Effects of Crops and Soil Treatment on Yields and Erosion

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Erosion is a serious problem on the light-colored loessial upland soils in southern Illinois. Two experimental projects conducted within the state are of interest in connection with this problem. These are (a) cooperative studies begun in 1938 at the Dixon Springs Experiment Station by the Soil Conservation Service, U. S. Dept. of Agriculture, and the Illinois Agricultural Experiment Station, and (b) the Elizabethtown Soil Experiment Field established by the Illinois Agricultural Experiment Station in 1918. By combining results from both these projects, the rates of erosion during production of various crops, as well as the long-time effects of good management and rotation on productivity and erosion, can be presented. These results are applicable to a large problem area covering several million acres in Illinois and adjoining states.

DESCRIPTION OF PLOTS

The plots used for measurement of soil losses at the Dixon Springs Experiment Station are located on 5 and 9% slopes. The plots were treated with limestone (3½ tons an acre) and 32% superphosphate (300 pounds an acre) in the fall of 1936 or in the spring of 1937. A 3-year rotation of corn, winter wheat, and rye grass was used. An additional application of 150 pounds an acre of 20% superphosphate was added on the plots each third year with the winter wheat.

The Dixon Springs results reported in this paper are from duplicated plots 140 feet in length. Data are also available from plots 15, 70, and 210 feet. The effect of length of slope on soil and water losses will be discussed in a later article.

One admitted weakness in design of this experiment is that each crop is not represented each crop year. The number of plots involved would have been beyond the facilities available at the station. Experience has shown that the critical period from an erosion standpoint during production of corn under the conditions of the experiment was from May through July, while the critical period in wheat production was October through April. As these critical periods occur during different seasons of the year, having each crop represented each crop year would permit accumulation of more data in a given period of time, but would not increase the accuracy of the results obtained from a specific number of crops produced.

The soil on the Elizabethtown Soil Experiment Field is a reddish-yellow silt loam with slowly to moderately permeable subsoil. Four series of plots were established and initial soil treatments applied in 1917. Nine systems of soil treatment were established, involving manure, limestone, rock phosphate, residues, and potash. These systems, providing for a step-by-step build up from no treatment to somewhat complex combinations are discussed by Bauer and others (1).

The rotation used at Elizabethtown was modified and again in 1931. Corn and winter wheat, however, have been in the rotation continuously since 1918. The 4-year rotation used since 1931 is corn, winter oats, clover-alfalfa hay, and again in 1931. Corn and winter wheat, however, have been in the rotation continuously since 1918. The 4-year rotation used since 1931 is corn, winter oats, clover-alfalfa hay, and (b) the Elizabethtown Soil Experiment Field established by the Illinois Agricultural Experiment Station in 1918.

To measure differences in amount of erosion on treated plots as compared with the untreated or check plots, files were examined. Soil samples were collected in 1935 and analyzed for total organic matter, total base capacity, and total replaceable bases.

RESULTS AND DISCUSSION

EFFECT OF CROPS ON EROSION

The total amount of soil lost during a given period when land is farmed to a rotation in which corn-winter grain combination may be expected to be as large as was the case on the plots at Dixon Springs. Soil moisture is frequently a limiting factor in the early fall for germination and growth of fall grains. Wheat frequently fails to make effective growth to protect the soil (Fig. 1). The soil, though treated with lime and phosphate, was low in organic matter. Removal of corn stubble and grazing of wheat in the spring limited the proportion of the land of carbonaceous residues which would effectively increase organic residues and reduce erosion.

Soil losses were greater from plots in wheat on the 5% slopes and practically equal on the 9% slopes. In some seasons soil losses from the treated plots varied considerably; however, the differences appear significant. The average