

Livestock Manure Utilization in No-till Cropping Systems

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SCIENCE

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Editors' Note: Reprinted from bulletin NM-1292 (August 2005) with permission of the authors and North Dakota State University. The authors emphasize that the publication in general is referring to beef manure from an open-air feedlot. Other manures can be surface-applied as well, but N losses may be significant.

Concern for the environment, water conservation, and economic savings through reduced fuel use have been the driving forces for adopting no-till crop production in North Dakota. Concern for the environment, economic savings through reduced commercial fertilizer dependence and, more recently, federal government incentives have driven enhanced manure management in the state.

North Dakota livestock producers have increased their reliance on manure nutrient credits to supply their crops with needed plant nutrients. They have done this voluntarily because they realize the value of the nutrients in the manure or they want to take advantage of government incentive programs.



Photos by Jay Fuhrer.

Beef feedlot manure being spread at Gabe Brown's near Bismarck, ND. No tillage will be done—rain does the incorporation. Manure contains many secondary and micronutrients as well as N, P, and K. (See the Dec. '06 *Leading Edge* for more on Gabe Brown's operation.)



No-till crop producers with livestock are concerned with surface, nonincorporated manure application for several reasons: availability of nutrients to the crop, increased weed competition, and nutrient stratification in the soil surface. Environmentally, a major concern is surface water contamination when surface-applied, nonincorporated manure leaves the field in runoff.

Environmental Issues

The transport of manure nutrients off-site in runoff is a major source of surface water contamination. Phosphorus and nitrogen in surface runoff are the major contributors to the impairment of lakes and ponds through the process of eutrophication. Eutrophication is the result of excessive bacteria and algae growth in surface waters due to nutrient enrichment, usually of nitrogen and phosphates. When this growth dies, other bacteria decompose the material, depleting the waters of oxygen, resulting in fish kills. Eutrophic waters contain high levels of bacteria and algae that cause taste and odor problems. In addition, certain types of algae in eutrophic waters are toxic to livestock and humans.

A recent study in Wisconsin¹ assessed the amount of phosphorus (P) in runoff from no-till plots with nonincorporated manure applications versus chisel-plowed plots with incorporated manure applications. The researchers found higher concentrations of dissolved P in the runoff from the no-till plots versus the chisel-plowed plots, but the total amount of P lost was lower for the no-till versus the chisel plow. They stated that the increased infiltration of water in the no-till plots lowered the sediment loss and reduced the total P load in runoff.

These results showed opposite effects on total P loss than what was expected from surface-applied nonincorporated manure. The researchers suggested examining all aspects of a cropping system when designing nutrient management recommendations to minimize losses of P that cause surface water pollution.

No-till crop production increases the amount of soil macropores and allows for greater water infiltration, which could lead to nitrate (N) contamination in groundwater.

¹ L.B. Bundy, T.W. Andraski & J.M Powell, 2001, Management practice effects on phosphorus losses in runoff in corn production systems, *J. Environ. Qual.* 30: 1822-1828.