
Effect of VA mycorrhiza on the growth and protein content in fruits of *Capsicum annuum* grown in acid lateritic soil

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A green house experiment was conducted to study the effect of arbuscular mycorrhizal association in *Capsicum* on growth characters, fruit yield and protein content. The experiment was conducted in 2003-2004 at the experimental cum Botanical Garden of Vidyasagar University, Midnapore, West Bengal.

Data analysis revealed that there was significant gain in fruit protein content because of the VAM inoculations. Maximum protein content was recorded in case of mixed inoculum followed by *Acaulospora dilatata*, *Glomus fasciculatum* and *Glomus mosseae*. Plant height and dry weight increased by *A. dilatata* and mixed inoculum significantly over others. Considering all the quantitative and qualitative characters, *A. dilatata* and mixed inoculum appeared more promising compared to *G. fasciculatum* and *G. mosseae* in promoting the growth of *Capsicum annuum* in the red lateritic soil of West Bengal.

Key words : *Capsicum*, fruit, growth, yield, protein, *Acaulospora dilatata*, *Glomus fasciculatum*, *Glomus mosseae*, mixed inoculum

INTRODUCTION

Plant grown under phosphorus deficient soil have greater dependence on mycorrhizae (Baylis, 1970). There is adequate possibility of utilization of VAM fungi in commercial agriculture (Ferguson, 1984; Schenck and Smith, 1981). Mycorrhiza spreads its extensive hyphal system beyond the depletion zone of plant roots and as an obligate symbiont help in absorption and translocation of phosphate and other nutrients. (Sanders and Tinker, 1973; Jacobsen *et al.*, 1992).

The biochemical and physiological activities of the host plants are greatly affected by arbuscular mycorrhizal (AM) inoculations (Koide and Schreiner, 1992; Smith and Gianinazzi-Pearson, 1988).

Pepper is one of many horticultural crops grown primarily in mid-latitudes and it is sensitive to high

temperatures (Wheeler *et al.*, 2000). The reported optimal range for vegetative and reproductive development of pepper plants is 21-33°C (Rylski and Spigelman, 1982). Biologically supra optimal temperatures above 34°C have been shown to cause marked reduction in pepper plant productivity (Erickson and Markhart, 2002). Roots of pepper normally form symbiotic associations with arbuscular mycorrhizal (AM) fungi (Davies *et al.*, 1992). Pepper shoot and root dry weights are reported to be affected by temperature and AM fungal treatments.

There is no previous evidence of pepper grown in acid lateritic soil with AM inoculations. Present study has been undertaken to see the effect of AMFs : *Acaulospora dilatata*, *Glomus fasciculatum*, *Glomus mosseae*, and mixed inoculum on *Capsicum annuum* grown on acid lateritic soil of southern part of West Bengal with respect to growth, yield and protein content in fruits.

MATERIALS AND METHODS

Plant growth conditions

The experiment was conducted from late October to February, 2003-2004, in a net house at Vidyasagar University, Midnapore, India, located at 22°10' N latitude and 87°19' E longitude at a distance of 130 km from the Bay of Bengal, at an elevation of 44 m above mean sea level. Soil used was the garden soil having organic matter 0.19%, total nitrogen 0.035%, available phosphorus 36 ppm and pH 5.1 and acid lateritic sandy clay loam was ground, sieved and mixed with sieved sand in 1:1 ratio. The mixture was oven sterilized (80°C) for 8 h on two days with interval of 24 h. Plastic pots measuring 20 cm upper diameter and 20 cm height were surface sterilized with formaldehyde, sun dried and filled with 3 kg of sterilized sand : soil mixture and kept moist for two weeks to remove the toxic effect if any because of heating.

AM fungal inoculum

Acaulospora dilatata, *Glomus fasciculatum*, and *Glomus mosseae* was multiplied in pot using sterilized soil : sand mixture. Sorghum plants were used as host and were cultured for 4 months in the net house. Mixed inoculum was prepared by mixing equal amounts of all the three AMF inocula. Inoculum consisted of sand, spores and mycelium of mycorrhiza and infected root fragments. Each pot was inoculated with 30 g inoculum for mycorrhizal treatment. Non-mycorrhizal control received 30 g sterilized inoculum.

The experiment consisted of a randomized block design with two factors : (1) mycorrhizal treatments with *Acaulospora dilatata*, *Glomus fasciculatum*, and *Glomus mosseae*, and mixed inoculum; (2) Non mycorrhizal control. Each treatment had five replicates. Pre-germinated seeds of *Capsicum annuum*, 3 in number were placed in every pot and later thinned to 1 seedling after 3 weeks. Pots were irrigated every day for four weeks and then every alternate day till the harvest, harvesting was done after 16 weeks.

