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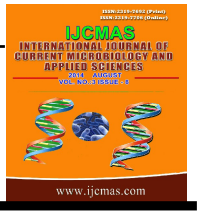

Original Research Article

Performance of Local Isolates of Arbuscular Mycorrhizal (AM) Fungi on Growth and Yield of Chilli (*Capsicum annuum L.*) Grown in Black Clayey Soil

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Keywords

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A B S T R A C T

A field experiment was conducted at Agricultural Research Station (ARS), Bheemarayanagudi, UAS, Raichur, during rabi season of 2011 to investigate the performance of local isolates of AM fungi along with standard AM fungus, *Glomus macrocarpum* on growth and yield of chilli variety, Pusa Jwala grown in black clayey soil. The results revealed that per cent root colonization, spore counts, population of free living nitrogen fixers and phosphate solubilizers in the rhizosphere of chilli were found to be significantly highest in plants inoculated with local isolate-9 and *G. macrocarpum* (Standard) as compared to rest of the local isolates of AM fungi and un-inoculated control, but, they did not differ significantly between AM fungi. A matching trend was observed with respect to plant height, total number of green fruits, fruit weight, plant dry weight per plant and shoot phosphorus concentration.

Introduction

Arbuscular mycorrhizal(AM) fungi are used to inoculate many crop plants to improve the nutrition and development of host plants (Jeffries, 1987;Sreenivasa et al., 1993).

Some scientists have observed wide variations among and within different species of AM fungi in their ability to promote plant growth (Rao *et al.,* 1983). Though AM fungi are not host specific, recent studies have indicated host preference for AM endophytes (Hetrick, 1984; Sreenivasa and Rajashekhara, 1989), thus suggesting the need to select suitable AM fungi for a particular host plant.

Therefore, the present investigation was undertaken to study the performance of local isolates of AM endophytes on growth and yield of chilli variety, Pusa Jwala, one of the predominant commercial crop of India. Moreover, chilli is a transplanted crop and it is practicable to raise mycorrhizal seedlings even with small quantity of mycorrhizal inoculum before transplanting to main field.

Materials and Methods

A field experiment was conducted at Agricultural Research Station (ARS), Bheemarayanagudi, UAS, Raichur, during rabi season of 2011 in black clayey soil. The soil had a 172.9kg total N/ha, the available phosphorus, 32kg/ha and available potassium, 295kg/ha with a pH of 7.7 and electrical conductivity of 0.20 ds/m.

Pot cultures of AM fungi were maintained in Rhodes grass (Sreenivasa and Bagyaraj, 1988). There were altogether eleven treatments each replicated three times. The inoculum of different AM fungi was placed 2cm below the soil as a thin layer @2kg per square meter nursery bed, based on the number of infective propagules.

The experiment was laid out in a randomized block design. Thirty day old precolonized chilli seedlings raised in unsterilized soil were transplanted at 2 seedlings per hill with a spacing of 75cmx45cm. The recommended dose of fertilizers (150:75:75, NPK, kg/ha) was given in two split doses as a basal and top dressing after 60^{th} day after transplantation(DAT). The crop was maintained for 122^{nd} day after transplantation. The plant height was recorded during peak flowering stage and plant dry weight was recorded after harvest.

The total number of green fruits and fruit weight per plant were recorded at an interval of one week from 75^{th} day to 122^{nd} day after transplantation. Totally two weeding operations were carried out and the field was irrigated at regular intervals. Percent root colonization was determined by staining the roots with trypan blue (Phillips and Hayman, 1970). The mycorrhizal spore counts were determined by wet sieving and decanting technique (Gerdemann and Nicolson, 1963). The population of free living nitrogen fixers and phosphate solubilizers in the rhizosphere of chilli was estimated by serial dilution and standard plate count method using Waksmann No. 77 and Pikovskaya's media respectively, during peak flowering stage during peak flowering stage. Shoot P concentration was determined by vanado-molybdate yellow color method (Jackson, 1967). The data recorded were statistically analysed by following randomized block design.

Results and Discussion

In the present investigation, all the local isolates of AM fungi colonized the chilli plants to varying degree. Among different local isolates of AM fungi, plants inoculated with Local isolate-9 and *G. macrocarpum* had significantly highest percentage of root colonization and spore counts as compared to un-inoculated control (Table 1).

AM inoculums contains three major components *viz.*, chlamydospores, infected root bits with arbuscles and hyphae. Few workers have indicated that the different rates of growth of fungi through root cortex may result in different level of colonization (Smith and Walker, 1981). Daft and Nicolson (1966) also correlated increased growth and yield of crops to the extent of mycorrhizal colonization.

