J. Biol. Control, 15 (1): 77-80, 2001

Management of root - knot nematode in brinjal by using VAM and crop rotation with green gram and pearl millet

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ABSTRACT: **Effects of vesicular arbuscular mycorrhizal fungi and crop rotation with pearl millet and green gram were investigated in microplots for the management of root – knot nematode. VAM fungi increased the yield and stimulated the growth of brinjal. The nematode population was decreased from 143 nematodes / 200ml soil to 105 nematodes / 200ml soil after the rotation with green gram and pearl millet.**

KEY WORDS: Brinjal, crop rotation, green gram, *G.mosseae* , *Meloidogyne incognita*, pearl millet

The highly polyphagous nature of root–knot nematodes has left two alternatives that can be implemented with some degree of success-crop rotation and changes in tillage practices (Mc Sorley and Gallaher, 1991). Crop rotation aims at keeping nematode population lower than tolerance limit by growing non-host crops or resistant varieties. By introducing non-hosts between susceptible crops, there is significant decrease in the number of life cycles and finally the population of the nematode declines to a significant level. The efficacy of crop rotation in minimizing build-up of certain plant- parasitic nematodes in cropping systems is relatively well documented (Noe *et al.*, 1991). Rotation with sorghum cultivars was beneficial in limiting population growth of *Meloidogyne incognita* (Kofoid *et* White) Chitw. (McSorley and Gallaher, 1991). The vesicular arbuscular mycorrhizae (VAM) suppress root pathogens through morphological, physiological and biochemical alterations in the host plant. The symbiotic fungus is one of the potentially more useful biological means of assuring plant protection. Therefore, the objective of the present study was to find the integrated effect of crop rotation with green gram, pearl millet and a biocontrol agent on the control of *M. incognita* as well as on the growth and yield of brinjal.

MATERIALS AND METHODS

Soil inoculum of *Glomus mosseae* (Nicol and Gerd) Gerd and Trappe was maintained in the glasshouse on pearl millet (*Pennisetum glaucum)* plants. One-month-old brinjal seedlings were transplanted to micro plots (75cm diameter cylinder and 65cm deep) filled with soil and fumigated with methyl bromide at 0.12 – 0.19 kg/ m^2. The soil was aerated for 2 weeks before infestation with *M. incognita* @ one nematode per gram of soil. The VAM fungus at the rate of 10g/ kg soil was inoculated before transplanting. The juveniles of root - knot nematode, maintained as pure culture were extracted and inoculated 15 days after transplanting at the rate of one nematode per gram of soil according to the treatments. The

second crop, pearl millet, was followed by green gram and again brinjal with a duration of 3 months each. Biometric observations like plant weight, plant height, spore count, and VAM colonization were taken for all the four crops at the time of termination. The root colonization of *G. mosseae* was done as per Phillips and Hayman (1970) for all the crops. Soil population and spore count were determined by wet sieving and decanting technique (Gerdmann and Nicolson, 1963).

RESULTS AND DISCUSSION

From Table 1, it was observed that the growth parameters were enhanced due to VAM and the population of nematode was decreased (143 nematodes / 200ml soil) in brinjal. The next crop was pearl millet, since it is a non-host, the nematode population was 97 nematode / 200ml soil (Table 2). Thereafter a slow increase in population was observed, since the next crop was green gram, which is a host crop (Table 3). When brinjal was sown, following green gram, the population was again raised to 105 nematode / 200ml, but not much due to the presence of fungal hyphae (Table 4).

VAM fungi had a beneficial effect on plant growth and the population of nematode was significantly lower when the mycorrhiza was inoculated fifteen days prior to the nematode (Hussey and Roncadori, 1982). Crop rotation is one of the most important agricultural technique used by the farmer in India and other countries to reduce soil borne diseases, and the control of several plant parasitic nematodes (Sitaramaiah, 1987). When pearl millet, which is a host for VAM fungi and a non – host for root knot nematode was grown, the VAM colonization and spore count were increased and the nematode population was decreased. Graminaceous and leguminous crops are generally believed to increase VA mycorrhizal population, while non-mycotropic plants decrease the population of VAM fungi (Sieverding and Leihner, 1984). Green gram increased the population of nematodes to an appreciable level, and there was an increase in growth parameters also. Soybean, blackgram, greengram and cowpea

Table 1. Effect of crop rotation on the interaction of *G. mosseae* with *M. incognita*

