

Comparison of Fertility Sources in a Three-Year Crop Rotation

Chris Bruynis, Agriculture and Natural Resources Extension Agent
Ed Lentz, District Agronomy Specialist
Phil Rzewnicki, On-Farm Research Coordinator

Objective

The objective of this research was to determine the acceptability of poultry litter as a replacement, at least in part, for commercial fertilizer in a crop-rotation system. The research design compared the cooperating farmer's normal fertility program, consisting of all commercial fertilizer, to a fertility program using poultry litter plus commercial fertilizer.

Background

Cooperator:	Tim Wood	Soil Test:	pH 7.2, P 61 lb/A, K 157 lb/A
County:	Wyandot		OM 2.6%
Nearest Town:	Marseilles	Variety:	Podach
Soil Type:	Blount silt loam	Fertilizer:	See Methods
Drainage:	Surface	Herbicide:	None
Tillage:	Minimum Till	Planting Date:	October 8, 2000
Previous Crop:	Soybeans	Seeding Rate:	1.67 million seeds/A
		Harvest Date:	July 6, 2001

Methods

A 40-acre field was divided into six replications of two treatments in systematically assigned pairs. The width of each treatment area was 90 feet, and the length was 1,300 feet. The arrangement of treatments has been maintained for three years. The manure and commercial fertilizer was incorporated with an offset disc at time of application. The field was prepared for planting with a field cultivator for year one and no-tilled the following two years.

Harvest data are based on harvesting one pass of the combine within each replication. Yields were adjusted for moisture content to 15.5% moisture for corn, 13.0% for soybeans, and 13.5% for wheat. Other than nutrient source, all tillage, herbicide application, planting rate, and other inputs were identical for the entire field. Listed in the chart on the following page are the different nutrient applications and the month of application.

The poultry litter, based on several analyses of the product used, contained on average 100 lbs P₂O₅, 70 lbs K₂O, and 40 lbs nitrogen per ton. A 4-ton application should supply sufficient nutrients for three or more crops. Commercial fertilizer application decisions were based on Extension Bulletin E-2567, *Tri-State Fertilizer Recommendations for Corn, Soybeans, Wheat, and Alfalfa*. Based on the bulletin, sufficient commercial fertilizer was applied for two crops.

Table 1. Fertility Programs

Treatment 1 Poultry Litter plus Commercial Fertilizer			Treatment 2 Commercial Fertilizer		
Application	Amount	Date	Application	Amount	Date
Poultry Litter	4 tons/A	March 1999	0-0-60	250 lb/A	March 1999
6-19-6 starter	120 lb/A	April 1999	18-46-0	150 lb/A	March 1999
28-0-0	320 lb/A	June 1999	28-0-0	300 lb/A	April 1999
46-0-0	200 lb/A	April 2001	6-19-6 starter	120 lb/A	April 1999
			28-0-0	320 lb/A	June 1999
			46-0-0	200 lb/A	April 2001

Results

Table 1. Crop Yields for Three Years.

Treatment	1999 Corn Yield (bu/A)	2000 Soybean Yield (bu/A)	2001 Wheat Yield (bu/A)
1	143.6	41.5	66.5
2	141.6	43.1	61.3
LSD (0.05)	NS	NS	4.3
F	< 1	1.9	9.7
CV (%)	4	4.7	4.5

Summary and Notes

During 1999 and 2000, there was no statistical difference in corn and soybean yield between the two treatments. However, in 2001, there was a statistically significant difference in wheat yield between the two treatments. The 2001 yield difference is partially explained by management decisions not to apply additional phosphorous or potassium. According to the Tri-State Fertility Bulletin recommendations, inadequate commercial fertilizer was applied in 1999 for three crops. The decision not to apply additional fertilizer was based on crop prices and nutrient levels already present in the soil.

Upon completion of harvesting three crops, the economic differences between the two systems should be examined. At the time of application, the poultry litter cost \$15 per ton, including spreading charges, for a total of \$60 per acre. The commercial fertilizer, in addition to the amount applied to both treatments, cost \$57 per acre plus \$4.50 application fee, for a total cost of \$61.50. The input costs of the two systems are basically the same in this example.

Examining the gross returns for the crops harvested during the duration of the research project indicates that the two systems realized similar results. Using a market price of \$2 for corn, \$5.50 for soybeans, and \$2.25 for wheat, the three-year income per acre was \$658.18 for the commercial plot and \$665.08 for the poultry litter/commercial fertilizer plot. The \$6.90 per acre difference is minimal and should not be interpreted that one system is more profitable than the other.

Further research is needed to determine changes in soil properties and nutrient composition between the two systems. Soil samples taken from the plots in 2000 indicated that the poultry litter plots tended to be higher in phosphorous and pH when compared to the commercial fertilizer plots. Research methods were not designed to statistically analyze soil properties in this research project.

Acknowledgments

The poultry litter used in this research was partially donated by Organigro, Inc., Jack Lill, Sales Representative, 740-386-1807. Soil testing, commercial fertilizer application, and technical support was provided by Farmers Commission Company, Bill Thornton, Agronomist, 419-294-1974. The cooperating farmer, Tim Wood, provided all additional inputs and labor to plant, harvest, and maintain the plot for three years.

For additional information, contact:

Chris Bruynis
The Ohio State University Extension
bruynis.1@osu.edu