B-33:Nodulation, nitrogen fixation and improved growth of *Paraserianthes falcataria*, on degraded soils of Sri Lanka

R R Premaratne[1], L H J van Holm[1], S A Kulasooriya[2]
([1]*Institute of Fundamental Studies, Kandy,*
[2]*Univ. of Peradeniya*)

Paraserianthes falcataria is a fast growing N_2 fixing tree used as a reforestation species and a shade tree in tea estates.

The tree could also occupy an important position in afforestation of abandoned tea lands, as it is adapted to grow in tea plantations.

Inoculation might be necessary to achieve maximum growth of this species in N deficient soils. However limited data available on *Rhizobium* requirements, restricted its use.

In this study *Rhizobium* requirements of *P.falcataria* and possibilities of enhancing its productivity on degraded soils were experimented through improved N_2 fixation and nursery practices. This will ensure maximum effects on soil rehabilitation and timber production.

Plant infection study for Rhizobium specificity Completely randomized design was applied with 4 replicates. Surface sterilized, pre-germinated seeds were planted and inoculated with several *Rhizobium* strains. Nodule parameters, plant parameters and nitrogenase activity (ARA) were recorded.

Effect of inoculation on seedling vigour of *P.falcataria* Completely randomized design was applied with 5 replicates.
P. falcataria seeds were treated as before, planted in polyethylene bags containing a mixture of soil, compost and coir; 1:1:1 (by volume) and inoculated with *Bradyrhizobium* strain Tal 45. Treatments were: Inoculation and application of N fertilizer Inoculation alone, application of N fertilizer alone and control. Urea was applied in 2 splits (10 and 20 kg N ha^{-1}). Plants were harvested at 2.5, 5 and 7.5 months after planting (MAP). Nodule parameters and plant parametera were recorded, ARA and total plant N was determined.

Early performance of P.falcataria on sloping fallow tea land as influenced by inoculation and fertilization The experiment was located on a slopy (37%) tea land at Nawalapitiya. The plots were arranged in split-split-plot desisgn with the following 3 factors at 2 levels and 3 replicates: Application of Brockwell fertilizer mixture as the main plot, N application as sub-plot and inoculation with TAL 45 as sub-sub plot. Seedlings, were transplanted in the field at 2.5 MAP. Plant height and girth were recorded every 3 months. Plants were harvested 6,12 and 18 months after field planting. Nodule parameters and plant parameters were recorded, ARA and total plant N was determined. Some soil characteristics were determined prior to planting and at each harvest.

Nodulation in *P. falcataria* was promiscuous. However, among the strains tested, TAL 45 produced most effective nodules, and a significantly higher biomass. This enhanced eventual N yield of the plants. The increase in yield was sustained even 7.5 months after potting and 18 months after field planting. In both pot and field experiments the effect of N-fertilizer (30 and 60 kg N/ha in pot and field respectively) on biomass production, nodule number and nodule dry weight was not significant when not inoculated. Inoculation combined with N fertilizer only marginally increased growth compared to inoculation alone. *P. falcataria* needs either high doses of N fertilizer (more than 60 kg N ha/year) or inoculation, as it shows poor response to low doses on N fertilizer. But addition of P, K, Mg and micro elements in the form of Brockwell mixture had a significant effect on the N yield biomass production in the field.

Nodule morphology varied from big profusely branched nodules in the more favourable potting medium, to small less profusely branched nodules in the less fertile field. The 3-fold increase in N yield due to inoculation even in a soil that had a native population of 10^3-10^4 cells/gr, clearly demonstrates the positive effect of inoculation. Although the effect was not significant, seedling survival of inoculated plants was found to be higher (97%) than non inoculated plants (94%).

Establishment of *P.falcataria* plants is often problematic in plantation forests. Provision of a suitable potting medium and inoculation with TAL 45 gave significant improvement of growth in adverse field conditions, sustainable for a long period of time. Therefore such a practice can be recommended as a low cost technique for forestry purposes.

60 kg N/ha was insufficient to cover N needs of the plants when not inoculated. The addition of a complete mixture of nutrients enhanced the growth of young *P. falcataria* significantly 6 months after transplanting. This demonstrated that the shallow top soil contained insufficient quantities of nutrients the rapid early growth.