EFFECT OF AM FUNGUS AND CARRIER MATERIALS ON BIOMASS YIELD AND P UPTAKE *ARTOCARPUS HETROPHYLLUS* LAM.

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Abstract:

A green house study was conducted under nursery conditions to study the effect of carrier materials and arbuscular mycorrhizal fungi on *Artocarpus heterophyllus* Lam. The seedlings raised with the inoculation of arbuscular mycorrhizal fungi with leaf compost showed an increased in shoot length, fresh weight of shoot, dry weight of shoot, root length, fresh weight of root, dry weight of root and number of leaves over the uninoculated control (UIC) and which was followed by other carrier materials like charcoal, peat and perlite. In case of Peat with mycorrhiza there is an increase in root colonization, spore number and P uptake. Considering the various parameters of the plants, it was observed that *Rhizophagus fasciculatum* and carrier materials are the best bio-inoculants for *Artocarpus heterophyllus* Lam.

Keywords: Arbuscular mycorrhiza fungi, *Artocarpus heterophyllsu* Lam., compost, Peat, Perlite, Charcoal, biomass yield carrier materials.

Introduction:

Mycorrhizal fungi always aid oil aggregation with the help of their mycelia and certain soil erosion. Its association is known to increase drought resistance of plants due to as they secrete growth regulators, enzymes and phenols in their roots (Smith and Read, 1997). Mycorrhizal fungi improved host nutrition particularly, which increases P delivery to roots and plants hydraulic conductivity in comparison to P deficient non-mycorrhizal plants. It may however be stated that interest in this phenomenon has escalated dramatically in recent years, partly because of what we have learnt about the benefits of mycorrhizae and partly because of economic and geopolitical events (Bagyaraj, 2006). Also because most of the economically important plants have been found to be associated with mycorrhizae especially arbuscular mycorrhizal (AM) fungi the subject is currently attracting much attention in agricultural, horticultural and forestry research programmes (Lakshman, 1996; Lakshman, 2009). AM fungi are obligate symboints and their growth and development require association with the host and the growth media, the two important factors, affecting inoculum production. Starter inoculum is added to the potting medium in which is placed seed/seedling of a suitable host plant (Caron and Parent, 1988). Therefore, in the present study carrier materials like charcoal, peat, leaf composite, perlite and used with indigenous AM fungi to enhance the plant growth.

Materials and Methods:

Earthen pots measuring 25×25 (v/v) diameter filled with sterilized sandy loam: sand (1:1) 4 kg/ potting mixture. The physic-chemical soil characteristics used for pot experiment were estimated according to Jackson (1973). Percent of organic matter is

determined according to Piper (1950). Electric conductivity is measured using Bridge meter and pH by 1:1 (w/v) soil to water ratio. The experimental soil was sandy loam with pH 6.8, organic matter 0.84%, Nitrogen 1.41 mg/kg, potassium 2.41 mg/kg, Phosphorus 0.18 mg/kg, Zinc 2.02 mg/kg, Copper 1.04 mg/kg, magnesium 1.42 mg/kg, electric conductivity 10.17 m.mho/cm.

Collection of Seeds: Seeds collected from forest department office Dharwad. Before sowing, seeds are surface sterilized with 0.02% sodium hypochlorite and their after washed 4-5 times with sterile distilled water.

Inoculation of arbuscular mycorrhizal fungi:

15g of air dried arbuscular mycorrhizal inoculums was placed to each pot as thin a layer 2cm below the soil surface (except to uninoculated control). The inoculums consist of 8g rhizospheric (152 chlamydospores/ 50g soil approximately) 2g of host plants root bits with hyphae and sporocarps.

All the experimental pots were kept in polyhouse, with randomized block design and following treatment was done as, with three replicates.

