SLOPE AND WATER RELATIONS AFFECTING THE MOVEMENT OF SOIL PARTICLES:  
II. FIELD STUDIES

LUKE A. FORREST AND J. F. LUTZ

Previous work in the laboratory has shown that both depth and velocity of water are important factors affecting the movement of soil particles. If the quantity of water is kept constant and the slope increased, the velocity is increased and the depth decreased. With certain combinations of depths and particle sizes, it is possible to decrease erosion by increasing slope.

While the work described above was being conducted in the laboratory, field studies were underway at the Soil Conservation Experiment Station near Raleigh, N. C., to determine the best grades to provide good drainage with minimum soil loss in tobacco rows.

Data from this experiment show less soil was lost from the 18-inch grade than from the 12- or 24-inch grade. This fact, together with the laboratory data, made it advisable to get mechanical analyses of the eroded material and determine the ratio of the various separates in the eroded material to those in the natural soil.

Six plots, 16 x 136.5 feet (1/20 acre) were used. They varied in grade from each other, by steps of 6 inches, from 0 to 30 inches per 100 feet of row. Mechanical rather than aggregate analyses were used because preliminary work showed that the small percentage of aggregates present in the sandy soil were destroyed by the wet sampling from the catchment basins. Representative samples of the eroded material were collected from each of the runoff catchment basins. A representative fraction of the total eroded material was composited from these samples for analysis. Analyses were made by the pipette method of the natural surface soil and of material eroded by two rains (Table 1) during the summer of 1943 and by water added to get velocity measurements. Two such velocity trials were made, one with the soil freshly cultivated and the other after the soil surface had become crusted and compact following a rain. The velocity measurements were made by adding water at a uniform rate and timing the flow of small pieces of cork over measured distances. The depth of flow was not determined, but in certain parts of the plot it was deeper than was used in the laboratory.

At the bottom of the channel between the rows, perhaps as deep as an inch during the velocity measurements. During heavy rains it perhaps was deep at the lower end of the plot in the furrow between the rows. On the ridge and at the upper end of the plot it was very shallow, being about 1 inch used in the laboratory.

As shown in Fig. 2, the major part of the runoff and erosion during the summer was caused by the rain of June 8 and 9. Therefore, averages for the runoff for the summer will not be given in more detail. For convenience in presentation, the data have been put in graphic form and the necessary discussion accompanies each graph.

PRESENTATION OF DATA AND DISCUSSION OF RESULTS

The runoff increases rapidly up to slopes of 18 inches per 100 feet of row and then is somewhat variable, within fairly narrow limits, on the steeper slopes (Fig. 1). Erosion increased with slope on the plot with 18 inches fall per 100 feet of row, lost less soil than either the 12- or the 24-inch grade. This was more pronounced with some rains than with others. Previous data, and data to be presented in, indicate that it is caused by depth-velocity relationships of the water. Soil studies to date show that this is a primary factor in account for such behavior of the 18-inch grade, and if it were related to the total, the decline would be on the 24-inch grade.

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2 Associate Soil Conservationist, Soil Conservation Service; and Associate in Soils Research, North Carolina Agricultural Experiment Station. Acknowledgment is made to M. T. Augustine, Acting Project Engineer, and Jacob A. Stewart, Engineer Aide, Soil Conservation Experiment Station, for valuable assistance in preparing the graphs and carrying out certain phases of the laboratory work. Acknowledgment is also made to T. C. Copley, Project Supervisor, Soil Conservation Experimental Station, for valuable suggestions and assistance in making the velocity tests.

3 Previous work in the laboratory has shown that both depth and velocity of water are important factors affecting the movement of soil particles. If the quantity of water is kept constant and the slope increased, the velocity is increased and the depth decreased. With certain combinations of depths and particle sizes, it is possible to decrease erosion by increasing slope.

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Table 1.—Data on the two rains causing runoff and erosion from which samples were analyzed.

<table>
<thead>
<tr>
<th>Date, 1943</th>
<th>Precipitation, in.</th>
<th>Duration, min.</th>
<th>5 min.</th>
<th>15 min.</th>
<th>30 min.</th>
<th>Condition of surface soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 8, 9</td>
<td>4.98</td>
<td>890</td>
<td>6.00</td>
<td>4.72</td>
<td>3.81</td>
<td>Freshly cultivated</td>
</tr>
<tr>
<td>July 5, 6</td>
<td>1.16</td>
<td>200</td>
<td>3.80</td>
<td>2.80</td>
<td>1.52</td>
<td>Crusted and moderate</td>
</tr>
</tbody>
</table>

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The runoff increases rapidly up to slopes of 18 inches per 100 feet of row and then is somewhat variable, within fairly narrow limits, on the steeper slopes (Fig. 1). Erosion increased with slope on the plot with 18 inches fall per 100 feet of row, lost less soil than either the 12- or the 24-inch grade. This was more pronounced with some rains than with others. Previous data, and data to be presented in, indicate that it is caused by depth-velocity relationships of the water. Soil studies to date show that this is a primary factor in account for such behavior of the 18-inch grade, and if it were related to the total, the decline would be on the 24-inch grade.