UK COOPERATIVE EXTENSION SERVICE
University of Kentucky – College of Agriculture

LEXINGTON, KY 40546

Department of Agronomy

Soil Science News & Views

Vol. 24, No.1, 2004

Update on Poultry Litter as a Nitrogen Source and the Long-term Benefits of Its Use

Monroe Rasnake, George Kelley, Lloyd Murdock and Frank Sikora

Poultry litter has been shown to be an excellent source of nutrients for corn production. This publication is a one-year update on two on-going studies in West Kentucky that look at 1) nitrogen availability from litter applied at different times, incorporation of litter, cover crops and assessing the accuracy of calculating available nitrogen under these conditions 2) the long-term residual benefits of poultry litter after litter applications have been discontinued.

The first study is being conducted in Hopkins County on a Belknap soil near Slaughters, Ky. Litter was applied at four tons per acre in fall (late Oct.) or spring (early April) and managed as shown in Table 1. Litter was broadcast on the incorporated plots and mixed into the soil with a rototiller. A check treatment with no nutrients added and a standard treatment of 200 pounds of nitrogen (N) applied in early April were included as comparisons. Corn was seeded with a no-till planter on May 1. Corn yields were determined by hand harvesting in Sept. 2003 with the averages of three replications shown in Table 1.

Yields were surprisingly high with no nitrogen added on this poorly drained soil (112 bu/A yield average of the check plots.) However, corn yields responded to added nitrogen either as fertilizer or poultry litter. Maximum yields were obtained with either 200 pounds N/A applied in the spring or 4T/A poultry litter applied in the fall plus 150 pounds N/A applied in spring. For this year the yields using fall poultry litter applications without a cover crop were as high as or higher than the spring applications. This may have been due to 1) low volatilization of nitrogen from the fall-applied litter due to environmental conditions 2) more nitrogen in the litter used in the fall or 3) winter annual weed infestations that preserved some of the nitrogen from winter losses. The fall litter treatment with the wheat cover crop was one of

Table 1. Response of Corn to Poultry Litter and Nitrogen Fertilizer in 2003. Hopkins County

Available Nitrogen Above Check* (lbs N/A)	Application Rate And Time Litter (ton/A) or N (lbs/A) Fall	Spring	Litter Incorporated Yes or No	Average Yields (bu/A)**
0	0 N	0 Litter		112 e
26***	4T Litter	0 N	No	158 bcd
26***	4T Litter	0 N	Yes	169 bc
84	4T Litter + Wheat Cover Crop		Yes	132 de
84	0 N	4T Litter	No	143 cd
101	0 N	4T Litter	Yes	170 b
176***	4T Litter	150 N	No	205 a
200	0 N	200 N		197 a

*As calculated by "ManureUse1-2.xls".
**Yields followed by the same letter are not significantly different ($\alpha = 0.05$).
***N from 4T/A fall applied litter assuming no cover crop; however, there was a significant stand of winter annual weeds on these plots.

the lowest yielding treatments. Therefore, some of the nitrogen taken up by this wheat crop may not have been available to the corn because it was killed at a late stage of growth.

Incorporation of poultry litter with fall applications had no effect on subsequent corn yields. However, there was an advantage with incorporation of spring-applied litter as shown by the significantly higher corn yields on plots where the litter was mixed into the soil shortly after application. Incorporation of spring-applied litter may have improved nutrient use efficiency by reducing N volatilization losses. The conditions for volatilization seemed to be favorable this spring.

This study helps test N availability calculations using the computer spreadsheet "ManureUse1-2.xls" which is available at http://soils.rs.uky.edu/calculators.htm. The correlation between corn yields and available nitrogen, as calculated by the calculator, were good (60% accurate). The fall applied litter without cover crops yielded more than expected, probably due to less volatilization than normal and winter weeds as a cover crop. If the winter weeds are considered as a cover crop, the correlation improves to 84% accuracy. If it is known that winter weeds will be present in a field, it may be appropriate to consider it as a winter cover crop when using the calculator. The calculator also overestimated the value of the wheat cover crop, but this was probably because the wheat was killed in a late stage of growth and decomposed slowly.

In all cases, if the amount of supplemental recommended nitrogen recommended by the calculator were used, the yields would have probably been at a maximum.

Long Term Effects of Litter on Yield

The long-term residual benefits of poultry manure can be seen from yield obtained this last year from an old study on a Zanesville soil on the UK Research and Education Center at Princeton. From 1998 through 2001 one treatment received 10 tons/a/yr (total of 40 tons) and the other received 150 lbs N/a/yr plus phosphate and potash each year. The yields are shown in Table 2 on the following page. In

2003, corn was grown on both treatments using only 180 lbs/a of nitrogen (inorganic) and the yields are found in Table 2 with pH and phosphorus soil tests.

These results indicate the benefits of poultry litter can last for several years. The benefits from the past litter applications come from several sources. The higher buildup of soil test phosphorus is a reserve that will last many years and pH is maintained with less lime additions. Other nutrients not shown in the table such as nitrogen, potassium, zinc and other secondary and micronutrients are more available. The increase in yields could also be due to soil structure changes that come from additions of organic matter that would improve the soil water holding capacity. It is obvious that there are benefits from using poultry litter that can persist for years.

Table 2. Effects of Poultry Litter and Nitrogen Fertilizer on Corn Yields (bu/A) and Phosphorus Soil Test Levels (lbs P_2O_5/A).

	Treatments applied annually, 1998-2001*	
	150 lbs N/A	10T Litter/A
1999 – 2001 Average Yields	125	141
2003 Yields (Av. of five reps)	155	195
Spring 2002 STP Levels	50	513
Soil pH	5.8	6.3

*180 lbs/A N only in 2002 and 2003.
Yield differences were statistically significant ($\alpha = 0.05$).

Greg Schwab
Extension Soils Specialist

Cooperative Extension Service
U.S. Department Of Agriculture
University Of Kentucky
College Of Agriculture
Lexington, Kentucky 40546

Official Business
Penalty for Private Use, $300

PRSRT STD
POSTAGE & FEES PAID
USDA
PERMIT NUMBER G268