

Nutrient Assessment and Distribution of Animal Manure

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Assessment of manure nutrient content in North Carolina indicates that this important source can represent substantial percentages of plant nutrient requirements in certain areas of the state.

NORTH CAROLINA is one of the leading states in animal production. Trends in this industry towards production consolidation and intensification, while sound from an economic and management perspective, can create a potentially significant negative environmental impact from large amounts of animal manures.

A nutrient assessment project was initiated to: 1) assess current generation of manure by county, 2) determine amounts of nutrients from manure that could be made available to agronomic crops, 3) determine the quantity of nutrients required in each county, 4) determine the amount of nutrients purchased in each county, 5) calculate the percent of agronomic crop nutrients that could be supplied by animal manure, and 6) determine the nutrient balance in each county after animal manure and purchased nutrients are considered.

The Situation

In 1989, approximately 20.7 million tons of animal manure were generated in North Carolina. Because many animals are not confined, only about 52 percent of the manure can be collected for use. Manures in 1989 contained the equivalent of 158,000 tons of nitrogen (N), 108,000 tons of phosphate (P_2O_5), and 101,000 tons of potash (K_2O). Quantities of other nutrients were also measured.

Some nutrients are not released from manure during the first year after application, while others are lost in storage or in the field due to volatilization, leaching, or denitrification. We estimated that only 20 percent (31,846 tons/year) of the N, 40 percent (42,912 tons/year) of the P_2O_5 , and 29 percent (29,795 tons/year) of the K_2O were available for plant usage. Considering the statewide nutrient requirements of agronomic crops and pasture and the plant-available nutrients from manures, 15 percent of N, 55 percent of P_2O_5 , and 39 percent of K_2O requirements could be met with manures. Manure would provide all P_2O_5 requirements for agronomic crops (except legumes) in 13 counties and all K_2O requirements in 8 counties.

Commercial fertilizer sales data were considered in assessing county nutrient balances. These data may reflect some bias because fertilizers purchased in one county may be used in another. However, based on this input, approximately 23, 19 and 25 percent of the counties had surplus quantities of N, P_2O_5 , and K_2O , respectively, utilizing a crop base excluding legumes.

This assessment is being used by the North Carolina Cooperative Extension Service to focus and network educational efforts on animal waste management where there is the greatest need. Extension

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anced. Soil test P and K values were high for all three yield categories (Table 4).

Table 4. Soil test levels for P and K for each yield category.

Yield category, bu/A	Average yield, bu/A	Soil test values	
		P	K
		----- ppm -----	
80-120	103	162	289
121-160	142	115	189
161+	171	119	254

Adequate and Balanced Nutrition for Most Efficient Yields

High yielding corn requires more total nutrients, but often those nutrients are used more efficiently because of the presence of adequate amounts of each nutrient and the utilization of other BMPs. Previous research has shown that nutrient uptake per unit of production for MEY corn is remarkably stable, suggesting a lack of luxury consumption with high nutrient availability. Split nutrient applications, particularly N, can have dramatic effects on N use efficiency as can the presence of adequate amounts of P and K.

Data from the Kent County MEY Club indicate that production in the highest yield category (161 bu/A up) required only 1.2 lb N/bu of grain compared to 1.7 lb of

N/bu in the 80 to 120/A yield range. Continuing as one of the challenges of MEY production is to better understand fertilizer placement and timing effects on plant nutrient uptake and nutrient interactions.

MEY and Economic Sustainability

Top corn producers in the Kent County MEY Club verified the principle of MEY . . . that highest profits result when high yields are achieved (Table 5). Highest profits resulted when BMPs were integrated into effective and efficient production systems. These 172 farm-years of data indicate that highest yields were associated with substantially lowered production costs per bushel, a greatly elevated gross return and significantly higher net profits.

Clearly, the integration of BMPs into an MEY production system provided for all of the targeted aspects of crop production . . . higher input efficiency, reduced per unit production costs, higher overall profitability, and improved farm economic sustainability. The Kent County MEY Club members benefited from their mutual experiences and the sharing of knowledge that such joint activities generate. ■

Table 5. Production costs and net return summary for MEY Club corn production.

Yield category, bu/A	Average yield, bu/A	Production cost		Gross return @ \$2.60/bu, \$/A	Net profit (no land cost)	
		\$/A	\$/bu		\$/A	\$/bu
80-120	103	228	2.22	269	41	0.38
121-160	142	240	1.70	370	130	0.90
161+	171	231	1.36	445	213	1.24

Cost of land is excluded from the calculation.

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agents are being encouraged to include manure management in their plans of work and to share this information with their county commissioners and advisory boards.

Extension agents are being encouraged to use the animal distribution maps that were developed to initiate discussions with livestock and poultry producers on the need to consider dispersing livestock

operations to prevent "clustering" of animal units that might serve as point sources of water contamination if they exceed the crop nutrient needs of the area.

Meetings with the fertilizer industry are being conducted to discuss the potential impact of these findings on sales and to explore opportunities for incorporating organic sources into existing fertilizer operations. ■