INTRODUCTION
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The forest resources are on rapid decline all over the globe. The consequences of the loss of forest cover are universal which manifest the problem of environmental declines and ecological disaster. India has a large human and livestock population, while only about 19 per cent of land area constitute forest with varied density. The pressure on forest and desert and deforestation gave birth to environmental awareness which resulted in the implementation of social forestry and agroforestry programmes. The changing scenario of forestry research priorities has given emphasis for improving the production of biomass for meeting the fuel, fodder, timber as well as needs of NWFP of the country. All such programmes required high quality of seed and seedling for plantations and also to develop effective planting technology for increasing the biomass within the short rotation. The high tech plantations are also being done by the state forest departments, farmers and NGOs to have a gain from forestry plantation within a shorter span.

The excessive use of forests is leading a vicious circle of destruction which may become irreversible if not checked in time. Once the topsoil is washed away and soil fertility is lost, neither agriculture nor animal husbandry or horticulture will be able to sustain the people. Therefore, the forests should not be looked as a source of revenue and sustained supply of raw materials but emphasis should be on protection and conservation of forests. The removal from the forests should be limited to the bonafide requirements of the local masses. The nature has carrying capacity beyond which it collapses and loses its ability to regenerate (Vinod Kumar, 1995).

Forest nurseries play a very important role in the development of plantations of forest trees. With the large scale demand for quality forest plants and the poor availability of good quality seed, it has become imperative that forest nurseries should be managed professionally to produce the desirable quality of plants. Technical inputs in the nurseries ensure healthy plants, better survivals and subsequent growth commensurate
with the productivity of the site. In forest plantations, the effect of poorly grown nursery plants can be felt throughout the life of the tree. A poor nursery plant may either stagnate or die after surviving at the site for one to several years. Poor nursery plants, therefore, result in wasted money. An adequate attention in developing healthy nursery plants will ensure their better survival in field. These plants will also give higher productivity in the long run than plants which are weak due to poor nursery practices (Chaturvedi, 1994). The improved nursery seedling stock can be obtained by application of biofertilizers (micro inoculants). A sustainable use of nursery sites can be made through application of biofertilizers. Mycorrhiza is one of the most important and effective component of biofertilizer.

Current nursery practices envisaged that intensive plant production requires the use of chemical fertilizers but the inorganic fertilizers are not only in short supply but also quite expensive for use in forestry species. Under such conditions, biofertilizers are only the alternative. The pathway of productivity improvement followed so far has however, been accompanied by an exponential increase in the consumption of non-renewable forms of energy. In view of the accelerating energy costs, energy will be a key limiting factor for increasing plant production in future. Therefore, it is essential to evolve a strategy of integrated nutrient supply by using a judicious combination of chemical fertilizers, organic manures and biofertilizers and the technology so developed should be the integral part of nursery and plantation management. Biofertilizers harness atmospheric nitrogen with the help of specialized soil microorganisms. The term 'biofertilizers' or more appropriately microbial inoculants can be generally defined as preparations containing live or latent cells of efficient strains of nitrogen fixing, phosphate solubilizing, or cellulolytic microorganisms used for application to seed, soil or composting areas with the objective of increasing the numbers of such microorganisms and accelerating certain microbial processes to augment the extent of the availability of nutrients in a form which can be easily assimilated by plants (Subba Rao, 1993).
The vesicular-arbuscular mycorrhizae received little attention in forestry, are now gaining importance in tree nutrition particularly phosphorus uptake from soluble and insoluble sources in the soil. In degraded and salt affected soils, the density and population levels of VAM fungi are generally low, hence planting success is poor because of low level of nutrients available to the plants. The solution to the problem lies in inoculation of species in planting sites. Mehrotra (1991) mentioned the selection of most efficient combination of tree species and suitable species/strain of fungi for each planting site with possible controllable factor such as soil fertility to enhance efficiency of root systems to explore unavailable nutrients.

Mycorrhiza representing mutualistic association between plant roots and specialized group of fungi is the nature's gift to the plants which the mycorrhizologists all over the world are trying to harness the forest productivity. In the present scenario indiscriminate use of chemicals fertilizers pose the problems of environmental pollution and ecological imbalance. Under such conditions biofertilizers are only the alternative. Mycorrhizae are one of the effective group of microbes which holds greater promise in nutrient budgeting and biocontrol of root diseases in plants.

