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EFFECT OF AM FUNGI, *AZOSPIRILLUM BRASILENSE* AND *PSEUDOMONAS FLUORESCENCE* ON GROWTH, BIOMASS, NUTRIENT UPTAKE, AND YIELD ENHANCEMENT IN CULTIVAR BYADAGI KADDI OF *CAPSICUM ANNUUM* L.

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ABSTRACT

The interactions of rhizosphere microbes among plants depend on the establishment of intimate associations connecting the two partners. Green house experiments were undertaken between beneficial microbes *Azospirillum brasilense*, *Pseudomonas fluorescence*, with AM fungus (*Rhizophagus fasciculatus*) on cultivar Byadagi kaddi of *Capsicum annuum* L. The results revealed that plant growth, biomass, fruit yield and nutrient uptake and mycorrhizal spore number and per cent root colonization were significantly additive response in triple inoculation over the control or non inoculated plants. However, dual or single inoculations brought better response over the control plants. Over all the maximum benefits were offered by the inoculation of AM fungus (*Rhizophagus fasciculatus*) with *Azospirillum brasilense* and *Pseudomonas fluorescence* was recorded. The varied response in cultivar Byadagi kaddi of *Capsicum annuum* L. with three bioinoculants and their synergistic importance have been discussed.

KEYWORDS: ***Rhizophagus fasciculatus*, *Azospirillum brasilense*, *Pseudomonas fluorescence*, Biomass, *Capsicum annuum* L., Per cent root colonization.**

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INTRODUCTION

The root-soil interfaces constitute a dynamic microcosm known as the *rhizosphere* where microorganisms plant roots and soil constituents interact.[1,2,3,4,5,6,7,8] Plants play a significant role in regulation of the composition and diversity of AM fungal and bacterial communities because of the different spectra of their root exudates.[9] On the other hand, both AM fungi and bacteria play important roles in the development of the plant community.[10] Further, the most important advantage of mycorrhizal is its superior soil exploration and increasing uptake of P, N, Zn, Cu, S, Fe, Mg, Ca and Mn and the supply of these nutrients to the host roots.[11,12,13] The majority of Indian soil shows lack of sufficient phosphorus and mycorrhizal fungi has recognized to augment the phosphorus absorbing capacity in the rhizospheric zones of numerous plants.[14] Arbuscular mycorrhizal fungi (AMF) are act as weapons to produce resistance to protect plants against several soil-borne plant pathogens.[15,16] AMF are well known to provoke alterations within the host's physiology, furthermore root exudates, which influence the microbial population composition in the mycorrhizosphere. Agricultural and Horticultural crops have been shown benefit from AM Fungi on worldwide basis.[18] Horticultural as well as agricultural crop species such as chilli (*Capsicum annuum* L.) is one of the most valuable crops of India. Chillies are the excellent source of natural colors, it has nutritive and medicinal value as is a good source of vitamin A, C, E and also has antioxidants property.[19] Because of current public concerns in relation to the side effects of agrochemicals, more attention is currently being given to research areas concerning biological stability in soil, microbial diversity or microbial dynamics in soil. This is why the study of interactions in the mycorrhizosphere is a topic of current concern. Accordingly, the aim of this study is to evaluate the effect of nitrogen fixer and phosphate solubilizing bacteria with arbuscular mycorrhizal fungi (*Rhizophagus fasciculatus*) under greenhouse condition to improve the growth, nutrition and yield in cultivar Byadagi kaddi of *Capsicum annuum* L. with an aim to reduce the application of chemical fertilizer for sustainable agriculture.

