

Response of *Capsicum annum* to two VAM species under green house condition

H.R. RAVEESHA, KOUSER SADATH AND G.R. MANJUNATHA REDDY

Accepted : October, 2009

SUMMARY

Pot trial experiments were conducted under green house condition to study the response of *Capsicum annum* (Chilli) to the inoculation of two species of *Glomus* fungi. Response of chilli in terms of growth and biochemical components were recorded. Experiments conducted by inoculating the *Glomus fasciculatum*, *G. mossae*, Nitrogen(N) Phosphorus(P) Potassium(K) and un-inoculated control in four replicates. Chilli showed improved performance than un-inoculated one. The growth parameters, number of fruits, weight of the plant, number of branches, size of the plant, number of flowers and biochemical concentration viz. carbohydrates, proteins and reducing sugars was significantly higher in *G. fasciculatum* and *G. mossae* compared to NPK treated, while un-inoculated control showed least performance among the experimental sets. Significant gain in growth parameters and biochemical composition was recorded.

Key words : *Glomus*, Pot trial, NPK, Biochemical

VAM fungi form symbiotic association with root system of more than 80% of Angiospermic plants. In Solanaceous vegetable crops *Glomus* species is most dominant AM fungus (Reddy *et al.*, 2006). *Arbuscular mycorrhizae* (AM) association is known to help in the growth of Chilli and other vegetables. Inoculation of VAM fungi improves physiological conditions of crop plants (Alexander *et al.*, 1989). The contribute of Mycorrhizae increases the uptake of major and minor nutrients (Srinivasa, 1993). Influence the better growth and higher yield as compared to non-mycorrhizal one (Powell, 1984). Further chilli is transplanted crop and hence, pre colonizing the transplant in the nurseries can help to exploit AM fungi. Hence, in the present experiment two species of *Glomus* compared to NPK and un-inoculated control evaluated under green house condition, performance of chilli in terms of growth and concentration of biochemicals was analyzed. During *Kharif* crop season all the experiments were conducted in triplicate, under green house condition. The aim of the experiment was to evaluate the efficiency of mycorrhizal fungus *Glomus* over chemical fertilizer NPK to improve the vegetative characteristics and biochemical composition.

MATERIALS AND METHODS

Present study was conducted at Department of Botany, Bangalore University, P.G Centre, Kolar in green house with an intention to evaluate the performance of chilli plant inoculated with *Glomus mossae* and *Glomus fasciculatum* compared to chemical fertilizer NPK and un-inoculated control. Pot trial method was used during the *Kharif*/rainy season during 2006. Uniformed sized pots of 15 cm diameter was filled with sterile soil having N=0.094, P=14.4, K=108 proportion of nutrients and 7.4 pH. Cultures of *Glomus mossae* and *Glomus fasciculatum* multiplied and maintained in pots containing sterilized soil and sand (1:1) on which Rhodes grass was grown (Sreenivasa and Bhagyaraj, 1988).

Seedlings of chilli plants were raised on well prepared nursery trays previously supplied with sterilized farmyard manure mixed with nursery soil. Inoculum was placed 2 cm below the soil as a thin layer with inoculum potential of $0.18 \times 10^4 \text{ g}^{-1}$ infective propagules of *Glomus mossae* and $0.19 \times 10^4 \text{ g}^{-1}$ infective propagules of *Glomus fasciculatum* i.e. 10g of inoculum per pot. Twenty days old seedlings from nursery trays were transplanted to each of the sixteen pots. Four pots each inoculated with *Glomus mossae* and *Glomus fasciculatum*, four pots NPK amended and four pots un-inoculated control. Three replicates of sixteen pots were kept.

