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STUDY OF INTERACTION BETWEEN AM FUNGI AND VERMICOMPOST ON GROWTH AND NUTRIENT CONTENT OF METHI (*TRIGONELLA FOENUM-GRAECUM*) IN UN-STERILE SOIL FROM EASTERN UTTAR PRADESH, INDIA

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ABSTRACT

The interaction between *Acaulospora laevis, Glomus fasciculatum, G. mosseae* (AM fungi) and vermicompost on growth and nutrient of Methi (*Trigonella foenum-graecum*) in un-sterile soil was studied. The plants inoculated with *G.fasciculatum* showed increased fresh weight, shoot length, root length, nodules and leaves over the control. There were also significant increases in nutrients; N,P, Ca and Zn increased in plants treated with *G. mosseae*; Mg and Cu increased in plants treated together with *A. laevis*, *G.fasciculatum*, *G. mosseae*, and vermicompost; and Fe increased in plants treated with *G.fasciculatum*. The increase in growth and nutrients of Methi were proportional to the increase in root colonization of arbuscular mycorrhizal (AM) fungi. The available P and N from AM fungal inoculated soil after harvest was less than that in un-inoculated soil indicating that AM fungi have helped in mobilization of P and N from soil to plant.

Figure : 00 References : 09 Tables : 03

KEY WORDS : *Acaulospora laevis*, *Glomus fasciculatum, G. mosseae*, Nutrient increase

Introduction

Trigonella foenum-graecum (Methi) is an important leafy vegetable and its seeds are used as condiments in India. It also contains vitamins, minerals and other nutrients that are useful for diabetic patients. The role of arbuscular mycorrhizal (AM) fungi in plant nutrition especially phosphorus is well known[7]. Several field and laboratory experiments have demonstrated that AM colonization improves the growth and nutrition of host plant[6]. There is no report on AM fungal association and vermicompost in Methi in relation to in microelements nutrition in un-sterile soil. Therefore studies were conducted on association of AM fungi with Methi to observe growth and nutrient uptake in un-sterile soil.

Materials and Methods

The present investigation was carried out in un-sterile soil[6] during rabi seasons 2014-2015 using local variety of Methi. *Acaulospora laevis* was isolated from rhizosphere soil of *Cajans cajan*, *Glomus fasciculatum* from rhizosphere soil of *Sesamum indicum* and *G. mosseae* from rhizosphere soil of *Pisum sativum*. These cultures were maintained on maize roots using a mixture of soil:sand:FYM (1:1:1). The rhizosphere soil containg 80-100 chlamydospores/50 g and root segments of maize colonized by particular AM fungus were used as mycorrhizal inoculum. AM inoculum @ 10 g/pot when single species was used and AM inoculum @ 5 g/pot of each species when two species were used in combination, and 5 g

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TABLE - 1: Effect of AM fungal inoculation and vermicompost amendment on growth parameters

Treatment	Shoot		Root				Root
	Fresh wt	Dry wt	length (cm)	length (cm)	Nodules	Leaves	Colonization
Control	0.25	0.035	7.1	2.66	2	9.53	45
Acaulospora laevis	0.37 (48)	0.04 (14)	8.65 (21)	3.45 (31)	3.83 (91)	11.4 (20)	75 (67)
Glomus fasciculatum	0.45 (80)	0.05 (43)	11.16 (57)	4.1 (54)	5.4 (170)	12.71 (33)	85 (89)
Glomus mosseae	0.32 (28)	0.05 (43)	8.36 (18)	3.28 (23)	3 (50)	10.33 (8)	80 (78)
Vermicompost	0.26 (4)	0.025 (4)	7.31 (3)	3.8 (43)	3.3 (65)	9.81 (3)	75 (67)
A. laevis, G. fasciculatum,	0.35	0.06	8.91	3.13	3.5	12.13	100
G. mosseae and Vermicompost	(40)	(66)	(25)	(18)	(75)	(27)	(122)
CD (*P=0.05*)	0.07	0.012	1.52	0.53	1.16	1.35	17.36
CV (%)	20.3	23.25	15.5	13.52	29.42	10.74	21.51

TABLE - 2: Effect of AM fungal inoculation and vermicompost amendment on nutrient content after 30 day colonization of *Trigonella foenum-graecum*.

Treatment	pH	EC	Organic carbon (%)	P_2O_5 (Kg/ha)	Potash (Kg/ha)	Zn (ppm)	Cu (ppm)	Mn (ppm)	Fe (ppm)
Control	8.55	0.51	1.00	3	200	1.77	6.16	41.17	7.58
Acaulospora laevis	8.45 (-)	0.45 (-)	1.16 (16)	3 (0)	205 (3)	2.5 (41)	6.31 (2)	38.27 (-)	5.66 (-)
Glomus fasciculatum	8.60 (0.6)	0.46 (-)	1.16 (16)	3 (0)	210 (5)	2.78 (57)	5.84 (-)	43.08 (5)	5.89 (-)
Glomus mosseae	8.55 (00)	0.54 (6)	0.96 (-)	5 (67)	200 (00)	2.44 (38)	7.68 (25)	41.91 (2)	6.59 (-)
Vermicompost	8.65 (1)	0.56 (10)	1.84 (84)	11 (266)	230 (15)	3.29 (86)	7.9 (28)	35.14 (-)	6.32 (-)
A. laevis, G. fasciculatum,	8.80	0.53	0.92	8	220	2.42	7.91	37.83	5.89
G. mosseae and Vermicompost	(3)	(4)	(-)	(166)	(10)	(37)	(28)	(-)	(-)
CD (*P=0.05*)	0.04	0.35	3.5	12.63	0.51	1.01	3.11	0.73	0.67
CV (%)	1	8	26	55	5	18	34	6	10

