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ISU RESEARCH REVEALS NEW INFORMATION ON NITRATES IN WATER

Recently Rick Koelsch, professor at UNL, described the results of a long-term field study with poultry manure conducted by researchers at Iowa State University. They concluded that poultry manure, when applied at a rate to meet the crop nitrogen (N) requirements, can reduce nitrate loss and achieve equal or better yields in corn soybean production systems. This research effort entitled “Long-Term Effects of Poultry Manure Application on Nitrate Leaching in Tile Drain Waters,” evaluated tile drain field plots over 12 cropping seasons. While this research focused on nitrate (NO₃-N) loss by field-tile drains (typically placed 3 to 6 feet deep), similar trends would be anticipated in Nebraska for nitrate leaching below the crop root zone and the eventual impacts on ground water and, possibly, surface water quality.

The research team evaluated four N treatments including poultry manure application rates of 150 lbs. N/acre; 300 lbs. N/acre; urea ammonium nitrate (UAN) at 150 lbs. N/acre and a control at 0 lbs. N/acre on a tile-drained field near Ames, IA from 1998 to 2009. Manure and UAN were typically applied on the same day between mid-April and mid-May. The research was conducted in loam soils with organic matter averaging 3.4% in the top 12 inches. Nitrate-N loss was measured from mid-March to October.

Average cumulative nitrate-N loss for the commercial UAN fertilizer treatment was significantly greater than nitrate-N experienced by the poultry manure 150 treatment. In addition, over-application of animal manure (300) increased nitrate-N movement to tile drains more than an agronomic rate of commercial fertilizer (UAN150) or manure (PM150). Nitrate losses were highest during March through June (periods of low evapotranspiration rates and high precipitation) and lowest during July through September (low precipitation, higher evapotranspiration, and deeper root zone).

The take home message is poultry manure applied at agronomic rates reduces loss of nitrate from the crops root zone as compared to commercial fertilizer and over-application of manure.

A look at 141 research studies by XIA (et al., 2017) explains three likely reasons why.

- 1) Slow release of nitrogen stored in manure’s organic matter results in nitrate release later in the growing season;
- 2) Rapid soil microbial growth resulting from manure’s carbon (energy for microbes) immobilizes nitrate-N early in the growing season. This microbial N is released later in the crop growing season; and
- 3) Improvements in soil properties including water stable soil aggregates and cation exchange capacity is more apt to hold plant nutrients in place.

Another take home message is poultry manure demonstrates equal or greater yields than commercial fertilizer when applied at similar nitrogen rates. In fact, the authors also noted that land application of poultry manure according to recommended nitrogen rates is an environmentally preferable source.



Koelsch further explained most animal manures will demonstrate similar results and, if applied at agronomic rates, reduce the risk of nitrates in Nebraska's ground water. The key is taking samples and knowing what the agronomic rate is that you are applying. With today's technology that is a no brainer for those lucky enough to have a manure source. Based on past research I would also pencil in 6-8 bushels per acre more corn and 2 bushel increase in soybean yield.

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