

Effect of VA-mycorrhizal inoculation on N and P uptake by rangpurlime seedlings

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ABSTRACT

In pot culture experiment using sterile, P deficient soil and VAM fungi observed that mycorrhizal treatments were superior over non-mycorrhizal treatments of Rangpurlime seedlings. *Glomus epigaeum* + *Glomus mosseae* + *Gigaspora calospora* combination were recorded the maximum root colonization and N and P uptake.

Key words : Rangpurlime seedlings, VAM fungi, Colonization, N-P uptake.

INTRODUCTION

VA-mycorrhizal fungi are the common form of mycorrhizae that occur in nearly all important crop plants. It has been reported in different plant, soil infecting roots of many species (Mosse and Hayman, 1969). The VAM fungi inoculation improve the uptake of phosphate and other micronutrients. The mycorrhizal fungus is a specialized member of root region or rhizosphere microorganisms. Mycorrhizal plant contain higher concentration of phosphorus in their tissues than control (Harly and Smith, 1982). Increase in the uptake of other nutrient elements such as zinc, sulphur and copper have also been reported as influenced by VAM inoculation (Parra *et al.*, 1990). Hence an experiment was conducted on the response of rangpurlime seedlings of *Glomus epigaeum*, *Glomus mosseae*, *Gigaspora calospora* and their mixture, inoculation in P-deficient sterile soil in respect of their colonization and N-P uptake.

MATERIALS AND METHODS

A pot culture experiment was conducted during October 2002 to April 2003 in completely randomized design with three replications and eight treatments. The rangpurlime seedlings were inoculated with single and their mix VAM inoculum adjusting the dose finally to 150 g/pot.

This inoculum of *Glomus epigaeum*, *Glomus mosseae* and *Gigaspora calospora* contained 680-800 spores/50 ml soil by volume. The rangpurlime seedlings were planted in pots with soil + FYM (1 : 1) mixture containing 12.40 kg/ha phosphorus and 207.60 kg/ha nitrogen. The rangpurlime seedlings were uprooted and VAM root colonization, nitrogen and phosphorus uptake were determined on 90 and 180 days after planting. The P and N uptake by plants were determined by microkjeldahl and vanadomolybdic phosphoric acid yellow colour methods (Jackson, 1971), respectively. The per cent root colonization was done by the procedure given by Phillips and Hayman (1970).

RESULTS AND DISCUSSION

On an average root colonization (Table 1) of mycorrhizal inoculated rangpurlime seedlings ranged from 60.04 to 68.34 and 65.79 to 76.82 per cent at 90 and 180 days, respectively, indicating differential degree of VAM colonization in different VAM species under sterilized soil. However, the single *Glomus mosseae* recorded colonization 66.27 and 73.68 per cent at 90 and 180 days. Mixture of three VAM fungi (GE + GM + GC) recorded the 68.34 and 76.82 per cent VAM colonization at 90 and 180 days respectively. The variation in root colonization could be due to an interaction between the host and different VAM strains

Table 1 : Effect of VA-mycorrhizal inoculation on root colonization percentage of rangpurlime seedlings.

Sr. No.	Inoculant	VAM root colonization (%)	
		90 days	180 days
1.	<i>Glomus epigaeum</i> (GE)	60.04 ^b	65.79 ^b
2.	<i>Glomus mosseae</i> (GM)	66.27 ^e	73.68 ^e
3.	<i>Gigaspora calospora</i> (GC)	62.93 ^c	69.35 ^c
4.	GE + GM	67.27 ^f	75.89 ^f
5.	GE + GC	63.84 ^c	71.21 ^d
6.	GM + GC	64.69 ^d	72.09 ^d
7.	GE + GM + GC	68.34 ^f	76.82 ^f
8.	Non-mycorrhizal (NM)	0.00	0.00
	Mean	56.65	63.10
	S.E. ±	0.46	0.31
	C.D. at 5%	1.4	1.00

Figures with different letters differ significantly

* Author for corresponsence.

Table 2 : Effect of VA-mycorrhizal inoculation on phosphorus uptake by shoot and root of rangpurlime seedlings

S. No.	Inoculant	Phosphorus uptake at 90 days (mg/plant)			Phosphorus uptake at 180 days (mg/plant)		
		Shoot	Root	Total	Shoot	Root	Total
1.	<i>Glomus epigaeum</i> (GE)	1.47 ^{ab} (34.86)	1.60 ^b (72.04)	3.07 ^a (8.48)	3.59 ^b (54.07)	3.45 ^b (50.00)	7.04 ^a (52.05)
2.	<i>Glomus mosseae</i> (GM)	3.38 ^e (210.09)	3.35 ^e (260.21)	6.73 ^{cd} (137.80)	8.17 ^e (250.64)	8.46 ^e (267.82)	16.63 ^d (259.18)
3.	<i>Gigaspora calospora</i> (GC)	1.87 ^{bc} (71.55)	1.99 ^c (113.97)	3.86 ^{ab} (36.39)	4.35 ^b (86.69)	4.70 ^c (104.34)	9.05 ^b (95.46)
4.	GE + GM	3.80 ^{ef} (248.62)	3.63 ^e (290.32)	7.43 ^{de} (162.54)	9.01 ^e (286.69)	9.36 ^{ef} (306.95)	18.37 ^e (296.76)
5.	GE + GC	2.20 ^c (101.83)	2.15 ^c (131.18)	4.35 ^b (53.71)	5.47 ^c (134.76)	5.40 ^c (134.78)	10.87 ^{bc} (134.77)
6.	GM + GC	2.88 ^d (164.22)	2.87 ^d (208.60)	5.75 ^c (103.18)	6.56 ^d (181.54)	6.62 ^d (187.82)	13.18 ^{cd} (186.66)
7.	GE + GM + GC	4.16 ^f (281.65)	4.07 ^f (337.63)	8.23 ^e (190.81)	10.56 ^f (353.21)	10.27 ^f (346.52)	20.83 ^e (349.85)
8.	Non-mycorrhizal (NM)	1.09 ^a	0.93 ^a	2.83 ^a	2.33 ^a	2.30 ^a	4.63 ^a
	Mean	2.61	2.57	4.92	6.19	6.24	12.57
	S.E. ±	0.15	0.11	0.31	0.27	0.31	0.79
	C.D. at 5%	0.46	0.32	1.04	0.84	0.95	2.43

