manure/ac spread and incorporated on his land and a laboratory analysis determines that there is a total of 75 lbs/ac of N in the manure, then the amount of N available to the crop is about 75 X 0.60 = 45 lbs/ac. If the producer reduced the fertilizer N rate by 45 lbs/ac at $0.20/lbs of N, the savings is $9.00/ac or $900 for 100 acres or $4500 for 500 acres. This is worth taking a little extra time to collect the samples and pay for a few laboratory analyses.

Summary

Poultry manure is a valuable supplier of fertilizer N, as well as phosphorus and potassium. The N in the manure is worth the little time and effort it would take to develop and instrument a management plan to take advantage of the available N.

Management Plan

1. Send a manure sample to laboratory for total N analysis (N, P_2O_5, and K_2O).
2. Spread manure evenly over the field.
3. Determine how much manure is spread per acre over the field by either:
   a. Obtaining weight receipts from truck that spread manure, or
   b. Place small pans across truck's spreading width to collect manure samples. Then weigh the manure in pans and calculate amount spread per acre.
4. Plant corn crop.
5. Find total nitrogen per acre in manure by multiplying amount of manure spread per acre by total nitrogen found in manure by laboratory.
6. Find available nitrogen per acre by multiplying total nitrogen per acre by 0.6 if manure is incorporated within two days, or use tables in AGR-146A if other circumstances exist.
7. Sidedress additional fertilizer nitrogen if needed.
8. Contact local Extension Service Agent for additional information.

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