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Natural Resources Research Update

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Title: Conservation practices to protect surface water from manure nutrients

Contributing Scientists: John E. Gilley

Location: Agroecosystem Management Research Unit, Lincoln, NE

Text: Runoff from cropland areas receiving manure may contribute to increased nutrient concentrations in streams and lakes. The use of crop rotations results in varying types and amounts of residue appearing in a particular field during alternating years. The tillage system that is used can significantly affect crop residue cover. The incorporation of manure following land application helps to conserve nutrients and reduce odors. However, the reduction in residue cover caused by tillage can also increase the transport of particulate P in runoff. Vegetative filters have been successfully used to reduce nutrient movement to surface waters. Narrow grass hedges placed at selected intervals along the contour can be established at a fraction of the cost of terraces and can serve as an effective surface water quality control practice. Stiff erect grasses contained in the hedges promote sediment deposition and the formation of berms that diffuse and spread overland flow. Since grass hedges are placed at relatively short intervals along the hillslope, sediment carried by overland flow moves only a short distance until it is deposited. Surface waters can be protected from nutrients in manure by adopting cropping, tillage and conservation practices best suited for conditions existing on individual farms. The objectives of this project were to: 1) determine the influence of tillage and crop residue on the movement of manure nutrients to surface water, and 2) evaluate the effectiveness of narrow grass hedges in reducing nutrient transport to surface waters. The transport of P in runoff was measured from sites containing corn, soybean or winter wheat residue on which beef cattle or swine manure was added under either disked or no-till conditions to meet crop nutrient requirements. Tests were conducted near Council Bluffs, Iowa and Lincoln, Nebraska to determine the effectiveness of narrow switchgrass hedges in reducing P transport from soils on which manure had been recently applied. Runoff concentrations of dissolved P (DP) were found to be significantly greater when the soil was not disked. Disking of beef cattle manure following application resulted in DP concentrations of runoff that were less than 1 mg L^{-1} , an established critical limit. The concentrations of DP and total P (TP) in runoff following the application of beef cattle or swine manure to plots containing corn, soybean

or wheat residue were not significantly affected by the type of residue or residue rate. On the swine manure treatments, concentrations of DP in runoff were similar for residue and no-residue conditions. For conservation tillage systems where a surface cover of at least 30% is maintained, disking is recommended as a best management practice to conserve nutrients contained in manure and reduce potential odor problems. A 0.75 m wide switchgrass hedge located on a Monona soil near Council Bluffs, Iowa reduced runoff concentrations of DP, particulate P (PP) and TP from no-till plots where beef cattle manure had been recently applied by 47, 38, and 40%, respectively. Corresponding reductions in runoff concentrations as a result of a grass hedge on the disked plots was 21, 43 and 38%, respectively. Runoff concentrations of DP from a Sharpsburg soil near Lincoln, Nebraska having a Bray soil P content of 225 mg L⁻¹ was reduced by 31% after moving through a 1.3 m wide narrow switchgrass hedge. Narrow grass hedges can serve as a cost-effective best management practice for reducing P losses in runoff from fields on which manure is applied.

Gilley, J.E., B. Eghball, L.A. Kramer, and T.B. Moorman. 2000. Narrow grass hedge effects on runoff and soil loss. *Journal of Soil and Water Conservation* 55(2):190-196.

Nicolaisen, J. E., J. E. Gilley, B. Eghball, and D.B. Marx. 2007. Crop residue effects on runoff nutrient concentrations following manure application. *Trans. of the ASABE*. 50(3):939-944.

Gilley, J.E. and B. Eghball. 2008. Narrow grass hedges effects on nutrient transport following manure application. *Trans. of the ASABE*. 51(3):997-1005.

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