- Uninoculated control (UIC)
- Rhizophagus fasciculatus
- AMF + charcoal
- AMF + peat
- AMF + Perlite
- AMF + leaf compost

Experimental pots were kept free from weeds, pests and irrigated every alternate day in order to maintain moisture. Once in fifteen days 15 ml of Hoagland solution without P was given to all the experimental pots. The plants were harvested after 60, 120, 180 days interval, plant growth parameters shoot height (SH), fresh weight of shoot (FWS), dry weight of shoot (DWS), root length (RL), fresh weight of root (RWR), dry weight of root (DWR), number of leaves (NL). The spore count was carried out by wet sieving and decanting method (Gerdemann and Nicolson, 1963). Percent root length colonization is estimated according to Phillips and Hayman (1970). Per cent of root colonization is calculated by the following formula proposed by (Giovennetti and Mosse, 1980).

$$\text{Percent of root colonization}(\%) = \frac{\text{No. of root bits colonization}}{\text{Total No. of root bits observed}} \times 100$$

After the harvest, experimental plants (shoot and root) are oven dried at 70°C until a constant weight is obtained to determine the dry weight. The P uptake is estimated according to Jackson (1973).

Results and Discussion:

Results of the experimental plants revealed positive growth response and per cent of root colonization. Arbuscular mycorrhizal (AM) fungal inoculation with AM fungus influenced in increased shoot length, fresh weight of shoot, dry weight of shoot, root length, fresh weight of root, dry weight of root and P uptake in shoot when compared with the uninoculated control (Table 1).

Plants treated with charcoal and AM fungus showed a significantly higher percent root colonization and spore number per 50 g soil. On the other hand plants treated with AMF+perlite or AMF+leaf compost had slightly lower application of charcoal stimulated the colonization of crops with indigenous arbuscular mycorrhizal fungi. The effect of charcoal is ascribed to its physico-chemical properties as Charcoal is porous, weakly alkaline and does not serve as substrate for saprophytes. The arbuscular

mycorrhizal fungi, sensitive to competition from saprophytes can be easily extend their extra radical hyphae into charcoal buried in soil and sporulate in the particles. Charcoal particles act as micro-habitats for arbuscular mycorrhizal fungi to survive and later grow in to the soil, which makes charcoal suitable as a carrier to arbuscular mycorrhizal fungal inoculums.

Perlite+AM fungus has facilitates better aeration and does not serve as substrate for saprophytes. Therefore, like charcoal it also serves as carrier material and as soil less media for the arbuscular mycorrhizal culture. Peat has better capacity to hold the moisture which is further helpful for the growth of beneficial microbes which helps arbuscular mycorrhizal fungal spore germination and to reproduce them.

In the present investigation, plants treated with AM fungus and Leaf compost brought very significantly increase plants height, root length biomass yield and P uptake was determined AM fungus (*Rhizophagus fasciculatus*) with leaf compost inoculation is considered to be most suitable for *Artocarpus heterophyllus* Lam., it is followed by AM fungus with peat mixture, and AM fungus with perlite selection for inoculation secondly thirdly respectively and fourth inoculum be AM fungus and charcoal as carrier material to this tree species at nursery stage.

Our results are strongly supports to the early workers (Dodd and Jeffries, 1986; Sylvia *et al*, 1993; Lakshman, 1996, 2009), who have reported that arbuscular mycorrhizal fungi influence root colonization and these plants absorb more nutrients and thus show better growth compared with UIC. Similar resulted data was recorded as the mycorrhizal inoculation drastically increased leaves number (Vinayak and Bagyaraj, 1990; Jeffries, 1987; Baltruschat, 1987, Lakshman, 1999), have documented higher percentage of P uptake in shoots was recorded in plants inoculated with mycorrhiza. The present findings are consistent with (Gaur *et.al.,* 2000; Gaur and Adholeya, 2002 and Hiremath *et al.,* 2006), that specific carrier materials required with indigenous AM fungus.

AM fungal inoculation with vermicalite and perlite treatment a bean influences root colonization (Mosse and Thompson, 1984). Peat is used for improvement of productivity of soil (Masanori, Takuya, 2002 and Lakshman, 2014) Incontrast to these findings, there was negative results were obtained by Mauritz Vestberry *et al*., 2008; Mahesh *et al.,* 2009). When AM fungus with perlite was treated on five agricultural crops.

