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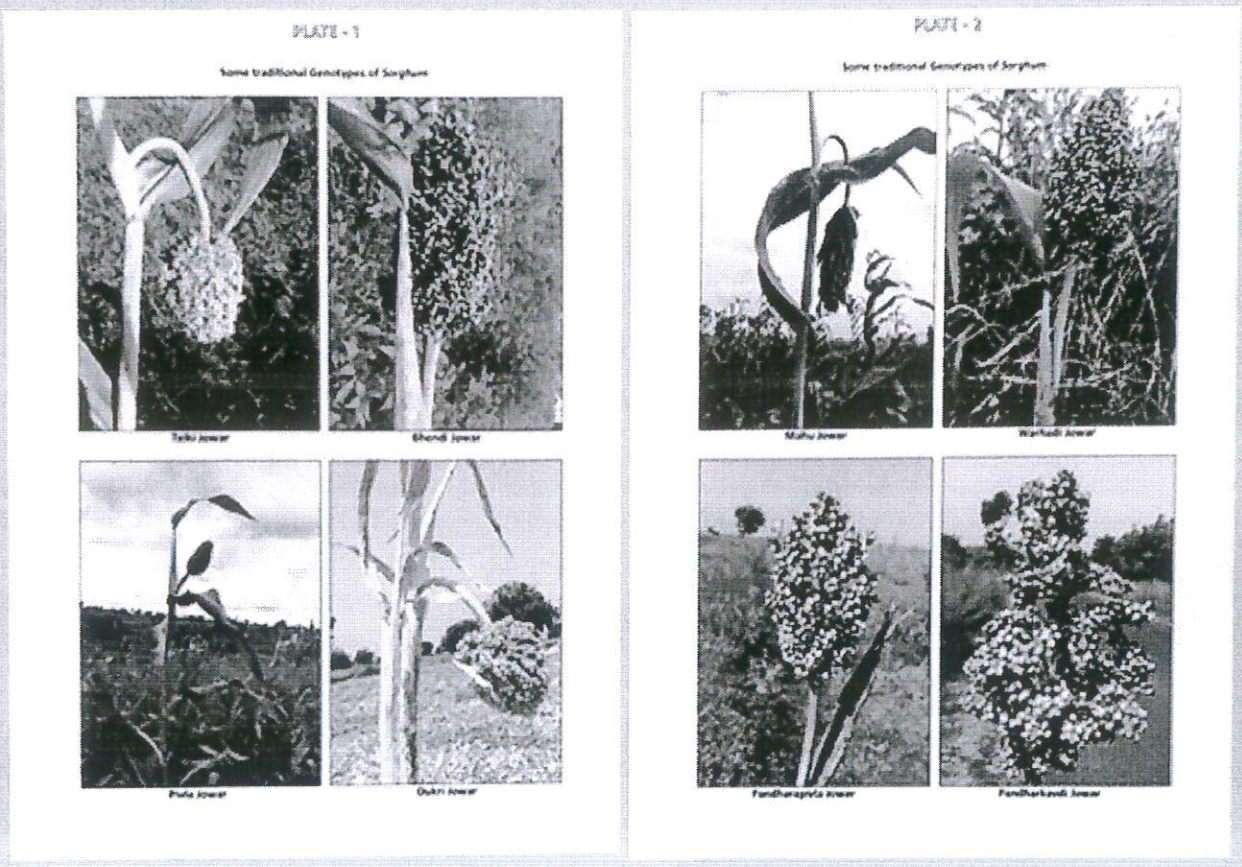

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EFFECT OF MYCORRHIZAE AND PGPF ON GOWTH OF TOMATO CV. TO1389

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ABSTRACT

The growth of tomato (*Solanum lycopersicum* L.) plants under the influence of arbuscular mycorrhizal fungi (AMF) and PGPF was studied under natural conditions. The mycorrhizal efficiency index (MEI) and interactive effect of AMF with other fungi (IEF) were calculated on the basis of dry biomass of plants. Fresh weight, dry weight and length of shoot and root of the tomato enhanced due to the application of AMF alone or mixed with other plant growth promoting fungi (PGPR). The mycorrhizal efficiency index showed maximum biomass production due to the application of AMF + *Aspergillus niger* followed by AMF + *Trichoderma harzianum*. Interactive effect of AMF with other fungi (IEF) was calculated. It was highest with *A. niger*, followed by *T. harzianum, T. viride, Alternaria solani* and *Rhizotonia stolonifer*. When the plants were treated with the indigenous AMF consortium, shoot length increased by 83.2 %, shoot fresh weight by 78.3 % and shoot dry weight by 40.7 % over control. The root length also increased by 6.3 %, root fresh weight by 8.6 % and root dry weight by 28.1 % over un-inoculated plant.

