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Nutrient Losses From Conventional and No-Till Cornfields

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Farmers must be concerned about both the monetary loss and the threat of groundwater and surface water pollution associated with the loss of plant nutrients from their fields. There is also an increasing public concern about pollution and the role of agriculture in nonpoint-source pollution. Movement of water over the surface of the soil as well as through the soil profile increases the potential for loss of water-soluble nutrients, especially nitrates.

The tillage system affects the amount of water moving over the surface and through the soil. Plowing has the short-term effect of enhancing the rate of water moving into the soil. However, after several rains, the soil settles and a crust may form at the surface. Long-term studies of no-tillage and conventional tillage often show greater infiltration in the relatively undisturbed no-tillage soil.

Since fertilizer is usually applied on the surface of no-tillage soil, there is a threat of greater losses under no-tillage, especially if heavy rainfall occurs shortly after fertilizer application. Also, in no-tillage, non-mobile nutrients tend to remain near the soil surface where they are usually bound to soil clay and organic matter. On the otherhand, no-tillage and other conservation tillage practices reduce soil sediment and water runoff losses.

Studies at the Agronomy Research Farm at Lexington since 1984 on a Maury silt loam soil show that nitrate and soluble phosphorus concentrations in the runoff water were sometimes greater from no-tillage than from conventional tillage corn plots. However, the mean values (Table 1) of all events measured

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during this study were higher for the conventionally tilled treatments. The highest concentrations were measured in runoff that occurred shortly after fertilizer application.

Total runoff losses of nitrate and soluble phosphorus were very small on this well-drained limestone soil, representing less than 1% of the amount of fertilizer applied. Thus the economic loss directly related to surface runoff of nitrogen appears to be negligible. Concentrations of nitrate were higher than the critical level of 10 ppm N set by Environmental Protection Agency on a few rainfall events following fertilizer applications. However, the mean of 5 to 6 ppm N is well within safe levels for human or animal consumption. Furthermore, the nitrate level is likely to be diluted further before reaching a stream. Deep leaching losses may be a greater threat on the well-structured limestone soils than surface runoff and sediment losses. Since no-tillage decreases surface runoff and increases infiltration, the additional percolating water may result in more leaching of nitrate.

Table 1. Nitrate and soluble phosphorus losses from soil erosion plots at Lexington, Ky. (June 1984 to April 1987)

Mean Concentration		Total Losses	
Conventional	No-tillage	Conventional	No-tillage
-------ppm-------		------lb/ac------	
	Nitrate-N		
6.0	4.6	1.78	1.57
	Phosphorus		
0.74	0.68	0.42	0.23

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