ASSESSMENT OF RESIDUES OF PHOSPHATE APPLICATION IN SOME SOILS OF NORTHERN NIGERIA
I. EXAMINATION OF L AND E VALUES
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SUMMARY

Phosphate residues in the soils of some manurial trials at Samaru, northern Nigeria were assessed as L and E values and by the isotopic-dilution factor. They gave significant correlations with yield and P uptake in a pot experiment. The E values, which were useful only when measured in the presence of carrier phosphate, and the I.D.F. values were both better in assessing the availability of residual phosphates than were L values on similar soils.

INTRODUCTION

The soil parameter which measures the amount of isotopically exchangeable phosphate in the soil, and is termed E or L value according to the method of measurement, has been widely and successfully used especially on fairly similar soils 7. For soils varying widely in their ability to maintain phosphate in solution, an intensity factor (phosphate potential or phosphate concentration of the soil solution 14) or a related value such as the isotopic-dilution factor 6 has been introduced. Phosphate supply to plants may therefore depend on either or both the quantity and intensity parameters 7.

In northern Nigeria Bache and Rogers 2 showed the differing implications of the quantity and intensity factors in relation to the P supply, on soils from long-term experiments in which annual dressings of dung and phosphate have been given for years. As a
continuation of this work, experiments were carried out to investi-
gate whether radio-isotope methods were able to detect the re-
side from much smaller phosphate applications such as used
by farmers. For this purpose soil samples were taken from field
experiments in which for a number of years following the ap-
lication of a phosphate fertilizer, the residual value of the fertil-
izer P was measured by means of crop response and P-uptake, and in
which the amounts of residual phosphate and its availability are
therefore known.

MATERIALS AND METHODS

Soils
Seven soil samples were collected in July, 1967 from two experimental
sites at Samaru (11°10’N, 7°30’E) in the Northern Guinea Savanna zone of
Nigeria. The samples were collected from seed beds at about 12 points with-
in each plot to a mean depth of 6 in. The manurial treatments which had
been received by the soils are given in Table 1. Soils A, E and G were from
DNPK plots (Obi 10) and Soils B, C, D and F were from a residual phos-
phate experiment of which Soil B served as a control. All were loamy fine
sands or sandy loams. The seven soil samples were slightly acid and of low
cation exchange capacity (2 to 6 me/100 g). The pH, percentage organic
carbon, and total phosphorus are reported in Table 1.

In the phosphate residual experiment it has been found that the effect of
a single application of superphosphate lasts several years (Goldsworthy,
private communication). Therefore, any method of soil analysis which is

<table>
<thead>
<tr>
<th>Symbol used</th>
<th>Previous treatment</th>
<th>pH</th>
<th>% Organic carbon</th>
<th>Total P ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>DNPK 2221* annually since 1980</td>
<td>6.1</td>
<td>5.3</td>
<td>0.46</td>
</tr>
<tr>
<td>B</td>
<td>Gypsum, 150 lbs per acre, 1964 and 1967</td>
<td>6.6</td>
<td>5.4</td>
<td>0.35</td>
</tr>
<tr>
<td>C</td>
<td>Superphosphate, 224 lbs per acre, 1966</td>
<td>6.4</td>
<td>5.1</td>
<td>0.41</td>
</tr>
<tr>
<td>D</td>
<td>Superphosphate, 224 lbs per acre, 1965</td>
<td>6.4</td>
<td>5.1</td>
<td>0.34</td>
</tr>
<tr>
<td>E</td>
<td>DNPK 0221 annually since 1950</td>
<td>6.4</td>
<td>5.9</td>
<td>0.15</td>
</tr>
<tr>
<td>F</td>
<td>Superphosphate, 224 lbs per acre, 1964 and 1967</td>
<td>6.2</td>
<td>5.0</td>
<td>0.45</td>
</tr>
<tr>
<td>G</td>
<td>DNPK 2201 annually since 1950</td>
<td>6.3</td>
<td>5.1</td>
<td>0.23</td>
</tr>
</tbody>
</table>

* 2221 – refers to 2 tons of dung, 100 lbs N, 100 lbs P, and 50 lbs K per acre per year.