Runoff and Erosion Characteristics of the Brown Loam Soils

Can good management practices control erosion in typical loessial uplands?

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PREDICTING runoff and erosion accurately requires a knowledge of soil erodibility, infiltration, rainfall characteristics, and the response of the soil to protective practices. These factors were investigated at the North Mississippi Branch Experiment Station, Holly Springs, Mississippi, where the Brown Loam soils are considered representative of the 26,000 sq miles of loessial uplands in the Southern Mississippi Valley. These soils are severely eroded, but are highly responsive to good management.

An average annual rainfall of approximately 50 in. fairly evenly distributed throughout the year, a 6-month frost-free growing season, and soils of varying steepness provide representative conditions for this study.

Twelve 0.022-acre plots, six 0.25-acre plots, and one 1.45-acre watershed were established within a 20-acre field. Duplicate treatments on the 5-percent slope, 0.022-acre plots were:

- Bare fallow, maintained by tilling the soil up and down the slope as often as needed to eliminate soil crusts and to prevent the growth of vegetation
- Continuous corn with rows up and down the slope
- Continuous corn with rows on the contour
- A 3-year sod-based rotation system consisting of 2 years of bermudagrass and 1 year of corn

The 0.25-acre plots were established on 2.5, 4.25, and 10-percent sloping land (two plots on each slope) with corn planted each year on rows graded toward a grassed waterway. The watershed was in continuous corn, with contour rows but without terraces during the earlier part of the experiment, then later with terraces and a grassed waterway. The slope length on all plots was 72.6 ft.

Two recording rain gages were used for precipitation measurements. All plots were equipped with small H-flumes and Coshocton-type wheel samplers for measuring and sampling runoff. A modified Parshall flume, slit boxes, and slot sampler were used to measure and sample runoff from the watershed. Total precipitation and runoff were obtained from each experimental area for each storm. Total soil loss was obtained for each storm from the plots but only monthly from the watershed. Soil loss rates during selected storms were determined also from a fallow plot.

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Erosion: 200 Tons/Acre

Fallow plot data indicated that these soils are highly erodible, as evidenced by average annual soil loss of 94 tons per acre, soil erodibility factors of approximately 0.55 and soil loss rates exceeding 200 tons per acre per hr during one rainstorm.

While soil content in runoff from a fallow plot increased with increasing runoff rates for most storms, the rate of increase was not the same for every storm.

Average annual runoff from fallow plots was 48 percent of the average rainfall. Runoff was somewhat less from other plots that received vegetative cover and soil surface treatments. A positive linear relationship between runoff and slope was evidenced by data from four different slopes. Averages for the percentage of rainfall measured as runoff in the four test years ranged from 26 from 2.5-percent slopes to 35 from 10-percent slopes.

Surface runoff sometimes exceeded rainfall during wet periods. This excess is attributed to groundwater out-cropping into the plots. All but two research areas in this study has a fragipan underlying the soil surface at depths of 6 in. to 4 ft. This compact layer caused the return flow of the infiltrated water, increasing annual water losses from these areas.

Infiltration varied from almost zero when the soil was wet to more than 1.78 in. on a freshly cultivated plot. The maximum 5-min infiltration rate on fallow plots was over 2.64 iph and the minimum rate was near zero. Data from several long duration rainstorms indicated infiltration rates ranging from 0.12 to 0.20 iph on bermudagrass and corn plots.

Vegetative cover practically eliminated erosion and reduced runoff considerably over that measured from fallow plots. Contouring also was effective in controlling erosion. Contour plots had only 45 percent as much runoff and 28 percent as much soil loss as did the plots with rows planted up and down the slope. Data from a 1.45-acre watershed before and after terracing indicated terracing reduced soil loss by 50 percent. ••

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