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PRE

IMPROVEMENT OF THE PRODUCTIVITY OF

*PARASERIANTHES FALCATARIA* (L.) NIELSEN

ON DEGRADED TEA LANDS IN THE MID COUNTRY OF

SRI LANKA

by

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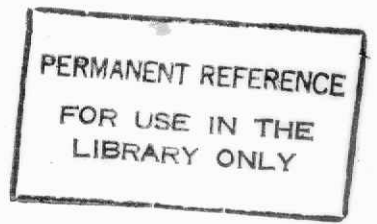
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## ABSTRACT

A large area of tea plantations in the mid elevations of Sri Lanka is being abandoned each year due to adverse production performances (23,000 ha from the period 1980- 1992). With a view of creating a more conducive and stable ecological system, most of these abandoned tea lands are earmarked for afforestation. However the process of afforestation on these degraded lands itself has become a problem as most of the introduced species fail to establish themselves well. The mineral Nitrogen in these lands has become limited because of it's continuous depletion through leaching and erosion.

The research studies included in this thesis are based on the plant *Paraserianthes falcataria* (*Albizia falcataria*) an important fast growing reforestation species. No attempts have been made in Sri Lanka to increase its productivity through improved N<sub>2</sub>-fixation or nursery practices. The limited data available on the *Rhizobium* requirements, have so far been confined to green house and laboratory experiments which have indicated conflicting results.

Therefore nodulation response of *Paraserianthes falcataria* to inoculation with *Bradyrhizobium* and fertilizer application was investigated under greenhouse and degraded field conditions. *Bradyrhizobium* strain (TAL 45) was selected as the best strain on the basis of effectiveness. Two potting media were tested to obtain healthy and vigorous seedlings for out planting within a short period of time.

The study has demonstrated that *Paraserianthes falcataria* can be nodulated by

*Bradyrhizobium* strains (introduced or native) albeit with different levels of symbiotic effectiveness. Poor nodulation of uninoculated plants showed that either the indigenous rhizobia are low in number or less effective. The study demonstrated that inoculation of *P. falcataria* was able to provide sufficient Nitrogen for its growth. Uninoculated plants were unable to provide the same yield as inoculated plants, even with the addition of nitrogen fertilizer up to a total of 100 kg N/ha. However it was confirmed that *P. falcataria* requires a small amount of N (10 kg N/ha) during early growth to satisfy the plants initial demand for N, at a time of insufficient nodulation. The optimum benefits from fertilizer application cannot be obtained on slopy land, where most of the reforestation programs are currently going on. Therefore inoculation with rhizobia is recommended as a low cost technique to overcome these problems.

In this experiment, the average rate of height increase for inoculated and uninoculated plants during the first 12 months of growth was 95cm/month and 60cm/month respectively. However, at the age of 2 years, the rate of increase in height in inoculated plants was in excess of 1.5 m/month compared to uninoculated plants which averaged 1.3 m/month. Inoculated plants with all nutrients produced the highest biomass (2659 kg dry matter per ha) at 18MAT (Months After Transplanting). Such high growth rates may be attributed to improved nursery practices, notably the use of an improved potting medium and inoculation. The study demonstrated clearly that an organic rich potting medium significantly enhanced seedling growth allowing for an early field planting (at 2.5 months). This saves maintenance cost and allows for a rapid production of seedlings.

Total N % in shoot was significantly higher (3.19% vs 2.91%) in inoculated plants than in uninoculated plants. More than 60% of total N is stored in leaves and hence a higher proportion of plant N is returned to the soil through natural litter fall. Therefore at a litter fall rate of 1700 kg/ha/yr inoculated plants will release about 54.23 kgN/ha/yr compared to 49.3 kgN/ha/yr by uninoculated plants.

Although *P. falcataria* is a tree species spontaneously nodulated by indigenous rhizobia, our data demonstrated that prior inoculation in nurseries with a selected *Bradyrhizobium* strain (TAL 45) enhanced tree growth and wood production under field conditions. However, inoculation of this tree species with *Rhizobium* has not yet become a widespread practice, though the tree is commonly planted in many tropical countries, including Sri Lanka. Therefore *Bradyrhizobium* strain (TAL 45) can be strongly recommended for the inoculation of *P. falcataria* seedlings in the plantation and reforestation programmes of the country.