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Manure application, reduced runoff and erosion, and soil aggregate stability

Charles S. Wortmann, Charles A. Shapiro

Abstract Text:

Surface application of manure may increase the risk of phosphorus loss in runoff. Manure application, however, often results in increased soil aggregate stability with reduced runoff and erosion and, therefore, reduced P transport potential. Three field studies were conducted with silt loam or silty clay loam soil in Nebraska to determine how water-stable soil aggregation in the 0- to 25-mm soil depth is affected: 1) by application of raw or composted feedlot manure; 2) by repeated annual manure application; and 3) by the residual effect of composted manure applied five to seven years before sampling. Large macro-aggregates (>2 mm) were increased 200% or more by both manure and compost application within 15 days after application; the effect persisted for the seven months of study with a greater effect due to compost application. Aggregate stability was similar for incorporation and no incorporation of the applied compost or manure. Bray-P1 in large macro-aggregates was 200% more than for the whole soil sample with manure or compost applied, but Bray-P1 in large macro-aggregates was similar to the whole sample in the control. Annual application of swine slurry for several years resulted in a 20% increase in aggregates >250 μ m. After four years of no compost following three years of compost application, aggregate size distribution was similar for the compost- compared to the no-compost-applied treatments. Increased macro-aggregate formation and high Bray-P1 in these aggregates may protect against P loss in runoff due to reduced runoff and erosion and protection of P in water-stable large macro-aggregates.

Impact Statement:

This research has resulted in improved understanding of the reasons for reduced runoff and erosion following manure or compost application, and for the decline in risk of P runoff with time following manure application.