Research Paper :

Influence of bio-agents and pesticides in improving nutritional status of tomato infested with root-knot nematode

M.R. HEMAVATHI, B.M.R. REDDY, V. KANTHARAJU AND N.G. RAVICHANDRA

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See end of the article for authors' affiliations

Correspondence to :
V. KANTHARAJU
Department of Plant Pathology, Krishi Vigyan Kendra, Agricultural Research Station, GULBARGA (KARNATAKA)
Email: kantharaju74@gmail.com

SUMMARY

A field study was conducted to understand the influence of bioagents on the nutritional status of tomato cv. Pusa Ruby infested with root-knot nematode, *Meloidogyne incognita*. Two separate field trials were conducted. In Trial-I, treatments *viz*., Neemark 0.03 EC 2% solution @ 1.25 lit./ m^2, Carbofuran 3G @ 0.3 g a.i./m^2 and *Pasteuria penetrans* @ 1 x 10^8 spores/g of soil and in Trial-II, treatments *viz*., *Glomus fasciculatum* (@ 50, 100 and 200 spores/g of soil) and Carbofuran 3G (0.3 g a.i./m^2). *P. penetrans* treated plants recorded higher N, P and K concentration in plants (3.21, 0.28 and 3.21 per cent, respectively) and fruits (2.53, 0.78 and 3.06 per cent, respectively) compared to Neemark 0.03 EC and Carbofuran 3G in Trial-I. *G. fasciculatum* @ 200 spores/g of soil recorded increased N, P and K concentration in plants (3.98, 0.41 and 4.56 per cent, respectively) and fruits (3.11, 0.95 and 3.59 per cent, respectively) in Trial-II.

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Tomato (*Lycopersicon esculentum*) is one of the most important commercial and widely grown vegetable crops. Plant parasitic nematodes, particularly root-knot nematode, *Meloidogyne* spp. are major constraints to crop production for subsistence of farmers and small holders in many developing countries. *Meloidogyne incognita* is the dominant species accounting for 64 per cent of total population and is widely prevalent inflicting 35 per cent yield loss of tomato fruits (Jonathan *et al*., 2001). There are several reports of decreased severity of damage or adverse effects of nematodes to host plants inoculated with mycorrhiza. However, published information regarding influence of *P. penetrans* on nutrient uptake is not available. Hence, a study was conducted to evaluate the influence of *P. penetrans* and *G. fasciculatum* in comparison with Neemark 0.03 EC and Carbofuran 3G on the nutritional status of tomato infested with *M. incognita*.

MATERIALS AND METHODS

Nursery stage:

Experiments were conducted in a *M. incognita* infested field belonging to Nematology Section, Department of Plant Pathology, GKVK, UAS, Bangalore. Forty raised nursery beds each measuring one m^2 were prepared. First Trial (Trial-I) was taken up in 20 nursery beds including the treatments T_1 = Neemark 0.03 EC (2% solution, 1.25 lt/m^2), T_2 = Carbofuran 3G (0.3 g a.i/m^2), T_3 = *P. penetrans* @ 1 x 10^8 spores/g of soil and T_4 = Inoculated check. Second trial (Trial-II) was taken up in another 20 nursery beds with the treatments 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, T_4 = *G .fasciculatum* @ 200 spores/g of soil and T_5 = Inoculated check. These treatments were imposed in the nursery at the time of sowing. Nursery beds were irrigated daily for first seven days and later on alternate days. Number of days taken for germination, percentage germination and nematode population in the nursery at the time of transplanting were recorded.

Main field:

Thirty days old seedlings from the treated

nursery were transplanted to the infested main field after making 2 x 2 m^2 plots. The treatments were allotted in randomized complete block design. Individual plots were irrigated separately every day until the plants established and once in two days later on. Normal package of practices were followed in taking the crop. Observations on N, P and K concentration in shoots, roots and fruits were estimated at harvest by using the procedure outlined by Jones (1988). Data were subjected to statistical analysis by using ANOVA method.

RESULTS AND DISCUSSION

The data on N, P and K concentration in shoots, roots and fruits for Trial-I and II are presented in Table 1 and 2, respectively.

In Trial-I, *P. penetrans* treated plants had highest concentrations of N, P and K (3.21, 0.28 and 3.21 per cent) in plants and fruits (2.53, 0.78 and 3.06 per cent), respectively when compared to inoculated check which recorded minimum N, P and K concentrations of 1.01, 0.38 and 1.22 per cent in fruits and 1.11, 0.18 and 1.93 per cent in plants, respectively. Carbofuran 3G and Neemark 0.03 EC were at par with each other for all these parameters.

