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Response of Papaya to Inoculation With Frateuria aurentia (Potassium Mobilizer) and Plant Growth Promoting Rhizomicroorganism (PGPR).

KEYWORDS: AMF, *Frateuria*, Papaya, PGPR.

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ABSTRACT *Interaction between Frateuria aurentia (K mobilizer) and plant growth promoting rhizomicroorganism (PGPR) viz. Glomus mosseae, Frateuria aurentia, Bacillus subtilis, Pseudomonas fluorescens and Trichoderma viride in soil and their consequent effect on growth and plant biomass of papaya was studied under glass house conditions. The AM fungus was inoculated singly and in combinations with PGPR's. The plants showed maximum plant height treated with Glomus mosseae and Frateuria aurentia with single inoculation followed by Glomus mosseae + Pseudomonas fluorescens and Glomus mosseae with Phosphate solubilising bacteria (Bacillus subtilis). Dual inoculation with PGPR showed increased in dry matter yield than uninoculated control plants.*

INTRODUCTION

Modern agriculture implies signification of the structure of the environment over vast areas replacing natures diversity with a small number of cultivated plants. (Alteri,1999). An improved understanding and management of the symbiosis of the plants with AM fungi and PGPR in agroecosystems ultimately has a large social and environmental impact, particularly in low input sustainable agriculture and in tropical agroecosystems (Singh and Adholaya 2002).

Plant rhizosphere is a rich source for variety of microorganisms and it is an important soil ecological environment for plant microbe interaction. These bacteria are normally referred as plant growth promoting rhizobacteria (PGPR). Nowadays PGPR and AM fungi are gaining more importance because of their beneficial role in plant growth promotion and its biological control of numerous pathogens. (Saxena and Tilak 1994) reported that uptake of minor elements was increased by the dual inoculation, possibly because of increased colonization by mycorrhizal fungi in the early stages of plant development.

However, there is very little information available on the response of high value fruit trees like papaya, which is one of the most important fruit crops of tropical and subtropical regions of the world.

Declerek etal (1994) studied the mycorrhizae dependency of banana and observed that inoculated plants had generally greater in shoot dry weight and shoot phosphorous content than uninoculated control plants.

MATERIALS AND METHODS.

The study was conducted under green house conditions at Bangalore University, Bangalore. Papaya seeds of local variety procured from IIHR (Indian Institute of Horticultural Research) were soaked in water for 12 hours before sowing. The nursery mix used in the study was soil: sand and sieved vegetable waste compost (market waste) (2:1:0.5) with consortia of microbes. Polythene bags of size 24.5x15.5 cm holding 1.85 kg unsterilized nursery mix were used. Plant growth promoting rhizomicroorganisms viz.. *Pseudomonas fluorescens, Frateuria aurentia* (potassium mobilizer) containing 10^9 cfu and *Glomus mosseae* containing 140 infective propagules/g inoculum was used for inoculating the nursery plants. *Glomus mosseae* was selected for the nursery plants since it proved to be the best for inoculating papaya. The inoculum was placed in soil and the seeds were sown later. Only one seedling was maintain per polybag. Each treatment was replicated 12 times and the plants were maintained for 95 days. The polybags were watered daily and optimum moisture condition was maintained. The treatment details are as follows.

C – control (uninoculated)

Glomus mosseae – (G.m)

Phosphate solubilising bacteria (*Bacillus subtilis*) – (PSb)

Trichoderma viride – (T.v)

Pseudomonas fluorescens – (P.f)

Glomus mosseae +*Potassium mobilizer* (G.m +K.m)

Glomus mosseae + *Phosphate solubilising bacteria* (G.m+ PSb)

Glomus mosseae + *Trichoderma viride* (G.m+ T.v)

Glomus mosseae + *Pseudomonas fluorescens* (G.m + Pf)

The plants were kept under glass house conditions and were harvested at 95 days after sowing. The plant height was measured from the surface of the soil to the tip of the growing point. Harvested plants were dried at 60 °C to attain a constant weight to determine the plant biomass. The data was subjected to one way analysis of variance for complete randomized design, Duncan's multiple range test was done to separate the means (Little and Hills 1978).

RESULT AND DISCUSSION

Treatments	Plant height	Total dry weight
Glomus mosseae	57.66 ^{ab}	12.95 ^{a}
K.m	67.33 ^{ab}	10.48 ^{ab}
Phosphate solubilising bacteria (*Bacillus subtilis*)	58.00 ^{ab}	8.90 ^{bc}

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Trichoderma viride	53.00 [b]	8.22 [c]
Pseudomonas fluorescens	64.00 [ab]	10.30 [abc]
Glomus mosseae+K.m	70.00 [a]	11.34 [abc]
Glomus mosseae+ Phosphate solubilising bacteria	64.00 [ab]	12.77 [ab]
Glomus mosseae+ Trichoderma viride	58.33 [ab]	8.91 [bc]
Glomus mosseae+ Pseudomonas fluorescens	61.66 [ab]	8.38 [c]

Table 1: Effect of combined inoculation of *Glomus mosseae* and PGPR on plant growth and biomass of nursery grown papaya plants.
*** Means with same superscript are statistically on par at P=0.05 DMRT**

The plant height and the total dry weight of papaya varied significantly because of different bioinoculants application to the plants individually and in combination (Table-1). Maximum plant height and number of leaves was observed in soil inoculated with *Glomus mosseae* and *Frateuria aurentia* than single inoculation with *Frateuria aurentia* alone. Maximum plant height was observed in plants treated with single inoculation of potassium mobilizer alone (67.33 cm) which was on par with plants treated with *Glomus mosseae* + Phosphate solubilising bacteria and *Glomus mosseae* + *Pseudomonas fluorescens*. The least plant height was observed in uninoculated control plants (36.5 cm)

The highest plant height was observed in plants treated with *Glomus mosseae* +*Frateuria aurentia* (70 cm). The next best treatment was *Glomus mosseae* + Phoshate Solubilizing bacteria. The plant dry weight also showed the same trend, maximum dry weight was recorded in plants treated with a *Glomus mosseae* alone followed by *Glomus mosseae*+Psb and was least in uninoculated control plants. The plants inoculated with *Glomus mosseae* + *Trichoderma viride* showed least biomass and total dry weight.Several studies have also shown that higher amount of biomass through dual inoculation of AM with PGPR synergistically interact in the rhizosphere of plants (Fitter and Garbaye 1997, Gurumurthy 1997). Coinoculation of PGPR, with *Glomus mosseae* further enhanced the growth and biomass of papaya plants, such observations have also been made by earlier workers in several crops (Sumanna, 1998, Arpana, 2000). Karangianniadis and Velemis (2000) also reported significant differences between apple and peach varieties as similar results were reported by Karangiannidis *etal* (1997) in four grape vine root stocks. Although these two parameters varied significantly in respect to different bioinoculants.

The present investigations clearly brought out that combined inoculation with *Glomus mosseae* + potassium mobilizer can be attributed to the fact that growth of papaya seedlings raised in the nursery significantly increased. Thus, it can be concluded that a *Glomus mosseae* and PGPRs have positive correlation by increasing the plant growth and biomass production. *Glomus mosseae* + potassium mobilizer followed by *Glomus mosseae* + phosphate solubilising bacteria form the best microbial consortia to produce healthy and vigorous growing seedlings of papaya which will establish better when planted in field.

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