Erosion in Relation to Rainfall, Crop Cover, and Slope
on a Greenhouse Plot

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SATISFACTORY methods of estimating the effectiveness of erosion control practices that may be applied to field areas are necessary. The discovery and evaluation of the relations that exist between the factors that affect erosion and rate of erosion are the objects of investigations dealing with this subject. Notable progress has been made in bringing the contributing factors together into an equation of relationship. Zingg (5) presents a rational equation relating erosion to the length and degree of slope. The constant of variation in the equation by Zingg includes, among other factors, that of the effects of crop cover and climate which together form a crop climatic constant. The crop sequence studies on the Soil Conservation Experiment Station at McCredie, Mo., were designed to provide information for evaluating this constant. Smith (4) has presented a recent summary of the data. Browning (1), following the suggestions of Smith (3), has used these data for evaluating the effectiveness of cropping systems and erosion control practices in Iowa.

The investigations reported here were undertaken to determine the nature of the variables that affect the rate of erosion from different slopes so as to permit a better assessment of the possibilities and limitations of an empirical equation for estimating soil erosion under field conditions.

PROCEDURE

This investigation was designed to provide information on the progressive rate of erosion from soil on different degrees of slope subjected to falling raindrops and to flowing water under conditions of a smooth surface, a furrowed surface, and a surface covered with growing barley.

Falling water.—The 1/100-acre greenhouse plot, 3.63 feet wide, 12 feet long, and 23 inches deep, and of variable slope as used by Neal (2) was also used for this investigation. The sprinkling system was redesigned to provide flexible tip nozzles oscillated by an electrically driven mechanical system that distributed the water evenly over the surface of the plot.

Flowing water.—A tank was attached to the upper end of the plot. Water was fed to this tank from a constant head source. A spreading board was provided so that the water from this tank could be delivered evenly across the top of the plot at a uniform rate of flow, thus permitting a study of erosion caused by flowing water.

Progressive erosion.—The runoff issuing from the lower end of the plot was passed through a sheet metal box with a gate that permitted the deflection of the runoff from one container to another at short intervals of time so that consecutive samples of 5 seconds duration could be obtained. By this method it was possible to obtain information on the rate of runoff and rate of soil loss throughout the period of runoff from the plot.

RESULTS

CHANGING RATES OF EROSION WITH TIME

Observations of the author indicated that the amount of erosion from freshly cultivated land was greater than from cultivated land that had been settled by a previous rain. This difference in the erodibility of a soil as affected by the condition of the soil suggested that during a rain on a freshly cultivated soil the rate of erosion must change as erosion progresses. This change in the rate of erosion must be studied by applying water at a constant rate to a freshly cultivated soil. Runoff and erosion were measured as the rain progressed.

The results of this study which are presented in Fig. 1, indicate that the rate of erosion as reflected by the density of runoff does change as erosion progresses, reaching a high rate initially and decreasing gradually to a fairly constant value. Changing rate of erosion with time introduces a difficult problem in evaluating the effect of slope on the amount of erosion because the amount of erosion is not a linear function of time.

CHANGING RATES OF EROSION ON DIFFERENT SLOPES

The progressive rate of erosion was measured on different degrees of slope, using a freshly cultivated smooth surface and a furrowed surface. Rates of rainfall were used at weekly intervals.