Treatment	Length (cm)		Weight (g)		VAM colonization (%)	Spore count (10g)	Soil nematode population (200ml)	Gall Index
	Shoot	Root	Shoot	Root				
M. incognita alone	28.0	20.3	27.5	25.6	-	-	312	4.3
G. mosseae alone	60.6 (116.4)	35.6 (75.3)	69.6 (154.1)	38.1 (48.8)	83.0	159	-	-
G. mosseae + *M. incognita*	35.5 (26.7)	31.3 (54.1)	60.8 (121.0)	27.6 (7.8)	68.3	117	143	3.6
Control	31.3	27.3	50.0	27.5	-	-	-	-
CD (P= 0.05)	3.6	2.2	3.5	2.4	-	-	-	-

First crop: Brinjal cv. Co.
Figures in parentheses indicate the per cent increase over nematode alone.

roots colonized by *Glomus* spp. significantly increased the yield and plant dry weight (Ramraj and Shanmugam, 1986; Carling and Brown, 1980).

When the first brinjal crop was compared with the brinjal crop after rotation, there was a significant change in shoot length and weight and root weight. VAM colonization and spore count

Table 2. Effect of crop rotation on the interaction of *G. mosseae* with *M. incognita*

Treatment	Length (cm)		Weight (g)		VAM colonization (%)	Spore count (10g)	Soil nematode population (200ml)	Gall Index
	Shoot	Root	Shoot	Root				
M. incognita alone	90.8 -	11.6 -	44.5 -	38.2 -	- -	- -	187 -	4.3 -
G. mosseae alone	97.1 (6.9)	15.3 (31.8)	82.2 (84.7)	42.8 (12.0)	90.0 -	191 -	- -	8.0 -
G. mosseae + *M. incognita*	94.5 (4.0)	20.4 (75.8)	45.5 (2.2)	52.9 (38.4)	89.1 -	185 -	97 -	6.8 -
Control	88.5	15.1	43.4	38.2	-	-	-	3.8
CD (P= 0.05)	NS	5.5	15.2	11.02	-	-	-	1.4

Second crop: Pearl millet cv. Co. 1
Figures in parentheses indicate the per cent increase over nematode alone.

Table 3. Effect of crop rotation on the interaction of *G. mosseae* with *M. incognita*

Treatment	Length (cm)		Weight (g)		VAM colonization (%)	Spore count (10g)	Soil nematode population (200ml)	Gall Index
	Shoot	Root	Shoot	Root				
M. incognita alone	32.5 -	14.3 -	64.3 -	8.2 -	- -	- -	19.5 -	2.8 -
G. mosseae alone	43.8 (11.3)	15.0 (4.8	76.2 (18.5)	6.6 (-19.5)	81.6	295	-	-
G. mosseae + *M. incognita*	39.0 (20.0)	17.8 (3.5)	72.6 (12.9)	7.4 (-9.7)	72.5	230	112	1.5
Control	36.6 -	19.1 -	69.2 -	6.2 -	- -	- -	- -	- -
CD (P= 0.05)	7.2	NS	NS	1.0	-	-	-	-

Third crop: Greengram cv. Co. 5
Figures in parentheses indicate the per cent increase over nematode alone.

Table 4. Effect of crop rotation on the interaction of *G. mosseae* with *M. incognita*

Treatment	Length (cm)		Weight (g)		VAM colonization (%)	Spore count (10g)	Soil nematode population (200ml)	Gall Index
	Shoot	Root	Shoot	Root				
M. incognita alone	37.6 -	13.3 -	131.3 -	54.3 -	- -	- -	223 -	4.0 -
G. mosseae alone	51.0 (35.6)	22.8 (71.4)	211.8 (61.4)	50.1 (-7.7)	95	250	-	-
G. mosseae + *M. incognita*	42.3 (12.5)	17.8 (33.8)	144.8 (10.4)	51.1 (-5.8)	92	164	105	2.5
Control	41.3 -	15.3 -	160.0 -	54.8 -	-	-	-	-
CD (P= 0.05)	4.3	2.8	NS	NS	-	-	-	-

Fourth crop: Brinjal cv. Co.2
Figures in parentheses indicate the per cent increase over nematode alone.

was increased when compared with the first crop, the nematode population, gall index showed a greater change. The points of advantage with root knot nematode are its obligate and specialized nature, limited mobility, difficult and random movement through soil and limited stored energy for the juveniles for host searching, so, absence of specific host in the vicinity, destroys the possibility of infection.

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