Keywords: Arbuscular Mycorrhizal Fungi, Plant growth promoting fungi (PGPF), Pot experiment, Biomass production, Tomato

Introduction

The arbuscular mycorrhizal fungi (AMF), associated with roots enhance plant growth (Muthukumar and Udaiyan, 2000). Plant Growth Promoting Fungi (PGPF), on the other hand, include some Ascomycetes (*Trichoderma, Fusarium, Phoma, Penicillium* and *Aspergillus)* and Oomycetes (*Pythum* and *Phytophthora*) genera. These fungi promote plant growth by inducing resistance against plant pathogens. Present investigation was undertaken to study the effect of AMF and PGPF on biomass production by tomato plants. It was reported that, when tomato seeds were treated with *T. harzianum* it did not affect seed germination but significantly improved shoot height, shoot diameter, shoot fresh and dry weight and root fresh and dry weight (Azarmi *et al.*,2011). Similarly, *T. harzianum* provided higher plant growth and protection against soil-borne pathogens that caused by damping-off seedlings in tomato (Harman *et al.*, 2004; Liu *et al.*, 2008.).

Material and Methods

Pot, soil and root segments of Sorghum were used as AMF inoculums (Menge *et al.*, 1982;Sharma *et al.*, 200),while rhizospheric fungi *viz.Aspergillus niger (ASCNB/fungi/17), Alternaria solani (ASCNB/fungi/28),Rhizopus stolonifer (ASCNB/ fungi/35)* and two *Trichoderma* species *viz. T. harzianum (ASCNB/fungi/43)* and *T.viride (ASCNB/fungi /44)* were collected from the field, isolated and identified (Subramanian 1971; Barnett 1999).

The experiment consisted of seven treatments with various inoculums combinations viz. T1: Control, T2: AMF, T3: AMF + *T. viride*, T4: AMF + *T. harzianum*, T5: AMF + *A. niger*, T6: AMF + *A. solani*, T7: AMF + *R. stolonifera*.

A pot experiment was undertaken to study the interaction of AMF and other PGPF and their impact on various growth parameters of tomato CV. TO1389 (Syngenta India Limited, Pune, Maharashtra). The experiment was conducted in the Botanical garden, Arts, Science and Commerce College, Naldurg during February to April, 2013. The soil was used as substrate, which was previously autoclaved for 1 h at 120°C and subsequently air dried. Pots (15 cm i.d.) were filled with autoclaved soil. A layer of 100 g AMF multiplied soil inoculums was distributed over autoclaved soil and covered with a thin layer of substrate soil.

Mycelial disc (2 cm dia.) of *A. niger, A. solani, R. stolonifer, T. harzianum* and *T. viride* from 7 days old culture was transferred to 50 ml PDA in a 250 ml conical flask and incubated for 7 days. After incubation, 100 ml sterile distilled water was added to the flask, and it was applied for inoculating the soil in the pots. Five surface sterilized seeds of tomato (cv. TO1389) were sown at of 2 cm depth. The pots were watered regularly.

After 20 days, a portion of the root was checked for AM colonization, while after 90 days the tomato plants were harvested for the study of growth parameters (Kumar *et al.*, 2009). Fresh weight of root and shoot were recorded, and then oven dried at 60°C for 48 h for determination of dry biomass (Muthukumar and Udaiyan, 2000).

The mycorrhizal efficiency index (MEI) was calculated following Bagyaraj, (1994).

The interactive effect of other fungi (IEF) with AMF was calculated by considering dry biomass of AMF treated plant as control as described by Bagyaraj (1994).

The data were statistically analyzed for variance (ANOVA) as described by Mungikar (1997).

Results and Discussion

The results obtained are given in Table 1. The shoot length was maximum when the plant was treated with AMF + *Trichoderma harzianum* (87.2 cm) followed by AMF + *T.viride* (86.3 cm), AMF + *Aspergillus niger* (82.1 cm), AMF + *Alternaria solani* (80.4 cm), AMF alone (75.3 cm) and AMF + *Rhizopus stolonifer* (73.5 cm), while minimum in control (non-mycorrhizal) plant (41.1 cm). Thus co-inoculation of AMF + *T. harzianum* showed highest length benefit

The root length was maximum in the plant treated with AMF + *A. niger* (20.6 cm) followed by those treated with AMF + *T. harzianum* (20.5 cm), AMF + *T. viride* (19.8 cm), AMF alone (18.6 cm) and AMF + *R. stolonifer* (17.8 cm) while it was minimum in control. Co-inoculation of AMF + *A. niger* (17.7 %) was found to be most beneficial.

