The Characterization of Slope Positions and Their Influence on the Total Nitrogen Content of a Few Virgin Soils of Western Iowa

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During the period from 1936 to 1942, inclusive, more than 2,000 sample corn yields were harvested from Tama, Marshall, Fayette, and Grundy soils in Iowa (4, 6). The effects on corn yields of A horizon depth and slope gradient were given primary consideration. Variations of A horizon depth and organic matter content within a soil series may result from many causal factors. One of these is the differences which existed in the original depths of the A horizon. During the analysis of the corn yield data it soon became apparent that the corn yield differences were caused by several factors in addition to erosion. In order to obtain some measurement of this original variability of the A horizon a study of a virgin area was made. Samples of several virgin soil profiles were collected and studied. These virgin soil profiles vary in part because they have different plant-microclimates which are related to topography. Geological erosion was also a factor.

CHARACTERIZATION OF A SLOPE POSITION

Topography or relief is recognized as one of the factors affecting soil formation (2, 3). It influences temperature, runoff, evaporation, and transpiration. Ecologists (7) have recognized some of these influences and their relationships to plant growth. Because of the modifying effect of topography on climate, the plants within a relatively small area have many different climatic environments. These are called plant-microclimates in this paper. A plant-microclimate is the climate of the immediate vicinity of the soil profile and it is the one that contributed to the soil properties. The soil climate as used by Ellis (1) and also that just above the earth's surface are included in the concept. An adequate description of the configuration of the land surface in the vicinity of a soil profile, its slope position, should provide a definite aid to the study and prediction of soil properties.

The topography associated with a soil profile site cannot be described adequately in terms of slope gradient. Slope length, direction or exposure, and curvature in addition to gradient are important in relation to soil formation. Many topographic features such as coves, spurs, knobs, and basins are distinguished by the nature of their slope curvatures.

Slope curvature has two distinct components—vertical and horizontal. Vertical curvature results from the slope gradient. Where the slope gradient increases in length, convex vertical curvature exists. Where the opposite is true, that is gradient decreasing toward the lower part of the slope, concave vertical curvature exists. These are illustrated in A of Fig. 1. Frequently a change in soil type where the vertical curvature changes from convex to concave. Horizontal curvature where the direction of exposure is changing words where the contour lines are curved straight. Where the slope directions converge toward the lower part of the slope, concave horizontal curvature exists. Where the opposite is true, convex curvature exists. The term, coves, indicates the area at the heads of drainageways which is horizontally concave. Spur is the term used to designate the area at the end of ridges where the horizontal curvature is convex.

Figure 1.—Diagram of vertical and horizontal slope curvatures.

A. Cross-sectional diagram illustrating vertical curvature.

B. Contour diagram illustrating horizontal curvature.