One set of three treatments and un-inoculated control plants from each replicate were analyzed at 25 days after transplantation and other set subsequently analyzed at the same interval i.e. at 50 days after transplantation. Morphological features like root length, root number, shoot length, shoot branches, stem nodes, leaf number and surface area of leaf, number of flower, fresh and dry

Correspondence to:

H.R. RAVEESHA, Department of Botany, Bangalore University, Post Graduate Centre, KOLAR (KARNATAKA) INDIA

Authors' affiliations:

KOUSER SADATH, Department of Botany, Bangalore University, Post Graduate Centre, KOLAR (KARNATAKA) INDIA

MANJUNATH REDDY, P.G. Department of Biotechnology, S.R.N. Adarsh College, BANGALORE (KARNATAKA)

weight of plant were studied along with per cent root colonization. Per cent root colonization studied by staining the roots with trypan blue (Phillips and Hayman, 1970). Primary metabolites in the different part of the plant were analyzed. Total carbohydrates and reducing sugars were estimated by using the method of Mahadevan and Sridhar (1986). Total proteins were estimated by using Lowery *et al.* (1951) method. The data recorded were statistically analyzed.

RESULTS AND DISCUSSION

Influence of mycorrhizal biofertilizer on growth and quality parameters in *Capsicum annum* were studied in the present investigation under green house condition. The observations recorded at 25th day and 50 days after transplantation. The soil mixture had the pH 7.4. The efficiency of *Glomus mossae* and *G. fasciculatum* compared to NPK in improving the vegetative characteristics and biochemical composition of capsicum was undertaken.

The mean root and shoot length in chilli plant were 10 and 33cms, 12 and 31.5 cms in *G. mossae* and *G. fasciculatum* treated plant, respectively (Table 1). Fresh and dry weight of the chilli plant record at 25 and 75 days after transplantation showed high increase in weight of

chilli plant treated with *G. fasciculatum* followed by *G. mossae* and NPK treated over untreated control (Table 2). After 45 days it was observed that flowering was occurred in *Glomus* species treated plant with almost no flowering in untreated control. In all the trials it was recorded *G. fasciculatum* performance was more than *G. mossae* followed by NPK treated.

Root, stem and leaf of *Capsicum* of 45 and 90 days old plants subjected to primary metabolite analysis. It was recorded that, total carbohydrate level in both the trials was higher in Chilli plants treated with *G. fasciculatum* followed by *G. mossae*, un-inoculated NPK compared to untreated control (Table 3, Fig. 1). The reducing sugar level in root, stem and leaf of Chilli treated with *G. fasciculatum* recorded after 45 days was 14.0 and 12.0 3.7 µg/0.1g followed by *G. mossae* treated (4.7, 4.7 and 1.0 µg/0.1g). The same trend was recorded at 90 days (Table 3, Fig. 1). *G. fasciculatum* treated chilli plant showed considerable low protein content in root, stem and also in leaf followed by NPK treated and un-inoculated control in both the trials (Table 3, Fig. 1).

The present investigation aim to evaluate the performance of *Capsicum annum* under the green house condition, under the influence of mycorrhizal fungus in terms of growth parameters and primary metabolite

Table 1 : Morphological features of capsicum on 45th (A) and 90th (B) day

	Morphological features																			
	Root length (cm)		No. of root branches		Shoot length (cm)		No. of whoot branches		No of nodes		5th Internodal length (cm)		No. of leaves		5th leaf area (cm ²)		No of flowers		No of rruits	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
C ₁	10	24	100	150	12	35	-	-	4	10	1.2	2.5	6	14	140	310	-	5	-	5
C ₂	25	28.5	150	450	25.5	48	-	-	7	14	4.5	4.0	14	20	170	730	2	7	-	7
C ₃	33	28	450	550	30.5	51	1	3	9	12	4.5	3.0	18	24	220	930	4	12	-	11
C ₄	26	26	350	650	31.5	41	2	2	10	14	5.5	3.5	22	24	230	1100	9	12	-	12