P and K concentrations of fruits and plants were lowest in inoculated check, which may be due to type of tissue damage.

In Trial II, plants treated with *G. fasciculatum* @ 200 spores/ g of soil recorded maximum concentration of N, P and K in fruits (3.11, 0.95 and 3.59 per cent) and plants (3.98,0.41 and4.56 per cent), respectively when compared to inoculated check which recorded minimum N,P and K concentrations of 1.19, 0.17 and 1.99 per cent in plants and 1.03, 0.36 and 1.24 per cent in fruits, respectively.

There was a significant increase in the above nutrient concentrations of fruits and plants with the increase in inoculum level of *G. fasciculatum.* However, Carbofuran 3G and *G. fasciculatum* @ 50 spores /g of soil were at par with each other for all these parameters.

The above findings are in agreement with the results of several workers who have reported that increase in various nutrient uptake by AM *viz.*, higher concentration of N, P, Ca, Cu and Mn were traced in foliages of mycorrhizae inoculated plants than that of non-mycorrhizal plants (Ross and Harper, 1970); increased P uptake by onion and clover plants pre-infected with different strains of VA mycorrhizal (Powell, 1975);

Table 1 : Influence of different treatments on nutritional status of tomato fruits and plants infested with *M. incognita*

Treatments	Plants			Fruits		
	N Concentration (%)	P Concentration (%)	K Concentration (%)	N Concentration (%)	P Concentration (%)	K Concentration (%)
T_1 – Neemark	2.86	0.25	3.20	2.38	0.61	2.82
T_2 - Carbofuran	2.40	0.24	3.41	2.37	0.60	2.77
T_3 - *P. penetrans*	3.21	0.28	3.21	2.53	0.78	3.06
T_4-Inoculated check	1.11	0.18	1.93	1.01	0.382	1.22
S.E. ±	0.04	0.002	0.13	0.031	0.017	0.024
C.D. (P=0.05)	0.12	0.008	0.42	0.097	0.052	0.076

Table 2 : Influence of different treatments on nutritional status of tomato fruits and plants infested with *M. incognita*

Treatments	Plants			Fruits		
	N concentration (%)	P concentration (%)	K concentration (%)	N concentration (%)	P concentration (%)	K concentration (%)
T_1 - Carbofuran	2.42	0.24	3.07	2.36	0.60	2.77
T_2 - *G. fasciculatum* @ 50 spores/g of soil	2.5	0.25	3.32	2.36	0.59	2.76
T_3 - *G. fasciculatum* @100 spores/g of soil	3.21	0.32	3.47	2.70	0.77	3.31
T_4 - *G. fasciculatum* @200 spores/g of soil	3.98	0.41	4.56	3.11	0.95	3.59
T_5 - Inoculated check	1.19	0.17	1.99	1.03	0.36	1.24
S.E. ±	0.06	0.008	0.16	0.036	0.01	0.12
C.D. (P=0.05)	0.16	0.02	0.50	0.11	0.05	0.37

greater P in cowpea, tomato and maize infected with VAM (Sanni, 1976) and improved P, Zn Cu, Mn and Fe nutrition in chilli (Shreenivasa, 1992).

Thus, plants treated with bioagents had maximum N, P and K concentration in plants and fruits followed by Neemark 0.03 EC and Carbofuran 3G. This may be due to the improved plant growth characteristics and reduced nematode population in these treatments.

The increased concentrations of N, P and K in plants and fruits grown in *P. penetrans* treated plots may be due to improved plant growth parameters and reduced nematode population. The nematodes remove the cell contents through their stylet while feeding and each kind of nematode induces its own type of tissue damage. Hence, the decreased nutrient contents in plants infected nematodes may be due to this type of tissue damage. *P. penetrans* reduces the penetration of infected juveniles and hinders the reproduction of nematodes also, infected females that develop fail to produce eggs (Sekhar and Gill, 1990). AM Fungi reduce nematode population by increasing the phenolic contents of the roots that affect the development of root-knot nematodes.

From the above results, it is concluded that *P. penetrans* and *G. fasciculatum* have positive influence in increasing the nutritional status of tomato plants and fruits by decreasing the nematode population.

Authors' affiliations:
M.R. HEMAVATHI AND N.G. RAVICHANDRA, Department of Plant Pathology, University of Agricultural Sciences, G.K.VK., BENGALURU (KARNATAKA) INDIA
B.M.R. REDDY, Department of Plant Pathology, Sericulture College, UAS (B), CHINTAMANI (KARNATAKA) INDIA

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