Soil Moisture Availability in Irrigated and Nonirrigated Pastures

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Pasture production is often limited by the amount of available soil moisture. The soil acts as a storehouse for this moisture. Water is drawn out of the soil by crops as needed. It is impossible to store in a given soil sufficient moisture to meet requirements during any given growing season. If natural rainfall is above normal and well distributed, maximum yields may be secured. Such ideal seasons seldom occur.

The extent to which summer rainfall penetrates the soil and is stored for crop use has not been adequately studied. Moisture penetration and storage of available moisture vary in different soils. Location and season determine the distribution and total quantity of rainfall. Little information is available on the effect or not a plant is being adversely affected by lack of soil moisture.

This paper gives the results of four seasons' work to determine the availability of soil moisture for forage crop production. In addition a preliminary report of moisture availability and forage yields is presented for one season on nonirrigated and irrigated pastures. All measurements were made on the Dixon Springs Experiment Station, Pope county, Ill.

Methods and Procedure

The soils on which measurements were made have not been definitely correlated and named. They probably belong to the Grenada series. The surface soil is a grayish brown silt loam. The subsoil is reddish yellow silt, while the substratum is usually a compact, mottled, silty clay loam. The soils permit a very slow rate of water percolation. The least permeable stratum is usually encountered at a depth of 15 to 20 inches.

Measurements in 1942-45 on nonirrigated pasture plots were made on an 8% slope. Pastures in the irrigation study in 1948 varied in slope from 1 to about 8%.

Moisture availability was determined by the electrical resistance method as described by Bouyoucos and Mick (1, 2). Plaster of Paris blocks with imbedded electrodes were installed at 3, 9, and 18 inches on two nonirrigated runoff plots. Plot 1, severely grazed, and plot 2, moderately grazed, were selected for this study. Both plots received similar fertilizer treatments. These plots are described in detail in previous publications (3, 4). Blocks were installed at a variable number of locations ranging from 3 to 24 sites on each 1/4-acre plot. More replicates were used at shallow depths than at lower depths. Measurements were made on these plots during the period 1942-45.

In 1948, blocks were installed on 5-acre irrigated (check) pastures. Both areas were treated with 1,000 pounds of limestone and 1,000 pounds of 8% rock phosphate. A Ladino clover-grass mixture was seeded in the fall and spring following treatment. The mixture consisted of 4.5 pounds Kentucky bluegrass, 3 pounds redtop, and 2 pounds Ladino clover with a nursery of rye. In addition, a part of each field was further developed by the application of superphosphate, potash, and nitrogen. The other one-half of the field was sprayed with a sprinkling irrigation system. The other one-half was divided into 2-inch bands.

In the irrigation study, resistance blocks were installed at various depths on both the irrigated and nonirrigated pastures (Table 1).

Discussion of Results

Soil Moisture Availability Without Irrigation

Resistance readings of absorption blocks collected from the period 1942 to 1945 on nonirrigated grazing pastures indicated that soil moisture may have limited forage production. Available soil moisture is considered to be the moisture retained in the soil between field capacity and permanent wilting. According to Bouyoucos and Mick, a resistance reading of about 75,000 ohms characterizes the permanent wilting point of a fairly large number of soils. Only approximately 20% of the available moisture remains in the soil at a reading of 10,000 ohms. For the purposes of this discussion, available soil moisture is considered to be approaching a critical or severe condition at a reading of 10,000 ohms. A heavy growth of forage can deplete the remaining supply in a few days. As resistance increases available soil moisture decreases. The converse is also true.

<table>
<thead>
<tr>
<th>Plot number</th>
<th>Soil treatment*</th>
<th>Depth installed inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>L, rP, sP, K</td>
<td>3, 9, 18</td>
</tr>
<tr>
<td>2</td>
<td>L, rP, sP, K, N</td>
<td>1 1/4, 4 1/4, 7 1/4, 10 1/4</td>
</tr>
<tr>
<td>3</td>
<td>L, rP, K, N</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>L, rP</td>
<td>None</td>
</tr>
</tbody>
</table>

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