Research Paper :

Biomanagement of root-knot nematode using AM fungus *Glomus fasciculatum* in tomato

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SUMMARY

A field study was conducted by using *Glomus fasciculatum* @ 50, 100 and 200 spores/g. of soil and Carbofuran 3G @ 0.3 g. a.i/m^2 individually against root-knot nematode, *Meloidogyne incognita* infesting tomato cv. PUSA RUBY. Carbofuran 3G @ 16.6 g/m^2 significantly reduced the soil nematode population and recorded better germination percentage in the nursery compared to all other treatments. However, in the main field, *Glomus fasciculatum* @ 200 spores/g. of soil was found to be effective in improving the plant growth parameters like shoot length (105 cm), shoot weight (103.5 g), root length (27.5 cm), root weight (20.32 g), yield per plot (3.54 kg) and C:B ratio (1: 3.26) and reducing soil nematode population by 84.51 per cent with less number of galls per plant (18.08), egg masses per plant (8.37) and root-knot index (2.75) over inoculated check.

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Tomato (*Lycopersicon esculentum*) is one of the most important commercial and widely grown vegetable crops. Tomato crop is being grown throughout the year and is attacked by 60 species of phytoparasitic nematodes from 19 genera. Among these, major damage is caused by root-knot nematode with an yield loss of 35 per cent (Jonathan *et al*., 2001).

Management of root-knot nematode, *Meloidogyne incognita* in solanaceous crops using environmentally safe and economical techniques *viz*., botanicals, bioagents, antagonistic crops, resistant or tolerant varieties and their combinations etc., are now being emphasized to reduce or phase out the use of synthetic chemicals. Keeping these facts in view, a field study was carried out to evaluate bioagent *viz*., *Glomus fasciculatum* at different spore load in comparison with Carbofuran 3G against *M. incognita* in tomato.

MATERIALS AND METHODS

Nursery:

The experiment was conducted in a *M. incognita* infested field belonging to Nematology Section, Department of Plant Pathology, GKVK, UAS, Bangalore. Twenty raised nursery beds each measuring 1 x 1 M^2 were prepared. The treatments included were T_1 = Carbofuran 3G (0.3 g a.i/m^2), T_2 = *G. fasciculatum* @ 50 spores/g of soil, T_3= *G. fasciculatum* @ 100 spores/g of soil and T_4 = *G. fasciculatum* @ 200 spores/g of soil and T_5= Inoculated check. Treatments were imposed in the nursery at the time of sowing. Nursery beds were irrigated daily for first seven days and later irrigation was done every alternate day. Percentage germination and nematode population in the nursery at the time of transplanting was recorded.

Main field:

Thirty days old seedlings from the treated nursery were transplanted to the infested main field with plot size of 2 x 2 m^2 plots. The treatments were allotted in a randomized complete block design with four replications. Normal package of practices were followed in raising the crop. The observations on shoot length, shoot weight, root length, root weight, yield, nematode population at 30, 60 and 90 days after transplanting, number of galls, egg masses/root system and root-knot index at harvest were recorded. Data were subjected to the statistical analysis by using ANOVA design.

RESULTS AND DISCUSSION

The results presented in the Table 1 reveal that germination percentage was highest in Carbofuran 3G treated plot (51.33 per cent) which was at par with *G. fasciculatum* @ 100 and 200 spores/g. of soil treated plots when compared to inoculated check under nursery conditions.

The above results are in line with Reddy (1988) who reported that Carbofuran was effective in increasing the number of tomato seedlings per bed and also recorded higher weight of seedlings.

In the main field, all the treatments were significantly superior in increasing host growth parameters. However, *G. fasciculatum* @ 200 spores/g. of soil treated plants recorded highest plant growth parameters *i.e.*, shoot length (105 cm), shoot weight (103.5 g), root length (27.5 cm), root weight (20.32 g) and yield per plot (3.54 kg) besides C: B ratio of 1:3.26 over inoculated check. This treatment was followed by *G. fasciculatum* @ 100 and 50 spores/g. of soil and Carbofuran 3G treated plants.

These findings are in accordance with results of Khaliel and Elkhidder (1987) who recorded an increased uptake of P and increased growth, N and P content and yield of tomato. Babu *et al.* (2000) who observed improved biomass production in tomato and Sundarababu *et al.* (2001) who recorded higher tomato yield by using *G. fasciculatum.*

With respect to nematode population, Carbofuran 3G @ 16.6 g/m^2 significantly reduced the soil nematode population and it was at par with *G. fasciculatum* @ 200 spores/g. of soil treated plots in nursery.

In main field, *G. fasciculatum* @ 200 spores/g. of soil treated plots had minimum nematode population in soil at 30, 60 and 90 days after transplanting amounting to 35.18, 59.36 and 84.51 per cent reduction over inoculated check (Table 2). This was followed by *G. fasciculatum* @ 100 and 50 spores/g. of soil treated plots.