It is observed that, in the presence of carrier material, the plant reacted differently in percent root colonization, spore number per 50g of soil and percent of P uptake in shoot. It can be concluded from present study that experimental plant reacted positively to all carrier materials and showed increased root colonization. Only positively reacting plant species may be selected for the one farm production of arbuscular mycorrhizal propogule. Further, research is needed on the mechanism of interaction of carrier material and host plant which help into mass multiplication of AM fungi arbuscular mycoirhiza fungal mass multiplication.

The present work suggested that arbuscular mycorrhizal fungi may need carrier materials like Charcoal, perlite, peat and leaf compost while inoculating, especially for tree species at nursery stage, before transplanting into agro forestry or bare land.

Table 1: Showing the effect of Arbuscular mycorrhizal fungi *Rhizophagus fasciculatus* and four carrier materials on growth of *Artocarpus heterophyllus* Lam.

Treatments	Sl (cm)	FWS (gm)	DWS (gm)	RL (cm)	FWR (gm)	DWR (gm)	NL	PC (%)	SN	P Uptake (%)
60 days										
Control	10.10b	2.90a	0.93a	14.50a	0.83a	0.39a	5.39b	80.00b	90.00f	0.05b
AMF	24.2c	5.7c	2.2c	17.3c	0.98b	0.4b	7.2d	58.1b	151.0d	0.12c
AMF+Ch	24.5d	5.8b	2.3b	17.8d	1.1c	0.53b	7.5e	58.1c	150.0e	9.12e
AMF+Peat	29.4ab	8.1d	3.4d	19.3e	1.1a	0.53d	8.1c	62.6d	173.0e	0.14d
AMF+Per.	33.2d	11.4ab	3.6e	19.7ab	1.2b	0.54c	8.3d	62.6e	176.0f	0.15g
AMF+LC	47.3g	13.5e	5.7g	21.2f	1.2g	0.54e	8.3f	66.4d	179.0b	0.17d
120 days										
Control	19.4a	3.3b	1.2a	16.1b	1.0a	0.48b	7.2a	0.00b	0.00f	0.06f
AMF	41.3b	9.10e	3.9d	31.3d	2.1c	0.78a	9.36c	66.3c	203.0e	0.14d
AMF+Ch	43.1d	12.2d	4.00d	31.4c	2.2d	0.79e	9.37b	66.4g	203.0e	0.14d
AMF+Peat	48.0c	14.3e	5.9e	33.5e	2.3d	0.82d	11.2g	67.1d	207.0d	0.16f
AMF+Per.	53.5e	16.2f	6.6d	34.2g	2.4c	0.83e	11.5e	68.2bd	217.0ab	0.17g
AMF+LC	57.2a	18.5g	8.2bd	37.1d	2.4b	0.83b	11.5f	71.0c	223.0b	0.19c
180 days										
Control	33.5a	11.6b	2.2b	19.4b	1.1a	0.53b	7.5b	0.00a	0.00f	0.06b
AMF	45.2b	12.9ab	3.9ab	34.3d	2.3ab	0.82b	11.4c	71.1e	211.0d	0.11c
AMF+Ch	49.3d	14.5d	6.1f	36.2c	2.4bd	0.83c	11.5e	72.2g	209.0e	0.13b
AMF+Peat	51.5c	15.7e	6.9e	39.5b	2.4e	0.83g	13.1e	72.5b	229.0d	0.27c
AMF+Per.	58.4e	18.2c	8.7g	42.1e	2.5b	0.84c	13.5g	83.4e	232.0b	0.24d
AMF+LC	64.1g	20.4d	9.5b	43.4g	2.5e	0.85d	13.7b	87.2d	241.0c	0.29c

Mean values followed by the same letter with in a column do not differ significantly at (p=0.05) according to DMRT.
Control-uninoculated control, AMF-Arbuscular mycorrhizal fungi
AMF+Ch=Arbuscular mycorrhizal fungi+charcoal
AMF+Per = mycorrhizal fungi+perlite
F+LC = Arbuscular myorrhizal fungi+leaf compost.

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