EFFECTS OF RHIZOBIUM AND MYCORRHIZA INOCULATION ON THE GROWTH AND NITROGEN FIXATION OF ALBIZIA PROCERA (ROXB.) BENTH UNDER NURSERY CONDITION

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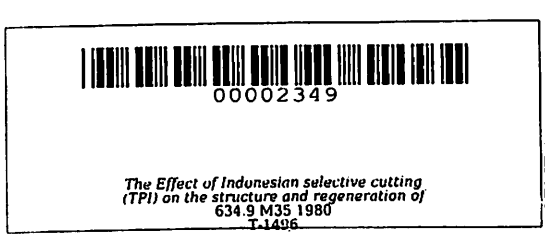

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ABSTRACT

MUHADIONO, IGNATIUS. University of the Philippines at Los Banos, March 1989. Effects of Rhizobium and VA Mycorrhiza Inoculation on the Growth and Nitrogen Fixation of Albizia procera (Roxb) Benth Under Nursery Conditions.

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Seedlings of Albizia procera (Roxb) Benth, a native species of the ASEAN region were grown under screenhouse condition for a period of three months (Studies I and II) and four months (Study III). The effects of soil types, chemical fertilizer and biofertilizer application on seedling growth were studied. The parameters were height, diameter, nodule number, dry weight, top/root ratio, total dry matter yields, N content, N uptake, Δ N uptake, P content, P uptake and Δ P uptake.

The effect of Nitrogen fertilizer application was significant on height, diameter, N content and Δ N uptake. Inoculation with Rhizobium yielded significant effect on height at 90 dap (days after planting); diameter at 60 and 90 dap; N content and Δ N uptake. The N concent was 20.7% better in the inoculated but fertilized with 100 kg N/ha rate than the uninoculated and fertilized with the same rate. The interaction effect between soil and N fertilizer was significant on height (90 dap), diameter (30 and 90 dap) and N content, while the interaction effect between soil and Rhizobium inoculation was shown to be significant on height (60 dap), diameter (60 and

90 dap), nodule number, total dry matter yield and N content. The interaction effect between N fertilizer and Rhizobium inoculation was significant on height (60 and 90 dap), diameter from 30 up to 90 dap and N content. Significant interaction effects among three factors, soil, nitrogen and Rhizobium inoculation was observed on height (60 and 90 dap), diameter (60 dap) and N content. The amount of nitrogen replaced by Rhizobium inoculation is estimated to be 82.5 kg N/ha of chemical nitrogen fertilizer.

Phosphorus application improved height and diameter growth, nodule number and dry matter production of A. procera (60 and 90 dap). Phosphorus application also significantly improved P content, P uptake and ΔP uptake of A. procera. Inoculation with Glomus etunicatum also favorably enhanced height and diameter (30 and 60 dap) and P content. The effect of the interaction between soil and P fertilizer was significant only on height and diameter growth (60 and 90 dap) and on P content. Only diameter and biomass production of the host were affected by the interaction effect of soil type and phosphorus fertilizer levels. The interaction effect of the three factors, soil, phosphorus and Gl. etunicatum inoculation significantly improved height (60 dap), diameter (60 and 90 dap) and P content. The phosphorus substitution by Gl. etunicatum is estimated to be 28.5 kg P_2O_5/ha.

The effect of nitrogen fertilizer either chemical or bioinoculant and its interaction with soil types and P application was generally not as dramatic as in the previous studies. The three factors alone

or in their combinations did not produce significant effect on height of A. procera except at 30 dap. Phosphorus application improved diameter of the legume host (30 and 60 dap), dry matter yield, N uptake and Δ N uptake. Nitrogen application significantly improved diameter, biomass, N content in the tissues, N uptake, Δ N uptake and the P content in the tissues. The N uptake by inoculated plants was improved by 10.9% over the uninoculated plants while the Δ N uptake was 85.4% better than the unfertilized control. The interaction effect between phosphorus and nitrogen application generally did not improve the growth parameters except for N content, P content and Δ P uptake.

The effect of dual symbiosis inoculation with Rhizobium and Gl. etunicatum shows that both Δ N and Δ P uptake affected the total dry matter yield expressed as:

$$\hat{Y} = 13.97 + 29.848\ X_1 + 742.225\ X_2$$

where $\hat{Y}$ is the total dry matter yield (g); X_1 is the Δ N uptake (g/plant) and X_2 is Δ P uptake (g/plant). The Δ N uptake was highest in Annam clay soil while Δ P uptake was a significant determinant in Taal loam soil type. Plants grown in Annam clay had higher total dry matter yield than the plants grown in Taal sandy loam soil.

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INTRODUCTION

Significance of the Study

All Southeast Asian countries have similar problems related to the regeneration of Imperata grassland. Night and Nations (1980) stated that on a worldwide scale, the tropical rainforests are being destroyed at the rate of 25 million hectares annually. Under Philippine conditions, it is estimated that there are 5 million hectares of grassland in mountainous areas (Sajise, 1979). Dela Cruz (1986) stated that there are more than 5 million hectares of Imperata grasslands or about 17% open lands out of a total land area of 30 million hectares.

Tilo et al. (1985) stated that over a hectare of land, there are about 75,000 tons of nitrogen or 78% in the form of gaseous nitrogen. by volume (Epstein, 1972). Legume tree species contribute large amounts of nitrogen to the soil plant system by way of symbiotic nitrogen fixation.

Upland areas are characterized by adverse conditions, low N and available P for the plant in the soil. According to Dela Cruz and Vergara (1987), effect of slash and burn agriculture in upland ecosystem result to decline in soil fertility, high soil erosion, surface runoff, sediment yields and ultimately crop failures.

Reforestation species grown under adverse upland condition need to be fertilized. Meanwhile, industrial nitrogen fertilizer can meet only about 20% of the annual fixed nitrogen deficit in the soil. There-