Root Length Density of Leguminous Agroforestry Tree Fodders in Niger Delta Region of Nigeria

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Introduction

Interactions between trees and crops for below-ground resources are often as important as those for above-ground resources. Therefore, identification of suitable woody species for agroforestry systems is one of the most important challenges of agroforestry. The few studies that have attempted to evaluate woody species for farming systems in the Niger Delta Region of Nigeria have focused on *Leucaena leucocephala* and *Gliciridia sepium*, but these two species have been found to perform poorly on acid soils regarding root distribution patterns and above-ground biomass production. Evaluation and selection of leguminous fodder species for agroforestry systems depend largely on an understanding of root distribution patterns of such species (Anegbeh and Tchoundjeu 2005). This is particularly important in Nigerian agroforestry systems, which are ecologically compatible, environmentally sustainable, and commercially viable, are promoted. The objective of this study was to examine quantitatively the root length densities of three leguminous tree fodders for agroforestry systems in the Niger Delta Region of Nigeria.

Materials and Methods

The experiment was conducted from 1994 to 1997 at the High Rainfall Station of the International Institute of Tropical Agriculture (IITA) Onne in the Niger Delta Region of Nigeria (4°51' N latitude 07°03' E longitude, 30m altitude). The soils are acidic (pH 4.4). Seeds of *Enterolobium cyclocarpum* (Jacq.) Griseb., *Inga edulis* Mart., and *Pterocarpus santalinoides* L’Her. Ex DC were collected from Agodi Botanic Garden (Ibadan), IITA Onne (Port Harcourt), and Ughelli (Warri) respectively. Seedlings were raised, hardened, and established as hedgerows in 1994. Treatments were arranged in a Completely Randomized Design with three replications using a spacing of 4.0 m x 0.25 m. Three-year-old trees were used for the root studies. A pin-board method described by Anegbeh and Tchoundjeu (2005) was used to collect fine roots data. The data were analyzed using the statistical analysis systems (SAS).

Results and Discussion

Root length densities varied considerably among the treatments with the lowest density occurring in the *Pterocarpus santalinoides* treatment (Table 1). From tree-crop interaction standpoint, this low root density of *E. cyclocarpum* is important because the species will not compete with agricultural crops in agroforestry systems. *Pterocarpus santalinoides* was the most shallow-rooted species and its fine roots extended only to 40cm soil depth. As expected, the highest root density was recorded for *Inga edulis*. Roots of *I. edulis* were found at the 90cm soil depth, and *Inga* was the most deep-rooted species. *Inga edulis* is a fast-growing species attaining 3 m in height growth on acid soils in 3 years. This may explain its greatest root length density. Based on previous report, Anegbeh *et al.* (2004) concluded that *I. edulis* was a valuable agroforestry tree legume for fodder. Irrespective of the woody species, the root density was greatest at the 40-100 cm lateral distance from tree base, suggesting wide inter-row spacing (≥ 10 m) of the species. This also suggests that the inter-crops (agricultural crops) in agroforestry systems should be arranged starting from 2-3 m away from tree base to minimize negative interactions from woody species (Haggar and Beer 1993). In simultaneous agroforestry systems, desirable trees, preferably legumes, are deliberately integrated with food crops so that the tree and crop components mutually maximize sharing of resource pool. The root length densities of all the species decreased with soil depth. With appropriate design and management in agroforestry systems, the studied species may help meet the needs of rural farmers for soil fertility improvement, crop and fodder production. The results of this study support the need for selection and use of desirable woody legumes for fodder and sustainable agroforestry systems in the Niger Delta Region of Nigeria.

Table 1. Root length density (cm cm⁻³) of fine roots* of three agroforestry tree legumes grown on acid soils in the Niger delta region of Nigeria (3 years after planting)

<table>
<thead>
<tr>
<th>Lateral distance from tree base (cm)</th>
<th>E. cyclocarpum</th>
<th>I. edulis</th>
<th>P. santalinoides</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-50</td>
<td>30.2</td>
<td>83.3</td>
<td>96.9</td>
</tr>
<tr>
<td>50-60</td>
<td>38.0</td>
<td>67.8</td>
<td>29.7</td>
</tr>
<tr>
<td>60-70</td>
<td>35.5</td>
<td>68.5</td>
<td>33.6</td>
</tr>
<tr>
<td>70-80</td>
<td>30.3</td>
<td>70.5</td>
<td>21.4</td>
</tr>
<tr>
<td>80-90</td>
<td>53.2</td>
<td>32.1</td>
<td>17.3</td>
</tr>
<tr>
<td>90-100</td>
<td>34.2</td>
<td>34.0</td>
<td>39.3</td>
</tr>
<tr>
<td>100-110</td>
<td>26.2</td>
<td>92.9</td>
<td>69.9</td>
</tr>
<tr>
<td>110-120</td>
<td>45.4</td>
<td>92.0</td>
<td>98.6</td>
</tr>
<tr>
<td>120-130</td>
<td>25.5</td>
<td>42.7</td>
<td>44.6</td>
</tr>
<tr>
<td>130-140</td>
<td>44.1</td>
<td>35.6</td>
<td>43.2</td>
</tr>
<tr>
<td>140-150</td>
<td>35.4</td>
<td>34.7</td>
<td>59.7</td>
</tr>
</tbody>
</table>

*(< 2 mm in diameter)*

Conclusion

This study shows the agroforestry potential of *Enterolobium cyclocarpum*, *Inga edulis*, and *Pterocarpus santalinoides*. These leguminous species, which are also valued for fodder,
are recommended to rural farmers in the Niger Delta Region of Nigeria for use in agroforestry systems to maximize benefits from farming systems.

References

Acacia Naming Decision

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Introduction
Name changes for the large genus Acacia have been pending for a number of years. In the last issue of this newsletter it was noted that the genus was likely to be divided into at least five genera and that under the normal rules of botanical nomenclature most species of economic importance would require a name change. A final decision on how to proceed was made at the International Botanical Congress in Vienna in July 2005.

Until recently, Acacia was accepted as one genus of almost 1400 species. These species were distributed throughout the tropics and especially in Australia. Studies have now shown that species in the genus comprise three main groups, with two other smaller groups in Central America. Almost all the Australian species fall into one group of about 1000 species. Some species of this group extend to the islands of the Pacific, to Southeast Asia and to Madagascar. Most of the remaining 380 species make up two more or less equal groups that predominate in the Americas, tropical and southern Africa and tropical Asia.

The Committee for Spermatophyta of the International Association for Plant Taxonomy (IAPT) recommended retypification of Acacia so that the largest group (subgenus Phyllodineae) would not require name changes. The Committee's opinion was based on the wish to reduce nomenclatural change and inconvenience to a minimum. This recommendation was endorsed by the IAPT General Committee and passed to the Nomenclature Section of the International Botanical Congress in Vienna. A move to overturn the Committee's decision and retain the African species as type was narrowly defeated. The decision had finally been made!

What does this mean? Nothing will change until formal proposals to split the genus Acacia have been published. When this happens, it is expected that the generic names will be: Acacia for species currently in subgenus Phyllodineae; Vachellia for species in the present subgenus Acacia; and Senegalia for most species in subgenus Aculeiferum. About 30 species from the Americas currently in subgenus Aculeiferum will be included in two new genera. There will still be name changes to some very important species and, while this will be inconvenient for some, the overall disruption will be less than it might have been.

Most of the information above has been taken from a more detailed account by Bruce Maslin and Tony Orchard. This can be consulted on the following website: www.worldwidewattle.com/infogallery/nameissue/decision.php