Growth response of rubber seedlings to N, P, and K fertilizer in Nigeria

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Abstract. A two-year study (1977/78 and 1978/79) was carried out using GT I seedlings raised in polybags at the Rubber Research Institute of Nigeria (RRIN) main station, to determine the response of rubber seedlings to the application of N, P, K fertilizer. The fertilizers were each applied at three rates as follows: 0, 45 and 90 kg N per ha as sulphate of ammonia; 0, 14.80 and 29.60 kg P per ha as single superphosphate and 0, 9 and 18 kg K per ha as muriate of potash. Stem diameter and height were measured at monthly intervals, while dry matter of tops was estimated at the end of each year of study. P emerged as the single most important nutrient followed by N and K in order of magnitude. Growth response to N and K were enhanced by the presence of P at both levels. The degree of response was related to the level of each nutrient in the soil. Best growth was obtained in the treatments containing all three nutrients. In conclusion, application of fertilizers to rubber seedlings on the soils used, is justified by the growth increases obtained, especially where all three nutrients were applied together.

In Nigeria, natural rubber (Hevea brasiliensis) grows in areas with acid sandy soils, to which the name 'Acid Sands' have been given. These soils are well known for their low nutrient-supplying power, as a result of which fertilizer use in the raising of crops is very essential [11].

The beneficial use of fertilizers in the cultivation of rubber at different stages of growth has been demonstrated in a number of studies carried out in the major rubber-growing countries of the world [1, 5, 6, 10]. Fertilizers if properly used should enhance growth and the early attainment of buddable girth of rubber seedlings. The judicious use of fertilizers requires the proper utilization of all available information on soil characteristics and the response of the crop concerned to applied nutrients; data from fertilizer experiments are the only reliable source of the later.

At the Rubber Research Institute of Nigeria (RRIN), current fertilizer recommendations are based on the extrapolation of data from other rubber-growing countries. As a result several experiments have been initiated to study the effect of fertilizers on the growth and yield of rubber. This paper discusses the results of one of such studies in which the effect of N, P, and K fertilizer on the growth of rubber seedlings is evaluated.
Materials and method

Two trials were conducted, one in 1977/78 and one in 1978/79. In each year top soil was collected from the year's nursery site and used to fill polybags measuring 30 cm x 40 cm to attain a weight of approximately 11.40 kg. Some characteristics of the soils are shown in (Table 1). One pre-germinated seedling of the GT I clone was sown into each bag.

Table 1. Some chemical properties of the soils used in the study

<table>
<thead>
<tr>
<th>Year</th>
<th>Soil pH (H₂O)</th>
<th>Organic-C (%)</th>
<th>Bray-P₁ (mg per kg soil)</th>
<th>Exchangeable-K (mg per kg soil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977/78</td>
<td>5.45</td>
<td>1.52</td>
<td>1.01</td>
<td>46.50</td>
</tr>
<tr>
<td>1978/79</td>
<td>5.65</td>
<td>0.85</td>
<td>1.11</td>
<td>11.00</td>
</tr>
</tbody>
</table>

One month after planting, fertilizers at the rates shown below were applied to the seedlings, by drilling into the soil.

Nitrogen  – 0, 45 and 90 kg N per ha as ammonium sulphate
Phosphorus – 0, 14.80 and 29.60 kg P per ha as single superphosphate
Potassium  – 0, 9 and 18 kg K per ha as muriate of potash

Height and stem diameter were measured at monthly intervals. Aerial parts were harvested eight and six months after planting in 1977/78 and 1978/79 respectively, to determine total dry matter of tops. The results presented for stem diameter and height were those obtained six months after planting in each year of study. The experiment was a randomized complete block design with treatment combinations arranged in a factorial manner in three replicates.

Results

Effect of nitrogen (N)

In the first year total dry matter and height were increased significantly by the 45 and 90 kg N per ha applications (Tables 2 and 5) while stem diameter was increased significantly by the 90 kg N per ha treatment, when compared with the 0 kg N per ha treatment (Table 3).

In the second year the 45 kg N per ha level increased stem diameter and total dry matter significantly and at the 90 kg N per ha level only total dry matter was significantly increased, compared to the control.

The presence of P at both levels enhanced the effect of N on total dry matter, stem diameter and height in both years (Tables 2, 3 and 5).