1. Figures with different letters differ significantly.

2. Figures in parenthesis indicate per cent increase over non-mycorrhizal i.e. uninoculated control

performance. Wani and Konde (1996) reported significant increase in root colonization of garlic with mycorrhizal inoculation.

The single *Glomus mosseae* inoculation (Table 2) recorded maximum P uptake (3.38 and 3.35 mg/plant) by shoot and root respectively at 90 days and 8.17 and 8.46

Table 3 : Effect of VA-mycorrhizal inoculation on nitrogen uptake by shoot and root of rangpurlime seedlings

S. No.	Inoculant	Nitrogen uptake at 90 days (mg/plant)			Nitrogen uptake at 180 days (mg/plant)		
		Shoot	Root	Total	Shoot	Root	Total
1.	<i>Glomus epigaeum</i> (GE)	25.46 ^b (40.19)	17.90 ^b (67.13)	41.36 ^b (50.19)	47.95 ^b (45.70)	32.08 ^b (54.60)	80.03 ^b (49.14)
2.	<i>Glomus mosseae</i> (GM)	41.32 ^d (127.53)	33.00 ^{cd} (208.12)	74.32 ^d (157.42)	94.13 ^e (186.02)	64.16 ^e (209.20)	158.29 ^e (194.98)
3.	<i>Gigaspora calospora</i> (GC)	27.38 ^{bc} (50.77)	20.50 ^b (91.40)	47.88 ^{bc} (65.85)	56.44 ^{bc} (71.49)	42.24 ^c (103.56)	98.68 ^{bc} (83.89)
4.	GE + GM	54.10 ^e (197.90)	34.67 ^d (225.71)	88.77 ^e (207.48)	118.23 ^f (259.25)	78.35 ^f (277.59)	196.58 ^f (266.34)
5.	GE + GC	29.18 ^c (60.68)	21.58 ^d (92.15)	50.71 ^c (75.64)	63.55 ^c (93.10)	49.03 ^{cd} (136.28)	112.58 ^c (109.80)
6.	GM + GC	39.53 ^d (117.67)	28.23 ^c (163.58)	67.76 ^d (134.70)	79.51 ^d (141.59)	56.58 ^{de} (172.67)	136.09 ^d (153.61)
7.	GE + GM + GC	68.66 ^f (278.08)	49.18 ^e (359.19)	117.84 ^f (308.17)	125.68 ^f (281.89)	85.52 ^f (312.14)	211.20 ^f (293.58)
8.	Non-mycorrhizal (NM)	18.16 ^a	10.71 ^a	28.87 ^a	32.91 ^a	20.75 ^a	53.66 ^a
	Mean	34.22	25.83	60.05	75.80	49.56	125.37
	S.E. ±	0.67	1.52	2.74	2.46	2.59	6.17
	C.D. at 5%	2.0	4.94	8.37	7.72	8.01	18.74

1. Figures with different letters differ significantly.

2. Figures in parentheses indicate per cent increase over non-mycorrhizal i.e. uninoculated control

mg/plant by shoot and root respectively at 180 days. This was followed by *Gigaspora calospora* and *Glomus epigeum* in order to their effectiveness. The VAM mixture (GE + GM + GC) treatment recorded maximum P uptake (4.16 and 4.07 mg/plant) by shoot and root respectively at 90 days and 10.56 and 10.27 mg/plant by shoot and root respectively at 180 days. This was followed by GE + GM, GM + GC and GE + GC. The mycorrhizal inoculation enhanced P uptake by shoot ranging from 34.86 to 281.65 and 54.07 to 353.21 per cent at 90 and 180 days respectively and per cent P uptake by root ranging from 72.04 to 337.63 and 50.00 to 346.52 per cent at 90 and 180 days, respectively. The enhanced P uptake with VAM inoculation has been reported in rough lemon (Singh *et al.*, 1992), trifoliate orange (Vinayak and Bagyaraj, 1990).

The single *Glomus mosseae* inoculation (Table 3) recorded maximum N uptake (41.32 and 33.00 mg/plant) by shoot and root respectively at 90 days and 94.13 and 64.16 mg/plant by shoot and root at 180 days. This was followed by GC and GE in order to their effectiveness. The VAM mixture (GE + GM + GC) treatment recorded maximum, N uptake (68.66 and 49.18 mg/plant) by shoot and root, respectively at 90 and 125.68 and 85.52 mg/plant by shoot and root, respectively at 180 days. This was followed by the combination of GE + GM, GM + GC and GE + GC in order to their effectiveness. The mycorrhizal inoculation enhanced N uptake by shoot and root ranging from 40.19 to 278.08 per cent and 67.13 to 359.19 per cent, respectively at 90 days and N uptake by shoot and root from 45.70 to 281.89 and 54.60 to 312.14 per cent, respectively at 180 days over the corresponding uninoculated plants. The combination of three (GE + GM + GC) responded significantly better to mycorrhizal than the rest of all single and combinations of VAM species. The enhanced N-P uptake with VAM inoculation has also been reported in grape vine (Sonawane *et al.*, 1997) and coffee seedlings (Para *et al.*, 1990).

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