Table 1 : Effect of different treatments on growth, development and yield of tomato infested with *M. incognita*

Treatments	Germination percentage	Plant stand in the main field	Shoot length (cm)	Shoot weight (g)	Root length (cm)	Root weight (g)	Yield per plot (kg)	Yield per hectare (q/ha)	C:B ratio
T_1-Carbofuran	51.33	32.75	87.5	43.5	17.18	9.82	2.09	52.25	1: 2.23
T_2- *G. fasciculatum* @ 50 spores/g of soil	50.16	33.5	87	44	17.3	9.45	2.11	52.75	1: 2.25
T_3- *G. fasciculatum* @100 spores/g of soil	50.41	33.5	94	68	19.25	14.57	2.98	74.5	1: 2.85
T_4- *G. fasciculatum* @200 spores/g of soil	50.91	33.5	105	103.5	27.5	20.32	3.54	88.5	1: 3.26
T_5- Inoculated check	36.39	23.25	61.75	37.75	15	7.3	1.34	33.5	1: 1.7
S.E. ±	0.337	0.60	1.49	1.43	0.64	0.28	0.05	-	-
C.D. (P=0.05)	1.0385	1.86	4.61	4.40	1.98	0.7	0.16	-	-

Table 2 : Effect of different treatments on survival and multiplication of *M. incognita* on tomato

Treatments	In nursery	Per cent reduction over control	30 days after transplanting	Per cent reduction over control	60 days	Per cent reduction over control	90 days	Per cent reduction over control
T_1 _ Carbofuran	461.5	30.49	612.75	15.54	586.50	22.93	403.5	50.88
T_2 - *G. fasciculatum* @ 50 spores/g of soil	476.75	28.2	606.00	16.47	581.00	23.65	403.5	50.88
T_3 - *G. fasciculatum* @100 spores/g of soil	471.00	29.05	557.00	23.22	464.00	39.02	278.5	66.08
T_4 - *G. fasciculatum* @200 spores/g of soil	466.00	29.8	470.25	35.18	304.25	59.36	127.25	84.51
T_5 - Inoculated check	664.00	00	725.5	00	761.00	00	821.5	00
S.E. ±	1.81		1.97		1.44		1.79	
C.D. (P=0.05)	5.60		6.09		4.46		5.53	

Initial nematode population – In nursery : 610 / 200 cc soil In main field : 650 /200 cc soil

Table 3 : Effect of different treatments on development and reproduction of *M. incognita* infested on tomato

Treatments	No. of galls/ root system	No. of egg masses root system	Root-not index
T_1 - Carbofuran 3G	52.35	19.19	4.0
T_2 - *G. fasciculatum* @ 50 pores/g of soil	52.5	20.00	4.0
T_3 - *G. fasciculatum* @100 pores/g of soil	31.47	16.17	3.5
T_4 - *G. fasciculatum* @ 200 spores/g of soil	18.08	8.37	2.75
T_5 - Inoculated check	122.57	72.22	5.0
S.E. ±	1.59	0.25	0.18
C.D. (P=0.05)	4.9	0.78	0.56

Regarding the effectiveness of *Glomus fasciculatum,* these results are in agreement with the findings of Rama (1995) in tomato; Devappa (1996)in sunflower and Ranganatha (1997) in brinjal who observed minimum nematode populations by using *G. fasciculatum* and also higher C:B ratio.

G. fasciculatum @ 200 spores/g. of soil treated plants recorded lowest number of galls and egg masses per root system (18.08 and 8.37) followed by *G. fasciculatum* @ 100 spores/g. of soil (31.47 and 16.17) as against inoculated check which had highest number of galls and egg masses per root system (122.57 and 72.22), respectively. *G. fasciculatum* @ 50 spores/g. of soil and Carbofuran 3G treatments were at par with each other.

Minimum root-knot index (2.75) was recorded in *G. fasciculatum* @ 200 spores/g. of soil followed by *G. fasciculatum* @ 100 spores/g. of soil treatment compared to inoculated check (5.0). *G. fasciculatum* @ 50 spores/ g of soil and Carbofuran 3G treatments were at par with each other.

Glomus fasciculatum reduced nematode population:

– By retarding the nematode population or reproduction within or near root tissue either by the production of nematostatic compounds or by competition for space and host photosynthates.

– By physiologically altering /reducing the root exudates responsible for stimulating egg hatch or chemostatic attraction of nematodes to roots.

– It may upset the yield loss normally caused by nematodes by enhancing the uptake of P and other nutrients, thus improving the plant vigor and growth.

From the above results it may concluded that *G. fasciculatum* @ 200 spores/g. of soil treatment is effective in the management of *M. incognita* infesting tomato and improving the plant growth parameters and yield besides C:B ratio.

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