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VAM FUNGI — A TOOL FOR REFORESTATION

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VAM inoculum holds tremendous potential for use in forestry, where goal focus upon maximum plant establishment and growth at minimum cost. This work summarises the effect of VAM fungi on growth and development of a fast growing leguminous tree *Leucaena leucocephala*. Inoculation of this plant with three species of *Glomus* resulted in fast and increased growth as compared of noninoculated plants. Efforts are directed towards the successful establishment of *Leucacna* in wastelands around Delhi.

Keywords : *Leucaena leucocephala;* Reforestation; VAM fungi.

Introduction

Man has deforested one third of South America's native forests, half of Africa's and two thirds of South-East Asia's. In the tropics need is urgent to protect the remaining forest cover from further damage and reforest the devastated area. Most indigenous tree species take 50-70 years to mature so the fast growing legumes come to rescue. Of all the tropical legumes, *Leucaena* is the most useful as it offers widest assortment of uses. It can produce nutritious forage, fire wood timber and rich organic fertilizer. Its diverse uses include revegetating hill slopes, arid semi-arid lands, providing wind breaks, fire breaks, shade and ornamentation. *Leucaena's* ability to thrive on steep slopes, in marginal soils and in areas with extended dry seasons, makes an important plant for restoring forest cover on denuded areas.

The tremendous interest in VAM has been stimulated mainly by the fact that they result in increased growth of plant by providing a primary mechanism for P uptake from soil (Hayman, 1982). The ecological significance of VAM fungi however is not yet very clear, but it has been suggested that they have numerous functions in plant communities, including regulation of species composition, competition and succession (Reeves *et. al.*, 1979; Janos, 1980; Trappe, 1981).

Plants introduced to eroded sites or arid lands face many adverse conditions such as high salinity, low fertility, and drought, and mycorrhizae have been shown to subside these effects on plant growth (Sanders *et. al.*, 1975; Hall *et. al.*, 1977; Menge *et. al.*, 1978; Gildon and Tinker, 1981).

Inoculation with endophytes or with soil containing endophytes can improve the growth and survival of desirable revegetation species (Aldon, 1975).

All these factors provide incentives for the development of VAM inocula for use in reclamation and forestry. Strains of VAM fungi differ markedly in their ability to stimulate the growth of a given plant in given soil (Hayman, 1977; Crush, 1978; O'Bannon *et. al.*, 1980; Lindsey, 1984).

The purpose of the present work was to study the response of *Leucaena* to VAM inoculation in the field conditions. To date, many pot culture and green house experiments have been done to establish mycorrhiza in this plant (Guzman-Plazola *et. at.*, 1984), but the literature on field trials is scanty. The increase in plant growth is noticeable in soils with low phosphorus levels in both sterile and unsterile soils. In unsterile soil the response of VAM is usually smaller as added inoculum has to compete with normal flora and uninoculated plants gradually become colonized with indigenous flora (Mosse and Hayman, 1971) where indigenous VAM population is very low, added inoculum has better effects.

Methods

Raising of plants and inoculation—Seeds of *Leucaena leucocephala* (Lamk) Wit. were grown in two plots (1.5 meters × 4.5 meters) in the Departmental garden. One of the plot was left with indigenous population of VAM spores and was referred to as noninoculated. In the second plot 1 kg of soil containing 20 spores/gm each of *Glomus macrocarpum* and *G. fasciculatum*, was added just before seed sowing. The inoculum was placed below the seeds to ensure that all growing roots passed through inoculum layer.

Spore counting—Five soil samples for spore quantification were taken at an interval of 15 days starting from one week after seed germination. A modification of the wet sieving and decanting technique (Gerdemann and Nicolson, 1963) was used to determine VAM fungal spore and sporocarp number in the soil.

Percent colonization—Three to four plants were taken every 15 days for mycorrhizal analysis. Washed roots were cleared using the standard technique of Phillips and Hayman (1970). Percent colonization was calculated by taking a ratio of colonized and non colonized segments in whole undecomposed roots.

Growth studies—Every 15 days three to four plants were taken for biometric analysis. After digging out the plant root length, shoot length, plant height and number of nodules was noted. Dry weights were calculated for root, shoot, whole plant and nodules after drying the plant material at 80°C for 48 hours. Mean and standard deviation was calculated for each trait (Table 1).