MATERIALS AND METHODS

Capsicum annuum cultivar Byadagi kaddi were procured from Horticulture Research Station, Haveri (Devihosur) – 581110 (University of Horticultural Sciences, Bagalkot India). The study area of its geographical location lying in between 15° 30' and 15°50' north latitude and 75° 07' and 75° 38' east longitude. Cultivar Byadagi kaddi of *Capsicum annuum* L. seeds were thoroughly washed under running water and then with distilled water. *Capsicum* seeds were placed in 2% mercuric chloride solution for 2-3 minutes then rinsed with distilled water to ensure the surface sterilization of the seeds. Surface sterilized seeds were placed in measuring 25 × 50 cm (Length× Breadth) diameter broad pots having 8 kg sterilized soil containing sand: soil (1:1/v:v), to get seedlings about 10 to 15 cm in height, equal height seedlings were selected and they were transplanted in to the experimental pots. The microbial inoculants such as *Azospirillum brasilense* (Nitrogen fixer), *Pseudomonas fluorescence* (Phosphate Solubilizing Bacteria) were procured from the Institute of Organic farming, University of Agricultural Science Dharwad (India). These microbial inoculants are maintained in refrigerator at 4^0C till to use. The AM fungal (*Rhizophagus fasciculatus*) inoculum was prepared in the microbiology laboratory, P. G. Department of Botany, Karnatak University, Dharwad (INDIA) using *sorghum vulgare* L. as a host plant.

Experimental Design

The experiments were conducted under greenhouse conditions. The experimental pots measuring 25 × 30 cm (Length× Breadth) diameter containing 4kg sterilized soil was arranged in completely randomized block design with triplicates per treatment. The physico-chemical properties of experimental soil were given in Table 1.

The treatments given to each experimental plant were as follows:-

T1: Non- mycorrhizal

T2: *Rhizophagus fasciculatus* (Thaxt.) C. Walker & A. Schüßler

T3: *Rhizophagus fasciculatus* + *Azospirillum brasilense*

T4: *Rhizophagus fasciculatus* + *Pseudomonas fluorescence*

T5: *Rhizophagus fasciculatus* + *Azospirillum brasilense* + *Pseudomonas fluorescence*

Each experimental pot was maintained with single seedlings and pots were provided with Hogland nutrient solution without P, for every fortnight and watered alternate day.

Table 1

Showing the physico-chemical properties of garden soil used for experimental pots

Sl No.	Parameters	Value
1	Soil	Sandy loam
2	pH	8.01±0.03
3	Conductivity (EC)µS	302±0.46
4	Moisture %	4.90±0.02
5	Total organic carbon	1.72±0.02
6	Nitrogen %	0.05±0.00
7	Potassium%	6.60 ±0.00
8	Magnesium %	0.13±0.00
9	Copper (ppm)	0.02±0.00
10	Zinc (ppm)	3.90±0.01
11	Manganese (ppm)	0.94±0.02
12	Iron (ppm)	7.12±0.02

Mean values of three samples ± S.E

Analysis of growth parameters

The harvested experimental plant was subjected to analyze growth parameters such as shoot and root length, biomass production, nutrient uptake, and yield of all the experimental treatments. The dry weight of the shoot and root were measured after exposing the plant material to temperature of 72^0 C for 48 hrs under hot air oven. The phosphorus content in the shoot was determined by the vanado-molybdate phosphoric acid yellow color method outlined by Jackson.[20] Total nitrogen content was determined by the Micro kjeldahl method of Bremmer.[21] The total chlorophyll content in the leaves were estimated following the method of Arnon.[22]

$$\text{Per cent mycorrhizal colonization (PMC)} = \frac{\text{Number of root bits colonized}}{\text{Number of total segments examined}} \times 100$$

STATISTICAL ANALYSIS

All the data were subjected to a Statistical (two way) analysis of variance (ANOVA) using the SPSS software student version 16. Treatment means were compared by the Duncan's multiple range test (DMRT) at P=0.001.[26]

