THE DIFFERENTIAL HEATING EFFECT OF SLOPE ORIENTATION AND ITS RELATIONSHIP TO EARLY CORN GROWTH

An Abstract of A Thesis
Presented to
The Department of Geography
Western Illinois University

In Partial Fulfillment of the
Requirements for the Degree
Master of Arts

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March 1991

ABSTRACT

The effect of topography on microclimate has been shown to significantly influence the growth rate of many plants. The purpose of this study is to determine if slope orientation influences corn growth through the resultant differential heating effect. Previous studies have shown that corn growth can be predicted by a summation of heat units accumulated above the minimum temperature necessary for growth. Measurement of these heat units is derived from soil temperature during the earliest stages of growth, and later from air temperature.

It was expected that the point of change from being a function of soil temperature to being a function of air temperature could be determined by comparing these parameters to increases in leaf area. It was further hypothesized that the differential heating effect would result in a significantly different leaf area for plants on north-facing and south-facing slopes at this point of change.

The study was conducted on an artificially constructed hill (approximately forty feet square) located in a prairie environment at approximately 90 degrees and 50 minutes west longitude, and 40 degrees and 10 minutes north latitude. The slope on the south side of the hill was about 20 per cent, and on the north side, it was about 16 per cent.

Since corn leaves are basically triangular in shape, leaf area was calculated by the formula: area equals one half of width times length. Measurements were made at noon

through May 28. After this they were made at sunset and sunrise.

Air temperatures were recorded on minimum-maximum thermometers which were maintained near the tops of the corn plants on both slopes. Thermometers were placed in the soil on both slopes, with the bulbs at a depth of four inches. Temperatures were measured at six a.m. and six p.m. C.S.T. to determine minimum and maximum soil temperatures for the day. A record of noon temperatures was also kept to insure against occasional anomalies of the normal diurnal temperature cycle.

When the rate of growth was compared to the temperature readings, it was discovered that using soil temperature as a predictor of development for plants on the south slope was only useful up to the time of emergence (May 17). On the north slope soil temperature was useful as a predictor of development through May 22.

While it was true that the heating differential gave a slight advantage to the south-facing slope at the time of emergence, leaf area on the north slope was much greater by the time that leaves were large enough to be measured. In fact, during early corn growth, the air temperature on the north-facing slope shows a significant positive correlation by the three or four leaf stage, while on the south slope, its significance as a limiting factor to growth occurs immediately after emergence,probably because it is more closely related to surface temperature.