MINERALIZATION OF ORGANIC PHOSPHORUS IN WET MEADOW SOILS

WET meadow vegetation in the Nebraska Sandhills frequently responds to applications of phosphorus fertilizer, especially where legumes are present. However, the common soil tests for available phosphorus have not been especially helpful in distinguishing between “responding” and “nonresponding” meadows.

It was reasoned that differences in the capacities of wet meadow soils to supply the vegetation with adequate phosphorus might be associated with a variability in the mineralization of organic phosphorus. This idea was tested at two locations in a limited manner during 1955 as part of a comprehensive study of phosphorus utilization by wet meadow vegetation. At one location (Loup sandy loam, Soil 1) the vegetation showed a marked response to phosphate whereas at the other location (Loup sandy loam, Soil 2) the vegetation showed little or no response to phosphate. Surface horizons of Soils 1 and 2 had pH values of 7.9 and 5.9 and organic matter contents of 12.8 and 16.9%, respectively. Water table levels ranged from 28 to 55 inches below the surface for Soil 1 and 19 to 52 inches below the surface for Soil 2 during the growing season of 1955.

Initially a method of incubation similar to that described by Thompson et al. was followed. In this method the soil containers were stoppered and opened periodically for aeration. An odor of putrefaction was noted, suggesting that anaerobic conditions were present in the stoppered soil containers. Mineralization of soil phosphorus was determined by extracting the soil with 0.2 N HCl (1:50 ratio of soil and solution) prior to and following incubation. Amounts of phosphorus mineralized during periods of 20 and 40 days at a temperature of 40 °C were nearly identical for Soils 1 and 2 (table 1). From these results it was reasoned that either mineralization of organic phosphorus was not a factor in explaining differences in responses of the wet meadow vegetation to phosphate fertilizer at the two sites or the method involving partially anaerobic conditions was not satisfactory for evaluating the mineralization of phosphorus under field conditions.

In order to obtain quantitative information on the oxygen content of the air in the incubation bottles were measured with a Beckman Model D Oxygen Analyzer. The two soils used in this study, the method of aeration was followed. Further, it seems reasonable to assume from the results reported in table 1 that decidedly different amounts of mineralizable phosphorus may be obtained where aerobic conditions are maintained during incubation than where partially anaerobic conditions are maintained during incubation. Furthermore, it seems reasonable to assume that phosphorus may be an important factor in the response of wet meadow vegetation to phosphorus.

Table 1—Changes in phosphorus extractable in 0.2N HCl resulting from incubation of two Loup soils under aerobic conditions at 35°C and under partially anaerobic conditions at 40°C.

<table>
<thead>
<tr>
<th>Soil</th>
<th>Initial acid-soluble phosphorus</th>
<th>Increase in acid-soluble phosphorus after incubation</th>
<th>Aerobic conditions</th>
<th>Anaerobic conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil 1</td>
<td>16.9%</td>
<td>0.5 ppm</td>
<td>20 days</td>
<td>40 ppm</td>
</tr>
<tr>
<td>Soil 2</td>
<td>12.8%</td>
<td>0.3 ppm</td>
<td>20 days</td>
<td>40 ppm</td>
</tr>
</tbody>
</table>

Figure 1—Oxygen percentages of atmosphere in milk bottles containing 75 grams soil and incubated according to the procedure of Thompson et al.

The air in the incubation bottles were measured by the use of a Beckman Model D Oxygen Analyzer. The two soils used in this study, the method of aeration was followed. Further, it seems reasonable to assume from the results reported in table 1 that decidedly different amounts of mineralizable phosphorus may be obtained where aerobic conditions are maintained during incubation than where partially anaerobic conditions are maintained during incubation. Furthermore, it seems reasonable to assume that phosphorus may be an important factor in the response of wet meadow vegetation to phosphorus.

BARREL LYSIMETERS FOR MEASURING EVAPOTRANSPIRATION FROM CROPS

A SIMPLE weighing lysimeter constructed from drums and culvert pipe was recently developed to measure evapotranspiration from low growing crops. A standard 55-gallon oil drum was placed on the soil within a 3-foot section of 30-inch diameter culvert pipe sunk in the soil. A large-mouth 5-gallon milk bottle containing 75 grams soil and incubated at 25°C for a period of 25 days in the manner described by Thompson et al. Oxygen contents of the air in the incubation bottles were measured by the use of a Beckman Model D Oxygen Analyzer.