RESULTS

Cultivar Byadagi kaddi of *Capsicum annuum* L. production was improved with inoculation of different beneficial microbes. The results were diverse with each combination of microbial inoculation. The optimum results were obtained in the triple inoculation(AM fungus (*Rhizophagus fasciculatus*) with *Azospirillum brasilense* and *Pseudomonas fluorescence*) where as the greater values were recorded for cultivar Byadagi kaddi of *Capsicum annuum* L. compared to other dual and single combinations but control or non inoculated plants do not showed better response. Plant height was found to be significantly increased in inoculated plants when compared to the control ones. The soil for the experimental plants was tested before using for its micro and macro nutrient availability and to know the deficiency of nutrition and the values are shown in Table 1. In cultivar Byadagi kaddi of *Capsicum* annuum L. the plant height was found to be highest in the plants inoculated with *Rhizophagus fasciculatus* (AMF) + *Azospirillum brasilense* (NF) + *Pseudomonas fluorescence*(PSB) inoculation at 60 days was (69.96cm), and at 90 days was (78.66cm) followed by the inoculation with AMF+ NF at 60 days was (64.91cm), at 90 days was (69.33cm) and AMF+PSB at 60 days was (58.73cm) and 90 days was (66.33cm). Plants inoculated with AM fungi alone showed lesser plant height at 60 and 90 days was (55.7cm and 63.33 cm) when compared to the other treatments but it was significantly high when compared to uninoculated (control) plants (Table 2, Fig 2). Dry weight of shoot and root.

Determination of PMC and MSN

Mycorrhizal spore number (MSN) was isolated from the cultivar Byadagi kaddi of *Capsicum annuum* L. rhizosphere by adapting the technique of wet sieving and decanting method proposed by Gerdemann and Nicolson.[23] The per cent mycorrhizal colonization (PMC) was evaluated microscopically followed by means of clearing of roots into 10% KOH and staining with 0.05% trypan blue in lactophenol according to method described by Phillips and Hayman.[24] The following formula was used to calculate the per cent mycorrhizal colonization given by Giovannetti and Mosse.[25] showed significant values in the plants inoculated with triple inoculation of AMF+PSB+NF at 60 and 90 days. The degree of increase varied with different combinations of beneficial microorganisms. Cultivar Byadagi kaddi of *Capsicum annuum* L. showed highest dry weight of shoot (14.16 g) and root (2.36 g) in triple inoculated plants. However, plants with dual inoculations of AMF+ NF dry weight of shoot was 8.99 g and dry weight of root was 1.94 g and in case of AMF+PSB inoculation dry weight of shoot was 7.90g, dry weight of root was 1.71 g. There was a moderate increase in AMF single inoculation but was significant when compared to control plants at 90 days (Table 2, Fig.1 A). Mycorrhizal spore number was observed at 60 and 90 days in experimental plant. Number of spores varied at the interval of 60 and 90 days in all the combinations of treatments. Cultivar Byadagi kaddi of *Capsicum annuum* L. showed highest spore number in the plants inoculated with AMF+PSB+NF (168.0/50 g soil) per plant and in case of dual inoculation the spore number was moderate in AMF+ NF (124.66/50 g soil) per plant and AMF+PSB (116.66/50 g soil) per plant. Spore number was found least in single inoculation of AM fungi (107.33/50 g soil) per plant and in control plants spore number was not recorded at 60 and 90 days. However, spore number was found to increase from 60 to 90 days (Table 2). Mycorrhizal colonization was found to be significant in all the treatments of cultivar Byadagi kaddi except in control or uninoculated plants. The per cent root colonization was recorded highest with triple inoculation (AMF+PSB+NF) (92.66%) followed by the dual inoculation of AMF+NF (83.06%) and AMF+PSB (74.66%). However there was not much increase in mycorrhizal colonization in plants inoculated with AMF (71.66%) alone (Fig. 1 B). There was no colonization recorded in control plants. Numbers of fruits were increased in all the inoculated plants over the control ones. Optimum numbers of fruits were found in the plants inoculated with AMF+PSB+NF (8.98) per plant, followed by AMF+NF (7.83), AMF+PSB (6.56) and single AMF (4.56) inoculation over the control plants (Fig. 1 C). Increased uptake of nitrogen was found in the inoculated plants when compared to the control ones. Uptake of nitrogen was found in varied concentration among the different combinations at 60 and 90 days (Table 2). Concentration of nitrogen in shoot was found more in triple inoculated plants (AMF+PSB+NF) (4.03 %) followed by the dual inoculation of AMF+NF (3.36%) and AMF+PSB (3.03 %). However, there was moderate increase in plants inoculated with AMF (2.23 %) alone but it was significant over control plants (Fig. 1 D). The