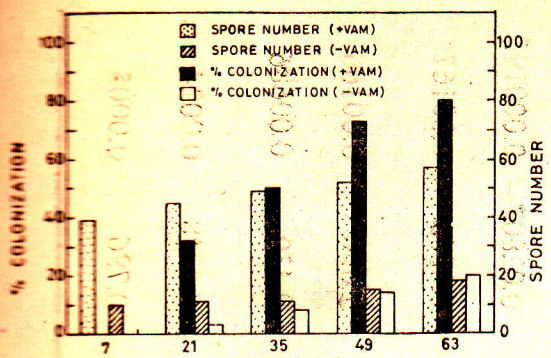

Fig. 1. Change in spore number and % colonization with age of the plant.

Results and Discussion

Mycorrhizal status and number of VAM spores—

In inoculated plants, the samples taken 21 days after germination showed the onset of colonization. Hyphae running parallel were observed in the cortex of the root. After 49 days, the roots had fully developed mycorrhizal structures, i.e., vesicles, arbuscules. The samples from non-inoculated plot showed infection only 49 days after germination and showed only the presence of hyphal structure (Fig. 1), however vesicles and arbuscules were absent even 63 days after germination. This difference is either due to lack of right fungal species in non-inoculated plot or availability of the spores in lower concentration. Carling *et al.* (1979) showed that inoculum density increases the rate and extent of colonization until a maximum is reached. The number of spores increased gradually in both soils but the increase was more profound in inoculated plot than in non-inoculated plot (Fig. 1).

Growth studies—For all measured traits, the inoculated plants showed better growth than non inoculated plant. Seedlings were slow growing to begin with but after 35 days the inoculated

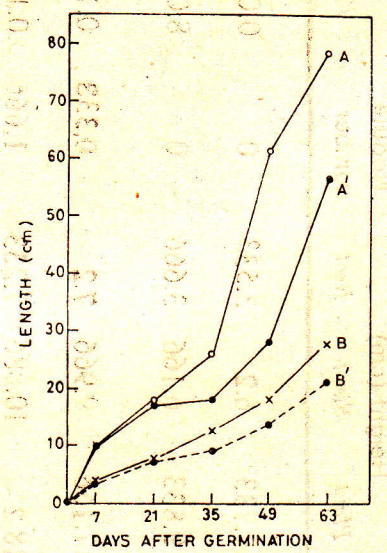

Fig. 2. Plant growth of inoculated [IN] and non-inoculated [NIN] plants.
A and A'—Shoot legnth of IN and NIN plants.
B and B'—Root length of IN and NIN plants.

Table 1. MEAN (X)

Time (days)	Treatment	Height (cm)			Nodule number	Dry weight (gm)			Nodule dry weight (gms)
		Plant	*Shoot*	*Root*		*Plant*	*Shoot*	*Root*	
7	—VAM	9.733	6.2	3.533	0	0.0807	0.0721	0.0086	0
	+VAM	9.833	6.166	3.666	0	8.0878	0.0785	0.0093	0
21	—VAM	17.166	9.966	7.2	0.333	0.1132	0.0979	0.0134	0.00183
	+VAM	18.2	10.886	7.233	1.666	0.1304	0.1136	0.0131	0.00545
35	—VAM	17.825	8.8	9.025	0.25	0.1453	0.1171	0.02807	0.000195
	+VAM	25.975	13.475	12.5	2	0.2210	0.1631	0.0563	0.00167
49	—VAM	28.066	14.033	14.033	3	0.433	0.345	2.086	0.00166
	+VAM	61.1	42.766	18.333	4	2.9680	2.5312	0.430	0.00686
63	—VAM	56.3	35.03	21.26	3.666	1.8428	1.4609	0.3818	0.0024
	+VAM	78.36	50.5	27.86	0.666	3.0622	2.7279	0.796	0.0005

plants grew rapidly (Fig. 2). At the early stages of growth there was no significant difference between inoculated and noninoculated plants as the mycorrhizal fungi took some time to establish in the roots. Later on the difference between the inoculated and noninoculated plants increased up to 49 days but by 63rd day even the noninoculated plants showed better growth. This is due to increased colonization of these plants by indigenous endogonaceous flora of the soil. Gueye *et al.* (1984) while working with *Vigna unguiculata* found similar results.

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