VAM (vesicular-arbuscular mycorrhiza) is always an integral component of forest ecosystem showing mutual dependency between fungus and higher symbiont for natural function and survival. It is now well established fact that adequate mycorrhizal development in seedlings is critical for success of plantation on harsh sites which is low in native population of the effective group of fungi.

VAM can prove to be effective biofertilizer in promoting growth of forest trees and thus help in reducing or dispensing with the practice of application of chemical fertilizers in forestry which are already is short supply. Moreover, being non-obnoxious, non-hazardous and non-polluting, VAM can be exploited in forest nurseries and plantations.
Mycorrhizae that are more relevant to trees can be broadly classified into two types: the ectomycorrhizae and endomycorrhizae. German Botanist ALBERT BERNARD FRANK (1885) was the first to coin the term mycorrhyzae for designating a symbiotic relationship between fungi and plant roots. Subsequently it was confirmed that mycorrhizal colonization is responsible for increased growth and nutrient uptake in the forest trees. Dangeard (1900) was the first to name a vesicular-arbuscular fungus. Mosse (1956) was the first to demonstrate experimentally that endogoneous species could produce VAM using sporocaps or spores of unnamed Endgone species as inoculum. She was able to produce typical VA mycorrhizae. Vesicular-arbuscular mycorrhizae are characterized by the presence of intracellular hyphae in the cortex which form specific structures called vesicles and arbuscules. Vesicles are likely storage organs that the fungus produces to store nutrient material inside the plant host. Arbuscules are thought to be site of nutrient transfer between the symbiotic partners. Verma and Hock (1995) mentioned that the management of mycorrhizal population in the field is certainly feasible and requires a clear understanding of the ecology of plant communities and have different farming system affect the populations of mycorrhizal fungus and their diversity and influence on nutrient uptake and growth of crops.

VAM have much wider distribution in tropical ecosystem as compared to ectomycorrhizae. They occur on bryophytes, pteridophytes, agricultural plants, fruit trees and majority of forest trees species. Besides increasing nutrient uptake, they increase tolerance to heavy metals, saline soils and drought stresses, transplanting shock, bind soil and reduce or supress the effects of various fungal pathogens and plant parasitic nematodes (Mehrotra, 1991). VA mycorrhizae play key role in mineral cycling, energy flow and plant succession in disturbed and undisturbed ecosystem (Reeves et al. 1979). VA mycorrhizae are also capable of reducing the effects of various fungal pathogens and suppressing the effects of plant parasitic nematodes (Sehenck, 1981). VA mycorrhizae can affect osmotic adjustment, (Auge et al., 1986) and root hydraulic conductivity (Levey et al., 1983; Graham and Syvertsen, 1984). Moisture stress tolerance of the plant is increased or boosted up with the VAM inoculants.
VAM fungi are very important in mobilizing P from soil to plant. VAM fungi have their most significant effect on improving plant growth when little phosphate is present in the soil (Harley and Smith, 1983). The P concentration on the soil solution is very low in tropical soils and the soil around the growing root is rapidly depleted of P ions within a distance of few mm. VAM plants can make more efficient use of rather insoluble rock phosphate than plants without mycorrhiza (Sieverding and Galvez, 1988 b).

The ability of VAM fungi to produce a dramatic increase in plant growth is well documented. Utilization of mycorrhiza technology to commercial production of food, fibre or fuel has been minimal. One of the main reasons is the difficulties in inoculum production, especially that of vesicular-arbuscular mycorrhizal fungi, which are obligate symbionts. Techniques to produce VAM inoculum in almost sterile environment through nutrient film techniques, circulation hydroponic culture system, root organ culture and tissue culture are available. But for large scale field trials, the only convenient method to produce large quantities of inoculum is the traditional pot culture technique. Such mass produced cultures may remain viable at room temperature for nearly two years (Bagyaraj, 1991).