uptake of nitrogen varied significantly in inoculated plants over control ones at 60 and 90 days. Phosphorus uptake in cultivar Byadagi kaddi of *Capsicum annuum* L. was found to be more in plants inoculated with AMF+PSB+NF (0.50%) than the dual inoculation of AMF+NF(0.41%) and AMF+PSB(0.38%). There was low percentage of uptake of phosphorous in the plants inoculated with AMF (0.36%) alone. Increased total chlorophyll content also found in triple inoculation AMF+PSB+NF (2.46mg/g) followed by dual inoculation of AMF+NF (1.95 mg/g) and AMF+PSB (1.66 mg/g). However, there was moderate increase in plants inoculated with AMF (1.46 mg/g) alone but it was significant over control (1.20mg/g) plants. Significant correlation was observed between all the growth parameters of cultivar Byadagi kaddi according to Pearson's correlation coefficient as shown in Table 3. Significant correlation was observed between dry weight of root and per cent mycorrhizal colonization (r=0.726), mycorrhizal spore number (r=0.944), phosphorous uptake in shoot (r=0.928), number of fruits per plants (r=0.684) and total chlorophyll content (r=0.932) at P=0.01.

DISCUSSION

The results brought significant effect with the different microbial inoculation on growth and yield in Cultivar Byadagi kaddi of *Capsicum annuum* L. under Green house conditions. Results on cultivar Byadagi kaddi of *Capsicum annuum* L. influenced by combined inoculation of AM fungus *Rhizophagus fasciculatus* (AMF), *Azospirillum brasilense* (NF) and *Pseudomonas fluorescence* (PSB) have brought positive growth and biomass yield. These findings are consistent with early contribution by Zaidi et al.[27] Barea et al.[28] have reported that synergistic microbial interaction between AM fungus and phosphate-solubilizing bacteria (PSB) in improving P supply on legume plant. Significantly increased P content was recorded in cultivar Byadagi kaddi of *Capsicum annuum* L. inoculated with triple inoculation AM fungus with *Azospirillum brasilense* and *Pseudomonas fluorescence*. This indicated that these microorganisms act synergistically when inoculated in combination. The experimental results also confirmed that, the dual inoculation of AM fungus and *Azospirillum brasilense* yielded positively over the single and control or non inoculated plants. Similar results were obtained with inoculation of beneficial microorganisms, their synergistic or additive effect further beneficial for increasing growth and yield on *Sesamum indicum* L. and Pigeon pea.[29,30] Since the soil contains extremely rich pool of microbial entities through extremely diversified and intricate relationships, this feature of soil may from time to time contribute difficulty to reproduce similar results at the same time these microorganisms contribute better root exudates and growth regulators.[31,32]

Table 2

Showing effect of AM fungi (Rhizophagus fasciculatus) with Azospirillum brasilense and Pseudomonas fluorescence on growth parameters such as shoot and root length, biomass production, yield parameters, and nutrient uptake in cultivar Byadagi kaddi of Capsicum annuum L.