TABLE - 3 : Effect of AM fungal inoculation and vermicompost amendment on nutrient content after 30 day colonization of *Trigonella foenum-graecum*.

Treatment	Total N (%)	Total P2O5 (%)	Total K2O (%)	Total Ca (ppm)	Total Mg (ppm)	Total Zn (ppm)	Total Cu (ppm)	Total Mn (ppm)	Total Fe (ppm)
Control	2.33	0.10	2.7	0.02	0.13	8	24	53	187
Acaulospora laevis	2.52 (8)	0.13 (30)	1.6 (-)	0.02 (00)	0.14 (8)	11 (37)	37 (54)	36 (-)	40 (-)
Glomus fasciculatum	2.54 (9)	0.11 (10)	3.18 (12)	0.03 (50)	0.14 (8)	6 (-)	28 (17)	67 (26)	157 (-)
Glomus mosseae	2.87 (23)	0.29 (190)	3 (11)	0.12 (500)	0.14 (8)	41 (42)	29 (21)	45 (-)	48 (-)
Vermicompost	3.06 (31)	0.11 (10)	2.8 (4)	0.03 (50)	0.14 (8)	13 (63)	16 (-)	33 (-)	34 (-)
*A. laevis, G. fasciculatu*m,	2.25	0.03	2.92	0.03	0.15	3	43	61	66
G. mosseae and Vermicompost	(-)	(-)	(8)	(50)	(15)	(-)	(79)	(16)	(-)
CD (*P=0.05*)	0.23	0.09	0.58	0.04	0.006	14.58	10.02	14.32	69.64
CV (%)	10.8	58.33	18.88	75	3.5	92.53	29.45	4.9	68.08

vermicompost as per treatment were applied. AM fungal inoculation was done by spreading the inoculum uniformly at 5 cm depth and putting a thin layer of soil above the inoculum. Five seeds were placed and covered with soil layer (2-3 cm). The treatments were labeled and kept apart from each other to avoid AM fungal cross contamination. All the values were recorded for six treatments and five replicates. Observation such as fresh wt, dry wt, root and shoot length, number of leaves and root nodules, percentage root colonization, available N and P after harvest and macro and micro-nutrients from leaves were recorded.

The root samples of the each treatment were collected, processed that stained with cotton blue[9]. Percent root colonization was calculated[2]. The available nitrogen and phosphorus from soil were determined[4]. Potassium was estimated by flame photometer. The soil used for experiment was with organic carbon 0.93%, pH 7.10, available N 0.69%, available P2O5 4 kg/ha, available K 99 kg/ha, native AM spore population, averaging 20 spores/50 g soil and E C 0.18 at 25C.

Results and Discussion

The plants inoculated with *G.fasciculatum* showed the highest fresh wt (0.45 g) of which was 80% more than control. A maximum dry wt (0.06 g) which was 66% more over control and was recorded in treatment of plants. *A. laevis*, *G. fasciculatum*, *G. mosseae* and vermicompost. The highest shoot length was 11 cm (57%) and root length of 4.1 cm (54% more over control) in *G.fasciculatum* treated plants. The max nodules were at 5/plant (170%) and leaves at 13/plant (33.36% more than control) in *G.fasciculatum* treated plants. The increase in growth parameters were directly proportional to the increase in the levels of root colonization in AM inoculated plants. This result indicated that AM fungi have helped in the uptake of nutrients from soil[3].

It is evident from Table - 2 that concentration of mineral nutrients from Methi leaves was high for P (0.29%%), Ca (0.12 ppm) and Mn (67 ppm) in *G.fasciculatum* treated plants and K_2O (3.18%) and Mn (67 ppm) in *G.fasciculatum* treated plants. The max levels for Mg (14.46 ppm) and Cu (43 ppm) were reported in *A. laevis*, *G.fasciculatum*, *G. mosseae* and vermicompost treated plants.

It is also evident from Table-3 that the available organic carbon (0.96%) was less in rhizosphere soil of *G. mosseae* and in *A. laevis*, *G.fasciculatum*, *G. mosseae*, vermicompost treated plants. The P (3 kg/ha) level was less in *A. laevis* and *G.fasciculatum*, whereas Cu (5.84 ppm) level was less in *G.fasciculatum* treated plants. The Fe level in all treatments was less than that of control. All these results indicated that the AM fungi singly and in combination have helped in the mobilization of nutrients from soil to plant. Similar reports were made in the investigation in the genus *Pinus* [1,5].

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