FERTILIZER APPLICATION IN AID OF PLANTATION ESTABLISHMENT IN THE SAVANNA AREAS OF NIGERIA

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Abstract. Fertilizer trials were conducted to stimulate tree establishment and growth in the savanna region of Nigeria. The main nutrients investigated were N, P, K and B while the tree species included Azadirachta indica (Neem), Acacia auriculiformis, Eucalyptus spp., and Pinus spp. Borate application reduced the incidence of die-back of eucalypts and it also increased height growth. There was positive response to phosphate application by all species; phosphate reduced mortality considerably in pines on some sites. Response to N fertilizer by the species varied and related to type of N fertilizer. Urea was often found injurious to pines. There was strong interaction between N and P and usually response to N was not obtained on P-deficient sites. In all the cases where it was applied, there was no response to K. On more arid sites with poorly buffered soils, mineral fertilizers alone were insufficient to produce satisfactory tree growth. Application of animal manure on such sites increased survival and growth of Azadirachta indica, E. camaldulensis and A. auriculiformis.

1. Introduction

In the dry savanna region of Nigeria the challenge of forest resources management, beside meeting the needs of the population for wood and forest products, is further compounded by the necessity to ameliorate the harsh and fragile environment. This is particularly true in the extreme northern part (Lat. 12°N and beyond) of the country where soil conditions, pronounced aridity and use of inappropriate land husbandry methods have led to low forest productivity and land degradation including desertification.

Deficits of timber, fuelwood, fodder, fibre and other forest products, decline in soil productivity and uncertainty about climatic changes have accelerated the search for adaptable tree species that are either productive of needs or protective of the environment or both. Kemp (1970) had reported early trials of exotic tree species in the different bioclimatic zones of the Nigerian savanna. An aspect of these trials was to have correct choice of species in relation to climatic and edaphic variations. Fertilization is considered a management option that can correct nutrient deficiencies of some of the hitherto impoverished land and stimulate tree growth in the early stage of plantation development.

This paper gives account of fertilizer trials during experiment stage of plantation establishment in the savanna region of Nigeria.

2. Description of the Nigerian Savanna

The savanna region covers over four-fifths of Nigeria's land area and includes a wide range of soils and climatic conditions (Kemp, 1970). There is a general trend of increasing dryness from south to north. The main factor controlling the distribution of natural vegetation is
climate, particularly those climatic elements which control the availability of water. The length and severity of the dry season are principal climatic factors that determine the possibility of tree growth.

The most commonly used classification of vegetation in Nigeria is that of Keay (1959) in which the savanna is subdivided into bioclimatic zones (Table I, Figure 1), varying in annual rainfall and length of dry season:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Range of annual rainfall (mm)</th>
<th>Length of dry season (months with less than 25 mm rainfall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sabel</td>
<td>250 to 500</td>
<td>7 to 8</td>
</tr>
<tr>
<td>Sudan</td>
<td>500 to 880</td>
<td>6 to 7</td>
</tr>
<tr>
<td>Northern Guinea</td>
<td>880 to 1250</td>
<td>5 to 6</td>
</tr>
<tr>
<td>Southern Guinea</td>
<td>1250 to 1520</td>
<td>4 to 5</td>
</tr>
</tbody>
</table>

3. Materials and Methods

In the field mineral fertilizers were usually applied a few weeks after planting in a ring around the tree, 15 to 30 cm from the stem and then worked in. Factorial design with three or four replicates was generally adopted. Plot size usually consisted of 36 trees (2.7 m x 2.7 m espacement) in which the inner 16 trees were measured. Manure was applied by digging small pits (30 cm x 30 cm x 45 cm deep) and mixing the dug soil with 2 kg of animal manure. The mixture was returned into the pit before seedling planting. Tree data collected were survival percentage, stem diameter (DBH) and total height.

4. Results

Since the intensity of climatic and edaphic factors limiting tree growth varies, the results of the trials are presented according to bioclimatic zone.

4.1 Guinea savanna

The genuses that have received considerable attention in this zone belong to the eucalypts and pines.

4.1.1 Eucalypts. Boron deficiency in eucalypts is somewhat widespread in the dry tropics and hence it was the first nutrient to be investigated. In a trial at three sites, borate fertilizer was applied at the rate of 0, 28 and 57 g per tree to different species of eucalypts. Boron application was found to reduce the incidence of dry season die-back in *E. Camaldulensis*, *E. citriodora*, *E. deglupta*, *E. robusta* and *E. torellina* (Table II). The lower rate of 28 g was as effective as the higher rate of 57 g per tree.