Treatment	Shoot			Root			Yield	Mycorrhizal status	Biochemical and Nutrient Status			
	Length (cm)	Fresh Weight (g)	Dry Weight (g)	Length (cm)	Fresh Weight (g)	Dry Weight (g)	Number of fruit/ plant	PMC	MSN/50 g soil	T C(mg/g)	Nitrogen uptake(%)	Phosphorus uptake(%)
60 DAYS												
[a]**NM**	44.65±0.00	17.62±0.01	1.26±0.00a	21.33±0.33	2.06±0.03a	0.73±0.00a	0.8±0.03a	[b]NR	[b]NR	0.99±0.00a	1.98±0.01	0.09±0.00a
R. f	55.7±0.01a	21.11±0.0a	4.78±0.01b	26.33±0.3a	2.88±0.0ab	0.97±0.00a	1.6±0.08b	60.77±0.03	92.66±0.33a	1.16±0.06a	2.1±0.00a	0.13±0.01ab
R. f +A b	64.91±0.01	29.66±0.0b	8.02±0.00c	31.66±0.32	3.97±0.0bc	1.08±0.01b	3.4±0.08c	68.63±0.02	112.00±0.57	1.33±0.03b	2.46±0.0b	0.18±0.00b
R. f + Pf	58.73±0.03	25.38±0.01	6.81±0.00b	28.00±0.0a	3.45±0.0bc	1.01±0.00b	2.83±0.03	61.43±0.0a	98.3±0.33ab	1.2±0.00bc	2.23±0.0b	0.16±0.00b
R. f +A b+ Pf	69.96±0.0d	31.03±0.01	11.3±0.03d	34.66±0.30	4.21±0.0cd	1.81±0.00c	4.6±0.11d	71.4±0.03d	128.67±0.33	1.5±0.00c	2.8±0.00c	0.25±0.01c
90 DAYS												
[a]**NM**	50.63±0.36a	19.3±0.30a	1.49±0.00a	30.66±0.3a	3.53±0.03b	1.23±0.02b	2.46±0.3b	[b]NR	[b]NR	1.20±0.00b	2.23±0.0b	0.13±0.01ab
R. f	63.33±0.33c	24.5±0.00b	5.13±0.02b	36.66±0.3c	4.13±0.07c	1.60±0.00b	4.56±0.28	71.66±0.3b	107.33±0.33	1.46±0.03c	2.86±0.03	0.36±0.01cd
R. f +A b	69.33±0.32d	34.66±0.33	8.99±0.00d	45.33±0.0d	5.16±0.03d	1.94±0.016	7.83±0.03f	83.06±0.09	124.66±0.34	1.95±0.02d	3.36±0.33	0.41±0.01de
R. f + Pf	66.33±0.3cd	31.66±0.3c	7.90±0.05c	38.33±0.4d	4.53±0.05d	1.71±0.00d	6.56±0.03	74.66±0.09	116.66±0.88	1.66±0.03c	3.03±0.0d	0.38±0.00d
R. f +A b+ Pf	78.66±0.33e	36.93±0.32	14.16±0.03	54.00±0.00	6.73±0.01e	2.36±0.03f	8.98±0.0g	92.66±0.67	168.00±0.57	2.46±0.03e	4.03±0.09f	0.50±0.01e
F-statistics values												
Days (D)	2031.1***	1579.23***	4569.13***	4465.12***	5360.99***	4089.97***	1607.7***	5267.48***	3612.5***	679.15***	4.68***	2432.43***
Treatment(T)	3362.7***	2579.57***	52596.7***	1099.81***	1976.04***	1301.12***	450.16***	32616.5***	31487.5***	235.35***	1.44***	461.01***
D×T	24.215***	160.59***	847.99***	94.81***	164.84***	39.46***	38.89***	438.03***	508.61***	46.04***	0.187***	91.42***

****** represents significant at P=0.001. The values represents mean of triplicate. Means of variables followed by same alphabet are not significantly differed (P>0.001) according to DMRT.***

Note: a- NM-Non Mycorrhizal, b- NR- Not Recorded, R.f- Rhizophagus fasciculatus, A b- Azospirillum brasilense, Pf- Pseudomonas fluorescence.

PMC- Per cent Mycorrhizal colonization, MSN- Mycorrhizal Spore Number, TC- Total Chlorophyll.