Measurements

The plants length was measured by plain scales. The dry weight was obtained after drying the plants in oven at 80°C for 48 h. VA-mycorrhizal infection percentage was determined following the method of Phillips and Hayman (1970). The protein content in fruit materials was measured following the method of Lowry *et al.*, (1951).

RESULTS AND DISCUSSION

Mycorrhizal infection percentage was recorded high in all the mycorrhizal inoculations. (Table 2). Plant height of mycorrhizal plants was found significantly greater under *Acaulospora dilatata* and mixed inoculum treatments compared to *Glomus fasciculatum*, and *Glomus mosseae* (Table 1).

Biomass

Plants inoculated with *A. dilatata* and mixed inoculum produced significantly more biomass over the other inoculations. (Table 1). The yield in terms of fruit dry weight was also significantly higher in plants inoculated with *A. dilatata* and mixed inoculum. The fruit/plant ratio was recorded maximum in *A. dilatata* followed by mixed inoculum and *Glomus fasciculatum*., *Glomus mosseae* produced fruit weight even lesser than control (Table 1).

Protein content

The mycorrhizal symbiotic effect on protein content was significantly higher in all the treatments. The highest protein content was found in mixed inoculum followed by *A. dilatata*, *G. fasciculatum*, *G. mosseae*, and control (Table 2).

DISCUSSION

The general growth superiority of the mycorrhizal plants over non mycorrhizal plants seemed to be the direct effect of mycorrhizal association. *Acaulospora dilatata* and mixed inoculum appeared

Table 1 : Plant height, plant, dry biomass and fruit dry biomass of *Capsicum annuum* L., in different AMF treatments

Treatments	Plant height (cm)	Plant dry weight (g)	Fruit dry weight (g)	Total biomass (g)	Fruit/plant ratio	Correlation of plant and fruit biomass	Correlation of plant and fruit biomass
<i>Acaulospora dilatata</i>	46*	8.54*	3.80*	12.344	0.45		
<i>Glomus fasciculatum</i>	29.8	5.86	1.56	7.418	0.27		
<i>Glomus mosseae</i>	32.1	7.0	1.09	8.09	0.16	0.81	0.93
Mixed inoculum	45.7*	9.01*	2.81*	11.81	0.31		
Control	29.2	5.96	1.09	7.05	0.18		
L.S.D.	11.90	2.99	1.54				

* Significance at 5% level

Table 2 : Fruit dry biomass, VAM infection % and fruit protein content of *Capsicum annuum* L., in different AMF treatments

Treatments	VAM infection (%)	Fruit protein content (ppm)	Correlation of protein content and AM infection %	Correlation of protein content and fruit yield	Correlation of protein content and plant biomass	Correlation of protein content and plant height
<i>Acaulospora dilatata</i>	87*	62.8*				
<i>Glomus fasciculatum</i>	74*	51.8*				
<i>Glomus mosseae</i>	66*	34.2*	0.78	0.68	0.81	0.81
Mixed inoculum	88*	105.2*				
Control	9	17.2				
L.S.D.	8.76	10.6				

* Significance at 5% level

highly effective in raising the height of the plants as well as the biomass. This was commensurated to the higher level of AM colonization which was observed 87% in *A. dilatata* and 88% in mixed inoculum. However, there were many reports on increased growth and yield of several cereal crops like barley, and wheat mediated by VAM inoculation (Powell, 1981; Posta and Fuleky, 1997; Karagiannidis and Zinoviadi, 1998; Alkaraki and Clark, 1998; Mendoza and Borie, 1998)

The fruit/plant biomass ratio showed that there was a positive relationship between plant biomass and fruit biomass (correlation 0.811363). Plant with greater biomass and height directly produced more yield (correlation 0.828764 and 0.932287) and better quality of fruits with more protein content (correlation 0.811363 and 0.81098). Root colonization by AMF certainly affected the protein composition of plants through metabolic responses in the host plant (Ghazi *et al.*, 1999). Fruit protein content was highly correlated with VAM infection % (correlation = 0.781917) and with fruit yield (correlation = 0.687291) in all the treatments. This investigation indicated that the mixed inoculum along with *A. dilatata* may be the suitable AMFs to

try for field level inoculations in red lateritic soil of West Bengal.

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