Fresh weight of shoot was maximum in the plants treated with AMF + *A. niger* (35.3 g) followed by AMF + *T. harzianum* (32.69 g), AMF + *A. solani* (31.53 g) and AMF + *T. viride* (30.05 g). Minimum shoot fresh weight was recorded in control plants (14.11 g). When AMF was added along with *A. niger*, fresh weight benefit increased by 150.2 % over control.

Root fresh weight was maximum in AMF + *A. harzianum* (4.08 g) followed by AMF + *A. niger* (4.06 g), while it was minimum in control. When AMF was added along with *T. harzianum*, it showed maximum benefit (120.5 %) over control. Shoot dry weight was higher in the plants treated with AMF + *A. niger* (5.57 g) followed by AMF + *T. harzianum* (5.21 g), AMF + *T. viride* (4.88 g), AMF + *A. solani* (4.7 g), AMF + *R. stolonifer* (3.88 g) and AMF alone (3.56 g), while it was minimum in control. Interaction of AMF + *A. niger* resulted in 120.2 % benefit.

Root dry weight was maximum in the plants treated with AMF + *T. harzianum* (0.64 g) while minimum in control (0.32 g). Interaction of AMF along with *T. harzianum* was beneficial.

Mycorrhizal efficiency index (MEI) was maximum due to the application of AMF + *A. niger* (53.73 %) followed by AMF + *T. harzianum* (51.28 %), while minimum in case of AMF alone (28.21 %). Interactive Effect of fungi (IEF) and AMF enhanced growth when AMF was applied with *A. niger* (35.55 %), followed by *T. harzianum* (32.14 %), *T. viride* (26.62 %) *A. solani* (22 %) and *R. stolonifer* (5.92 %).

Table- 1: Effect of Arbuscular Mycorrhizal Fungi and PGPF on tomato after 90 DAI.

Sr. No.	Treatments	Shoot Length (cm)	Shoot Fresh Weight (g)	Shoot Dry Weight (g)	Root Length (cm)	Root Fresh Weight (g)	Root Dry Weight (g)	MEI (%)	IEF (%)
1	Control	41.1	14.11	2.53	17.5	1.85	0.32	-	-
2	AMF	75.3	24.45	3.56	18.6	2.01	0.41	28.21	-
3	AMF + *T. viride*	86.3	30.05	4.88	19.8	3.58	0.53	47.32	26.62
4	AMF + *T. harzianum*	87.2	32.69	5.21	20.5	4.08	0. 64	51.28	32.14
5	AMF + *A. niger*	82.1	35.30	5.57	20.6	4.06	0. 59	53.73	35.55
6	AMF + *A. solani*	80.4	31.53	4.70	16.8	2.97	0.39	44.01	22.00
7	AMF + *R. stolonifer*	73.5	26.51	3.88	17.8	2.76	0.34	32.46	5.92
C.D@ p= 0.05		14.20	6.33	0.96	1.37	0.82	0.12		

MEI = Mycorrhizal Efficiency Index, IEF = Interactive Effect of Fungi

There are many previous reports indicating effect of *Glomus monosporum, G. vesiculiferum, G. deserticola, G. intraradices, G. mosseae* and two unidentified AMF species on plant growth and fruit production of tomato (*Lycopersicon esculentum* Mill.) (Utkhede, 2006). It was observed that there was enhanced plant height (60.1 cm), shoot (1.03g) and root dry weight (0.69 g) in tomato after nine weeks by dual inoculation of *T. harzianum* (isolate P52) and AMF consortium containing one *Glomus*, three *Acaulospora* and one *Gigaspora* species than *T. harzianum* (isolate P52) alone (59.9 cm, 0.75 g and 0.48 g) and AMF alone (55.3 cm, 0.73g and 0.47g) and control (47.48 cm, 0.66 g and 0.33 g), while studying biocontrol potential of two arbuscular mycorrhizal fungi (AMF) *(Funneliformis mosseae* and *Acaulospora laevis*) and *T. viride* on Tomato (Mwangi et al., 2011). It was observed co-inoculation of *F. mosseae, A. laevis* and *T. viride* showed maximum increase in plant height, shoot fresh weight and root dry weight while dual inoculation of *F. mosseae* and *T. viride* increased the rest of the growth parameters like shoot dry weight, root fresh weight, root length and leaf area (Tanwar, 2013). It was investigated that there is positive effect on shoot and root length, dry shoot and root biomass due to the application of *T. harzianum* and or AMF over control under greenhouse conditions in tomato (Nzanza *et al.*, 2011).

The study concluded significant growth response of tomato plants due to the application of AMF and PGPF. On the basis of the values of MEI and IEF, obtained during present investigation, it can be concluded that AMF and other soil fungi improve growth and development of tomato plant.

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