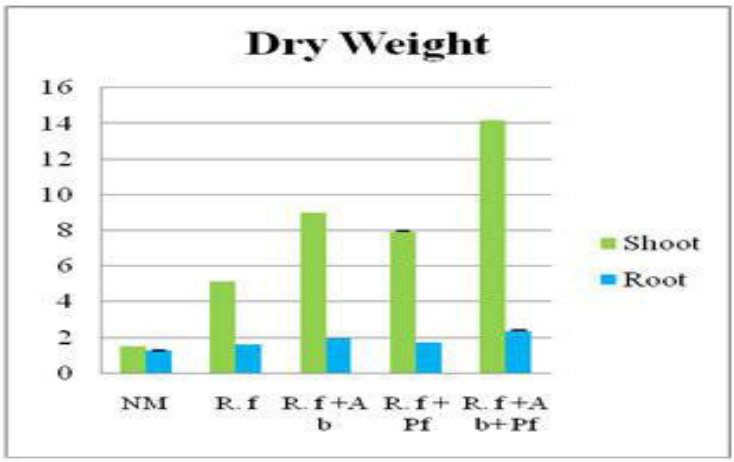
Table 3

Showing the Pearson's correlation coefficients (r) of AM fungi (Rhizophagus fasciculatus) with Azospirillum brasilense and Pseudomonas fluorescence on growth parameters such as shoot and root length, biomass production, yield parameters, and nutrient uptake in cultivar Byadagi kaddi of Capsicum annuum L.

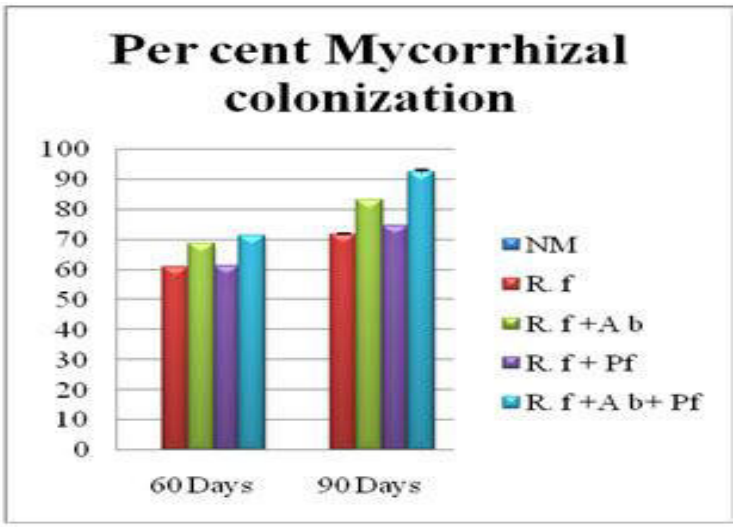
	TR	SL(cm)	SFW(g)	SDW(g)	RL(cm)	RFW(g)	RDW(g)	NF/P	PMC	MSN	TC(mg/g)	N (%)	P (%)
Days	0.000	0.361	0.355	0.145	0.694	0.620	0.657	0.196	0.166	0.670	0.610	0.644	0.722
TR		0.838**	0.863**	0.925**	0.597**	0.681**	0.658**	0.768**	0.838**	0.656**	0.636**	0.638**	0.570**
SL			0.941**	0.957**	0.882**	0.918**	0.883**	0.903**	0.941**	0.888**	0.875**	0.891**	0.851**
SFW				0.921**	0.830**	0.872**	0.824**	0.838**	0.874**	0.889**	0.841**	0.854**	0.823**
SDW					0.789**	0.846**	0.801**	0.855**	0.921**	0.801**	0.821**	0.815**	0.728**
RL						0.985**	0.954**	0.705**	0.736**	0.971**	0.979**	0.983**	0.949**
RFW							0.936**	0.733**	0.777**	0.954**	0.969**	0.966**	0.914**
RDW								0.684**	0.726**	0.944**	0.932**	0.957**	0.928**
PMC									0.986**	0.742**	0.704**	0.719**	0.746**
MSN										0.759**	0.747**	0.757**	0.749**
NF/P											0.960**	0.973**	0.964**
TC												0.983**	0.930**
N (%)													0.966**

