

CATTANACH, ALLAN W., GILES, JOSEPH F., LAMB, JOHN A., AND NORMAN R. CATTANACH. Soil Science Departments, North Dakota State University and the University of Minnesota, Fargo, ND 58105. Primary tillage effects on soil susceptibility to erosion after sugarbeet harvest.

#### ABSTRACT

Erosion damages hundreds of thousands of acres of arable land in Minnesota and North Dakota each year, according to Soil Conservation Service data. Environmental protection and erosion reduction is desired by the public and sugarbeet growers. According to an annual sugarbeet grower survey, the most common tillage tools used after the 1991 sugarbeet harvest were chisel plows, disks, field cultivators, and deep tillage tools; 48, 24, 14, and 7%, respectively. Field experiments were conducted in 1989, 1990, 1991, and 1992 to determine the effect of tillage after sugarbeet harvest on subsequent crop yields, percent ground cover, surface roughness, and soil aggregate size. Tillage was done with field size equipment in late October each year.

Use of a field cultivator after beet harvest increased residue cover by 69% versus untilled checks. Residue cover was increased by 20% with a disk but reduced 4% and 85% using a chisel plow and moldboard plow. Small reductions in ground cover percent were observed over the winter months.

Field surface random roughness was greatly increased by moldboard plowing and significantly increased by the chisel plow and disk operations. Random roughness values for the field cultivation treatment were not significantly different than the untilled check treatment.

Surface soil samples from the 0- to 2-inch depth were dry sieved to determine soil aggregate sizes. Soil aggregate geometric mean diameter in the fall was greatly increased by moldboard plowing. Small increases in geometric mean diameter occurred after fall tillage with a disk and chisel plow. Tillage with a field cultivator after beet harvest had almost no effect on soil aggregate geometric mean diameter. Overwinter weathering processes reduced geometric mean diameter of soil aggregates by about 50% for the no-till, chisel, disk, and field cultivator treatments on the Fargo silty clay soil. Geometric mean diameter was reduced only about 20% after overwinterizing on the Bearden-Lindass silt loam soil. Aggregate geometric mean diameter decreased about 80% over winter on both soils following fall moldboard plowing. Geometric mean diameter aggregate size remained above the 0.84 mm minimum particle size erosion threshold for all soil types and tillage operations.

Small grain yields the year following fall tillage were not affected by tillage treatment at any location.

These results indicate percent ground cover can be significantly increased after sugarbeet harvest by tillage with a field cultivator or disk. Tillage with a disk, moldboard plow, or chisel plow will also increase surface random roughness, improve snow catch, and reduce erosion potential. Surface soil aggregate size may also be increased and erosion potential decreased with proper fall tillage tool selection.