In forestry mycorrhizal inoculations has two purposes :- (1) Introduction of mycorrhizal fungi into soil or substrates where they are lacking and (2) Replacement of the naturally occurring fungi by more efficient species. Soil properties such as pH and organic matter content play an important role in determining mycorrhizal population. The mycorrhizal population of nurseries usually differs from that of natural forests. It has been generally observed that after transplanting, the seedlings into natural forest soil, the nursery mycorrhizal fungi are replaced by indigenous species of the site. Obviously, this replacement may cause stagnation of the seedlings for some time after transplanting. It is, therefore, necessary to regulate the soil conditions suitably for the introduced species. There would be proper vigilance over the effective group of VAM being transported alongwith the nursery seedlings and also the effective inoculum being applied in the
plantation. Monitoring the inoculum potential of VAM in nursery and plantations is highly beneficial for the growth and establishment of plantations (Jamaluddin, 1997).

Commercial production of mycorrhizal inoculum is a problem and obviously mycorrhizal inoculation can not become a routine forestry practice in the nurseries unless large amount of cheap inoculum and effective inoculation techniques are available. Similar problem is confronted when seedlings tailored with suitable mycorrhizal fungi are out planted in the field where they are most likely to be replaced by the indigenous mycorrhizal fungi. This is mainly due to inability of native mycorrhizal species of the nurseries to adapt to the forest out planting sites. This problem can be surmounted by choosing fungi which have a positive effect on the out planting success of different seedlings on different sites. Further, screening the symbiotic efficiency of different species in natural conditions is important for success of mycorrhizal inoculation programmes besides developing suitable inoculation techniques.

According to Sieverding (1991) the substrates along with infected roots (which contain infected roots and/or VAM mycelium and spores) are common sources of VAM inocula.

Mass inoculum production of VAM fungi is a vital constraint in its direct large scale use in forest plantations. This is mainly because of obligate biography of the endophytes. However, mycorrhizal inoculation of seed, seed bed and nurseries is a practically feasible proposition as it requires application of bulk amount of inoculum, for tailoring a large number of seedlings with mycorrhizae in short span of time.

Besides the important role of nitrogen fixation in the forests, most of the legumes species are exploited in various purposes. *Albizia procera* (Roxb.) Benth. is a valuable timber species and is used in general construction, carriage and carts, motor bus bodies, agricultural implements, tool handle, packing cases and gates, etc. It is a high grade furniture timber, though not so decorative. The leaves are readily eaten by cattle, sheep
and goat. Its wood has a good calorific value. The species finds favour in plantation programmes especially in poor, marginal, dry and degraded lands due to its varied adaptability. Its resistance against drought has made this species popular in dry zones. *Albizia procera* has been extensively used in experimental planting in saline and alkaline areas. Besides its good soil binding capacity due to fast growth it has excellent power to fix the nitrogen and thereby enrich soil status. It is often grown in gardens and avenues for ornamental purposes. All parts of the plant are reported to show anti-cancer activity.

The litter accumulated from *A. procera* contribute higher input of N and C after its proper decomposition. The litter from legume species is easily decomposed and mineralized through the aid of microbes. Thus the legumes are recognized as multipurpose species in forest ecosystem and plantation. Jamaluddin and Gupta (1997) published an account of Rhizobia and its role in N fixation in legume trees including *A. procera*. Since the plant is N fixing, therefore it is essential to build up the population of organisms like VAM in the rhizosphere to meet the P economy to the host plant.

The studies pertaining to inocula production of VAM fungi are very less. More efficient technologies for inocula production need rapid development as there is demand of VAM inocula for nursery and field application in forestry species. Therefore, this study is highly beneficial in production of effective VAM inocula. Besides *A. procera* these standardized techniques can be used in other tree species also. The present studies therefore, aimed at following heads:

- Distribution and characterization of VAM collected from different age groups and localities of *Albizia procera*.
- The role of substrates and hosts on VAM inoculum production in *A. procera*.
- Enumeration of infective propagules, optimization of doses and storage of inoculum.
- Suitability of VAM inocula for *A. procera*.
- Effect of different mixture of compost on VAM infection in *A. procera*.
• Effect of different moisture regime along with VAM fungi and fertilizers on
growth of *A. procera*.
• Effect of different P level on VAM development in *A. procera*.
• Effect of VAM along with bacterial and inorganic fertilizers on *A. procera*.
• Effect of VAM, rhizobium and inorganic fertilizers on growth of *A. procera* in
micro plots and in field.