****. Correlation is significant at the 0.01 level (2-tailed).**

Note: TR: Treatment, SL: Shoot length, SFW: Shoot Fresh weight, SDW: Shoot dry weight, RL: Root length, RFW: Root fresh weight, RDW: *Root dry weight, NF/P: Number of fruit per plant, PMC: Per cent mycorrhizal colonization; MSN: Mycorrhizal spore number, N: Nitrogen, P: Phosphorus.*



(A)



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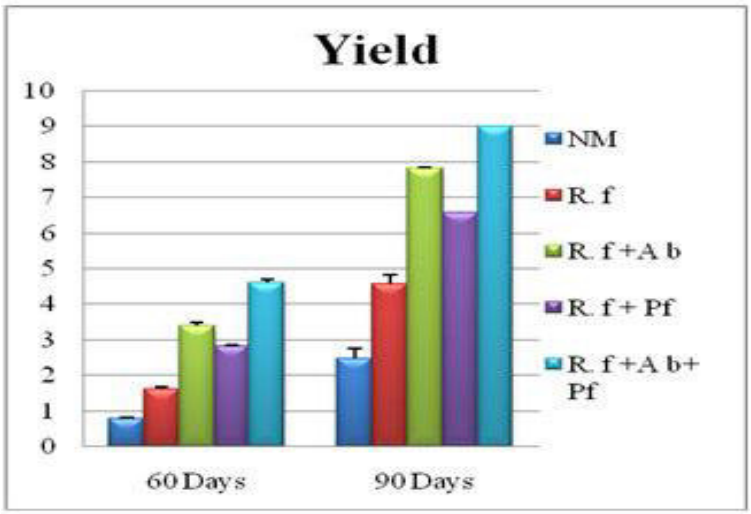

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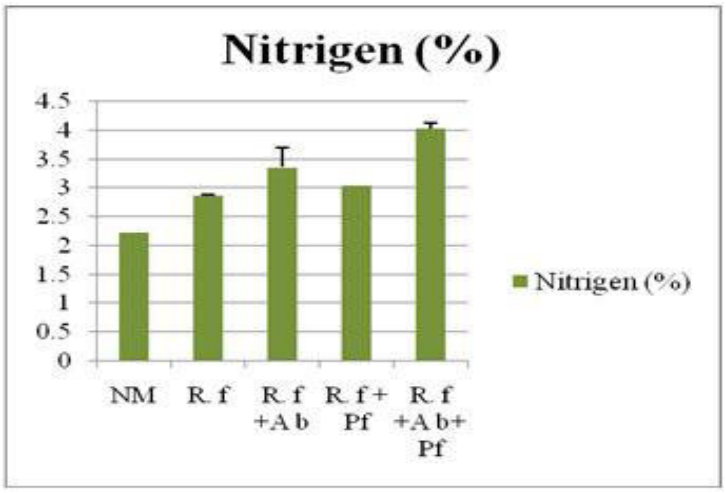

(D)

Figure 1

Showing the interaction effect AM fungus (Rhizophagus fasciculatus) with Azospirillum brasilense and Pseudomonas fluorescence on dry weight of soot and root (A), Per cent mycorrhizal colonization(B), Yield (C) and Nitrogen uptake (D) in cultivar Byadagi kaddi of Capsicum annuum L. at 90 days.

Figure 2

Showing the interaction effect AM fungus (Rhizophagus fasciculatus) with Azospirillum brasilense and Pseudomonas fluorescence on cultivar Byadagi kaddi of Capsicum annuum L. at 90 days.