Table 2 : Fresh and dry weight of capsicum plant at 45th and 90 days

Treatments	Plant part	45th days		Treatments	Plant part	90th days	
		Fresh weight (g)	Dry weight (g)			Fresh weight (g)	Dry weight (g)
C ₁	Root	0.640	0.243	C ₁	Root	5.483	0.636
	Stem	0.645	0.199		Stem	5.355	1.603
	Leaf	0.726	0.121		Leaf	6.230	0.321
C ₂	Root	3.236	0.297	C ₂	Root	6.883	0.764
	Stem	3.454	0.485		Stem	6.942	2.478
	Leaf	4.667	0.421		Leaf	8.830	0.576
C ₃	Root	6.525	0.421	C ₃	Root	7.711	2.918
	Stem	4.830	0.425		Stem	8.818	4.729
	Leaf	5.344	0.473		Leaf	8.836	0.875
C ₄	Root	6.846	0.495	C ₄	Root	6.988	3.315
	Stem	7.183	0.575		Stem	23.643	8.283
	Leaf	9.650	0.673		Leaf	28.768	3.006

Table 3 : Estimation of total carbohydrates, reducing sugars and total proteing

Biochemical	Plant part	45th days				90th days			
		C ₁	C ₂	C ₃	C ₄	C ₁	C ₂	C ₃	C ₄
Carbohydrates	Root	59	69	72	84	143	147	160	164
	Stem	64	70	84	78	125	131	131	132
	Leaf	105	97	108	105	97	111	117	133
Reducing sugars	Root	4.7	7	7	14	10.5	12.5	14.5	30
	Stem	4.7	7	7	12	15.5	19	20	24
	Leaf	1	1.5	3.2	3.7	4.7	7	7	9
Total proteins	Root	146	196	235	245	385	422	435	425
	Stem	155	187	219	290	342	410	362	407
	Leaf	233	268	332	450	498	560	590	560

Values are mean of triplicate

Values are mg/g of the plant material

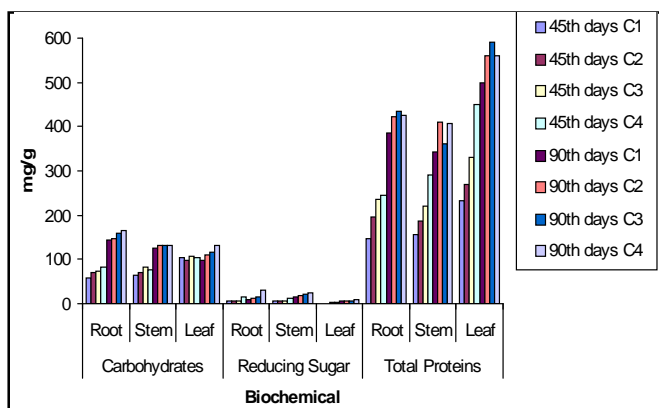


Fig. 1 : Showing carbohydrate, reducing sugar and total proteins at 45th and 90th day of analysis