Similar observations were recorded by Sreenivasa (1992) , Sreenivasa *et al*, (1993 and Srinivasan *et al*, 2012) in chilli and Amla respectively. Similarly, the population of free living nitrogen fixers and phosphate solubilizers were also found to be significantly highest in the plants inoculated with Local isolate-9 and G. macrocarpum as compared to other AM fungi and un-inoculated control plants (Table 1).

Table.1 Influence of arbuscular mycorrhizal fungi on per cent root colonization, spore count, population of free living nitrogen fixers and phosphate solubilizers in the rhizosphere of chilli

Treatments	Per cent root colonization	Spore Count/50g soil	Population of free living Nitrogen fixers (No.x10^4/g soil)	Population of Phosphate solubilizers (No.x10^4/g soil)
Un-inoculated Control	39.67	122.33	12.00	8.00
Local Isolate-1	78.00	167.33	15.67	10.33
Local Isolate-2	71.00	174.33	16.00	10.33
Local Isolate-3	80.33	189.67	18.33	11.00
Local Isolate-4	80.33	197.33	20.33	12.33
Local Isolate-5	81.33	208.00	22.67	13.67
Local Isolate-6	82.00	222.00	27.67	15.33
Local Isolate-7	84.67	241.33	26.33	15.67
Local Isolate-8	83.33	216.33	30.00	17.67
Local Isolate-9	86.00	233.00	32.67	18.00
Glomus macrocarpum (Standard)	92.00	268.67	36.33	19.00
S Em+	**1.44**	**5.20**	**0.79**	**0.71**
CD@ 5%	**4.23**	**15.33**	**2.32**	**2.10**

Table 2: Influence of arbuscular mycorrhizal fungi on growth, yield parameters and shoot phosphorus concentration in chilli

Treatments	Plant height (cm)	Number of green fruits / plant	Fruit weight (g / plant)	Plant dry weight (g/ plant)	Shoot "P" concentration (%)
Un-inoculated Control	47.33	37.00	86.00	5.42	0.10
Local Isolate-1	60.00	47.35	90.00	7.58	0.14
Local Isolate-1	64.00	48.60	90.45	10.92	0.15
Local Isolate-1	64.67	49.65	101.50	9.67	0.17
Local Isolate-1	67.33	50.00	94.00	11.50	0.18
Local Isolate-1	66.33	48.40	95.00	11.65	0.18
Local Isolate-1	64.33	50.65	100.30	12.80	0.19
Local Isolate-1	67.30	48.00	95.00	11.85	0.19
Local Isolate-1	54.45	51.75	107.50	12.40	0.21
Local Isolate-1	73.20	52.30	112.60	20.42	0.24
Glomus macrocarpum(standard)	77.10	53.65	117.00	20.75	0.27
S Em+	**2.60**	**1.29**	**3.67**	**0.60**	**0.01**
CD@ 5%	**7.67**	**3.82**	**10.83**	**1.72**	**0.03**

Increases in these rhizosphere population in mycorrhizal plants were earlier ascribed to increase in root biomass and root exudates as compared to non-mycorrhizal plants (Graham and Menge, 1982). It is a well known fact that higher microbial activity and nutrient concentrations are found in the rhizosphere region. Any change in this region might affect the rhizosphere microflora and inturn plant growth.

In the present study, the plant height, plant dry weight, total number of green fruits and fruit weight per plant were significantly highest in plants inoculated with local isolate-9 and *G. macrocarpum* when compared to other AM fungi and un-inoculated control plants(Table 2).

AM fungi are associated with increased growth of many plant species. They increase the uptake and translocation of not only P but also other nutrients (Abbott and Robson, 1982 ; Sreenivasa et al., 1993). Many workers have reported increased uptake of P, Zn, Cu,Mn, and Fe due to mycorrhizal inoculation in crop plants (Rao *et al.,* 1983 ; Sreenivasa, 1992 and Srinivasan *et al*,2012). In the present trial, higher levels of phosphorus in inoculated plants might have resulted in the improved crop growth and yield (Table 2). In a field response study on chilli to AM inoculation in black clayey soil, Sreeramulu and Bagyaraj (1986) observed higher values for growth, yield, P and Zn contents in plants inoculated with *Glomus fasciculatum* as compared to un-inoculated plants.

However, the results of the investigation clearly indicated the superiority of Local isolate-9 and *G. macrocarpum* in increasing P status of plants, and in turn plant growth and yield of chilli. Similar increase in growth, yield and nutrient content in plants inoculated with *Glomus etunicatum* and *G. mosseae* was reported by Sreenivasan *et al.,* 2012 and Hemalatha *et al.,* 2012 in Amla (*Emblica officianalis Gaerten*.) and French bean respectively.

The present investigation clearly brought out that the efficient AM fungi, Local Isolate-9 and *G. macrocarpum* were proved to be efficient in improving growth, yield and nutrition of chilli for black clayey soil to harness maximum yield.

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