1. *Rhizophagus fasciculatus* + *Azospirillum brasilense* + *Pseudomonas fluorescence*, 2. *Rhizophagus fasciculatus* + *Pseudomonas fluorescence*, 3. *Rhizophagus fasciculatus* + *Azospirillum brasilense*, 4. *Rhizophagus fasciculatus* (Thaxt.) C. Walker & A. Schüßler, 5. Non-mycorrhizal

The present study revealed that, cultivar Byadagi kaddi of *Capsicum annuum* L. influenced by the inoculation of AM fungus and other beneficial microbes in combination have showed significant results with respect to rhizosphere microbial density. It indicated that, AM fungus cope up with other microbes associated with cultivar Byadagi kaddi of *Capsicum annuum* L. rhizosphere. Since AM symbiosis is recognized to alter microbial population composition in the rhizosphere,[17,33] testing the interaction of AM fungi in addition to soil beneficial microbes have constructive to understand the probable additive or synergistic effects. The young roots showed that arbuscules make possible additional nutrient exchange possible, where as extensive vesicle formation is seen only at later stage of growth. Thus arbuscules functioning as nutrient exchange as reported by Subba Rao.[34] Rukmani,[35] have explained that the beneficial effects of bacterial inoculation have resulted in increased protein content and elemental nutrition as well as phosphorus uptake in plants. Selvakumari et al.[36] explained that plant augmentation is promoted by the inoculation of bio-fertilizers. In general the use of bio-fertilizers was highly useful for increasing vegetative growth and yield. Specific rhizosphere microorganisms are also important and can play a relevant role in promoting root growth and mycorrhizal development, facilitating plant performance in a semiarid ecosystem. This could be critical for optimal establishment of plants in these areas. [16,30,37] A meticulous understanding of the AM fungi-beneficial microbial interactions are essential for their successful consumption for increasing growth and yields of crops without inorganic fertilizers and pesticides.[38] Many researchers have demonstrated a clear association between 'above-ground' and 'below-ground' diversity.[39,40] AM fungi interact with a complete array of other microorganisms in soils. The highest mycorrhizal spore number was recorded in the cultivar Byadagi kaddi of *Capsicum annuum* L. rhizosphere inoculated with AM fungus (*Rhizophagus fasciculatus*) with *Azospirillum brasilense* and *Pseudomonas fluorescence* over the control plants. This may due to bacterial communities and precise bacterial strains endorse germination of AM fungal spores in addition to increase the rate and extent of root colonization by AM fungi.[41] The current experimental results as well revealed that, the microbial inoculation is responsible for increased yield over the non mycorrhizal (control) plants. The parallel results were observed by previous workers with inoculation of some plant growth promoting microorganisms.[12,42,43,44,45] On the basis of the various growth parameters, it is concluded that the inoculated plants showed greater growth rate than the uninoculated plants. However the triple inoculation with *Rhizophagus fasciculatus* (AMF) + *Azospirillum brasilense* (NF) + *Pseudomonas fluorescence* (PSB) was found to be superior in increasing the growth and biomass and the production can be increased with the application of bioinoculants like *Rhizophagus fasciculatus*, *Azospirillum* brasilense and *Pseudomonas fluorescence*, the mycosymbiont under goes pronounced alteration of root system besides ensuring ecological sustainability[46,47,48] Therefore, from this study we concluded that the potential of PSB, *Azospirillum brasilense* and *Rhizophagus fasciculatus* association on cultivar Byadagi kaddi of *Capsicum annuum* L. was well established.

CONCLUSION

The present study verified that the AM Fungi inoculation with beneficial microorganisms will help the plan significantly with respect to growth, yield and nutrient uptake of plants by enhanced bioavailability and mobility of plant nutrients. Thus, soil amendment with AM fungi and beneficial microorganisms have the potential to crop improvement, growth, yield and nutritional value of *Capsicum annuum* L. for cultivar Byadagi kaddi growers. The important finding is that the AM Fungi and beneficial microorganisms will possibly reduces the use of commercial fertilizers application for this experimental plants.

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CONFLICT OF INTEREST

Conflict of interest declared none.

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