Rates of Water Entry Into a Chernozem Soil as Affected by Age of Perennial Grass Sods

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SYNOPSIS. Four years of grass in a rotation on a chernozem soil substantially increased the rate of water intake into soil over that of grain-fallow sequence. Application of nitrogen fertilizer did not affect the rates of water entry into soil.

INVESTIGATION of the effects of perennial grasses on soil properties in Nebraska was undertaken 20 years ago because of the interest in re-seeding land to grass and the demand for information on the value of grass in dry-land cropping systems for maintaining soil organic matter, improving soil tilth, and providing protection against erosion. At present, the interest in grass plantings has been intensified as a result of governmental restriction on acreage of wheat and corn, favorable livestock prices, and conservation planting.

In 1946, the first 10-year cycle of a grass experiment at the North Platte Station was completed and the effects of grasses on the total nitrogen and carbon contents of soil, pore space, and aggregation were published (4, 5). In 1956, the second 10-year cycle was completed. A portion of the results on the effect of age of grass stand and the application of nitrogen on the physical properties of soil is reported herein.

PROCEDURE

Area selected for the study was identical to that reported by McHenry et al. (4) for the first 10-year cycle of grass experiment. Plots are located on a Holdrege silt loam, a chernozemic soil. The second 10-year cycle consisted of 4 replications of 18 one-tenth acre plots of which 16 were in grass. Intermediate wheatgrass, Agropyron intermedium, and bromegrass, Bromus inermis, were sown in pure stands on fallow land every second year. The remaining pair of plots in each replication to cash grain-fallow systems for the 20-year period. In 20 years, the various plots were in grasses for 4, 8, 12, and 16 years.

In the first 10-year cycle, no nitrogen was applied to plots, but in the second 10-year cycle, one member of each pair of plots received 40 pounds of nitrogen per acre, every spring. One-half of each plot was mowed late in the growing season, the other half was mowed late in the growing season, forage was left on the ground. In addition, 3 plots with 6 replications of a 5-year sequence of corn, corn, and wheat were available for comparing the effects of grasses on the physical properties of soil.

At the end of the second 10-year cycle, rates of water entry into soil were measured. Three of the 4 replicates were covered with plots raked for hay. This measurement has proved satisfactory for evaluating structural changes in the surface soil of Nebraska (6, 7). Rates of water entry into soil (single determination) were measured in double cylinders with an inner cylinder 12 inches in diameter, cylinder 18 inches in diameter. The inner cylinder was driven 5 inches into the soil and outer cylinder 4 inches. Water in the cylinders was maintained on the soil surface for 6 hours. Measurements were taken during August and September when moisture in the soil was at or near field capacity. After measurement of water entry into soil, the inner cylinder was removed and the plots raked for hay. This measurement has proved satisfactory for evaluating structural changes in the surface soil of Nebraska (6, 7). Rates of water entry into soil (single determination) were measured in double cylinders with an inner cylinder 12 inches in diameter, cylinder 18 inches in diameter. The inner cylinder was driven 5 inches into the soil and outer cylinder 4 inches. Water in the cylinders was maintained on the soil surface for 6 hours. Measurements were taken during August and September when moisture in the soil was at or near field capacity.

RESULTS

Data on the rate of water entry on plots of Bromus inermis and Agropyron intermedium were subjected to analysis of variance. Effects of grass, age, fertilizer, and interactions of grass × age, grass × fertilizer, and grass × age × fertilizer were not statistically significant.