Fig. 4 : 90th day of analysis

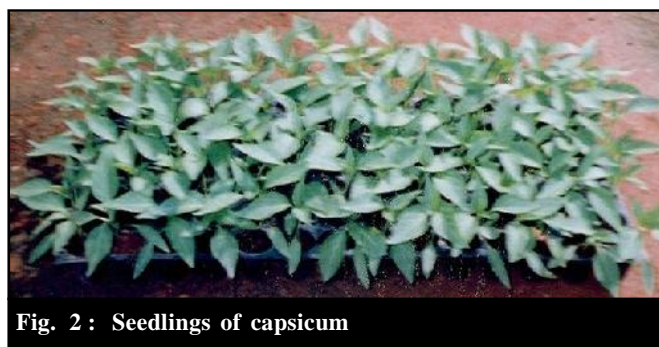


Fig. 2 : Seedlings of capsicum

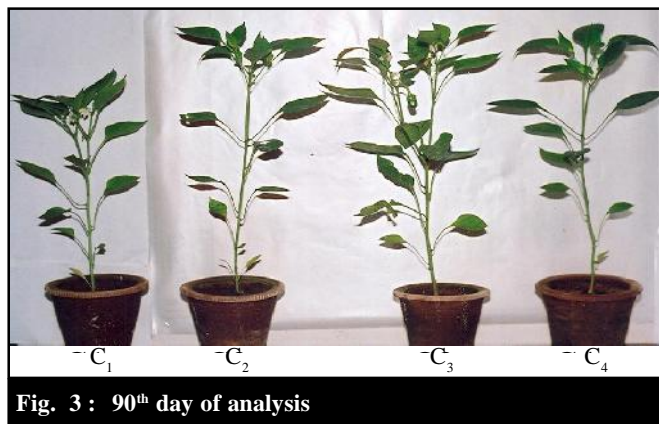


Fig. 3 : 90th day of analysis

content. Early flowering recorded in mycorrhizae inoculated plants compared with un-inoculated plants and is in consonance with the reports of Sreenivasa and Bhagyaraj, 1988. *G. fasciculatum* inoculated Chilli plant showed considerably higher performance in growth parameters like root and shoot length, fresh and dry weights, number of flowers. *G. mossae* treated Chilli plants showed considerable low performance followed NPK treated and un-inoculated control.

G. mossae and NPK treated plant showed significantly similar performance, this may be due to availability of NPK which is added in case of NPK treated plant and this may be due to increase of NPK uptake by the plant mediated by mycorrhizal fungus. Such observation is in consonance with the finding of Srinivas *et al.*, 1993.

The increase in the yield and yield components could be traced back to vegetative growth. Fresh and dry weight is also significantly higher in capsicum plant treated with *Glomus* species. These inturn correlate with the increase in the supply of macro and micronutrients as influenced by VAM species. Inoculation of *G. fasciculutum* found

to be best in increasing the total carbohydrate, total protein content and reducing sugar followed by *G. mossae*, however it was observed that *G. mossae* inoculated Chilli plant showed considerable higher level of protein content than *G. fasciculatum* treated.

Higher values of primary metabolites in VAM treated Chilli plants may be due to enhanced uptake of zinc. Zinc promotes growth hormones, starch formation and fruit production. Present findings are also in consonance with the report of Srinivasa *et al.* (1993) in Chilli performance

under the influence of VAM fungi. Other corroborative findings were that of Shrihari and Srinivasa (1997) and Sudhanshu and Verma (2006).

Conclusion:

The present green house experiment gives evidence that *Glomus* spp. improves the mineral uptake of plants, thereby influence the biochemical synthesis. Hence VAM species can be effectively used instead of chemical fertilizers.

REFERENCES

- Lowery, O.H., Rosebrough, N.J., Farn, A.L. and Randal. R.J. (1951). Protein measurements with the John phenol reagent. *J. Biol. Chem.*, **193** : 265- 275.
- Mahadevan, A. and Sridhar, R. (1986). *Methods in Physiological Plant Pathology*, p. 141-146.
- Phillips, J.M. and Hayman, D.S. (1970). Improved procedure for clearing roots and staining parasitic and vesicular arbuscular mycorrhizal fungi for rapid assessment of infection. *Trans. Br. Mycol. Soc.*, **55** : 156-161.
- Rao, G.Y.S., Bagyaraj, D.J. and Rai, P.V. (1983). Selection of an efficient VA mycorrhizal fungus for finger millet. *Zbl. Mikrobiol.*, **138** : 409-413.
- Shrihari, P.C. and Sreenivasa, M.N. (1997). Response of chilli (*Capsicum annum* L.) to inoculation with different AM fungi under two soil types. *J. Soil. Biol. Ecol.*, **17**(2): 102-108.
- Srinivasa, M.N., Krishnaraj, P.U., Gangadhara, G.A. and Manjunathaiah, H.M. (1993). Response of chilli to the inoculation of an efficient VA mycorrhizal fungus. *Scientia Hortic.*, **53**: 45-52.
- Sreenivasa, M.N. and Bagyaraj, D.J. (1988). *Chloris gayana* (Rhodes grass) a better host for mass production of *Glomus fasciculatum* inoculum. *Pl. Soil*, **106**:289-290.
- Sudhanshu, S. and Verma, N.K. (2006). Effect of VA mycorrhizae on the growth and protein content in fruits of *Capsicum annum* L. grown in acid laterite soil. *J. Mycopath. Res.*, **44**(2): 197-200.

