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Research Article

Increasing the Seed Germination and Seedlings Health of Brinjal Crops through the Management of Soi Borne *Rhizoctonia solani* and *Meloidogyne incognita* by *Trichoderma virens*, *Glomus fasciculatum* and Oilseed Cake Under Nursery Condition

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Abstract: Soil amended with four cruciferous plants viz., Brassica rapa (var. TLl5), Eruca sativa (vaT. TMLC 2), B.juncea (var. PBR 97) and B. napus (var. GSL I) was evaluated for the control of root knot nematode in tomato nursery beds along with check (no amendment). The plants were sown in second half of September and incorporated into beds after forty days of sowing. Soil in beds was turned over on for 10 days alternatively. Seeds of tomato var. Punjab Upma were sown in the amended and unamended beds after 10 days of incorporation. All the treatments were replicated thrice in 0.5 x 0.5 m beds. Pooled data of two years on number of galls / seedling, seedling height and weight after 40 days revealed that maximum reduction in number of galls produced on roots by root knot nematode was observed in Brassica rapa amended plots (52.17 % reduction over check) and was very closely followed by reduction in gall numbers in Eruca sativa amended plots. Maximum increase in seedling height (26.28 %) was observed in Brassica rapa amended soil followed by increase in Eruca sativa amended soil (22.63 %) which was at par in the two treatments and significantly better than unamended soil. Maximum increase (34.56 %) in seedling weight was recorded in Brassica rapa amended-seil followed by'irrcrease in Eruca sativa amended soil (29.41 %) and the two treatments were at par and significantly better than all other treatments.

Key word:

Introduction

Root rot, Rhizoctonia solani Kuhan and root-knot nematode, Meloidogyne incognita (Kofoid & White) Chitwood are an important soil borne pathogen of vegetable crops causing yield and quality losses especially in tomato, brinjal, okra and cucurbits. Rising concerns on environmental safety and eco-friendly approaches enforces nematologists to look for alternative management strategies to control root knot nematode. Organic matter supports diverse populations of organisms that may help to check nematode pest populations. Soil amendment with organic materials increase the nutrient status and fertility of soil and may also decrease nematode populations depending on the crop used as amendment. Different materials have been tried for this purpose (Singh & Sitraramaih, 1967; Haseeb et al., 1984; Alam et al., 1989; Jonathan et al., 1991). Mustard cake used as soil amendment has been found effective against nematodes (Sharma et al., 1981). Mustard root exudates are also known to be nematicidal in nature. The present studies were carried out to find the effect of soil amendment with crucifers of mustard group on root-knot nematode in seedbeds of tomato.

Materials and Methods

For present investigations on nursery disease management of tomato, experiments were conducted for 2 successive years on identified sick plot/hot spot of seedbeds of tomato at farmer's field which was containing initial population of pathogenic fungus cfu 3x108/gram soil and 2 larvae of M. incognita/gram soil. Soil amendment with four oilseed cruciferous crops viz., B. rapa (var. TL 15), E. sativa (var. TMLC 2), B.juncea (var. PBR 97) in B. napus (var. GSL 1) were evaluated for the control of root-knot nematode in tomato nursery beds along with check (no amendment). The crops were sown in fortnight of September and incorporated into beds after forty days of sowing. Soil in beds was turned on alternatively for 10 days. Seeds of tomato var. Punj ab Upma were sown in the amended and un-amended beds after 10 days of incorporation. All the treatments were replicated thrice in 0.5 x 0.5 m beds. Observations on root gall numbers per seedling, height and weight of ten seedlings per replicate were recorded 40 days after sowing of tomato seeds.

Tomato plants showing heavy infestations of root knot nematode were collected from farmers

vegetable fields at different location in and around Delhi and Uttar Pradesh of India showed a number of associated fungi on the egg masses. The fungal floras were isolated, identified and maintained at (25±2) °C in biological oxygen demand (BOD) incubator. Out of which two fungal bioagents viz. Paecilomyces lilacinus and Trichoderma viride were multiplied in mass culture by solid based fermentor for the production of talc based formulations, which were used for further study. The field trial was carried out in nematode sick plot having 2 larvae/g soil at experimental field IIVR, Varanasi. The experimental fields were divided in twelve microplots (1 m×1 m) with three furrows. Mustard cake was used at 500 kg/ha, which was allowed to be decomposed through constantly watering for 3 weeks in each of the furrows. After three weeks talc based formulation of P. lilacinus, Trichoderma viride at 1 kg/ha was also applied while furadan was applied at 2.5 kg/ha, simultaneously. Four-week old healthy seedlings of tomato cv. Pusa Ruby were transplanted singly into each microplot at three plants per furrow. The treatments used were (1) mustard cake (Mc) alone at 100 kg/ha, (2)Trichoderma viride alone at 1 kg/ha, (3) P. lilacinus alone at 1 kg/ha, (4) furadan, alone at 2.5 kg/ha, (5) Trichoderma viride at 0.5 kg/ha+mustard cake at 50 kg/ha, (6) P. lilacinus at 0.5 kg/ha+mustard cake at 50 kg/ha, (7) Trichoderma viride at 0.5 kg/ha+furadan at 1.25 kg/ha, (8) P. lilacinus at 0.5 kg/ha+furadan at 1.25 kg/ha, (9) Trichoderma viride at 0.33 g/ha+P. lilacinus at 0.33g/ha+mustard cake at 50 kg/ha, (10) Trichoderma viride at 0.33 g/ha+P. lilacinus at 0.33 g/ha+mustard cake at 33.3 kg/ha+furadan at 0.83 kg/ha, (11) nematode alone at 2 larvae per gram soil, and (12) control. Three replicates were maintained for each treatment of the above. Observations on plant growth, number of galls/plants, number of egg masses/plant, number of eggs/egg mass and nematode population in soil were recoded after 60 d.

Results

Data of the years 2004 and 2005 are given in Tables 1 and 2, respectively, and pooled data in Table 3.

Root galls per seedling: Pooled data (Table 3) showed that maximum reduction in number of galls produced on roots by root knot nematode was observed in B. rapa amended plots (52.17 % reduction over un-amended check) and was very closely followed by reduction in gall numbers in E. sativa amended plots (50.72 % reduction) which was statistically at par with each other and significantly better than all other treatments. Though amendment with B. juncea also reduced gall numbers significantly but reduction was only 14.19 % over un-amended check. Amendment with B. napus, was however ineffective in reducing gall numbers on roots. Seedling height: Maximum increase in seedling height (26.28 %) was observed in B. rapa amended soil followed by increase in E. sativa amended soil (22.63 %) which was at par in the two treatments and significantly better than unamended soil. Seedling height increased significantly in B. juncea and B. napus soil as well but this increase was significantly less as compared with the increase in B. rapa and E. sativa amended plots (Table 3). Seedling weight: Maximum increase (34.56 %) in seedling weight was recorded in B. rapa amended soil followed by increase (29.41 %) in E. sativa amended soil and the two treatments were at par and significantly better than all other treatments and check. B. juncea and B. napus amendments significantly increased seedling weight over check but were significantly inferior to B.rapa and E. sativa amendments (Table 3).

Table:1 Effect of different formulations of B.licheniformis in suppressing R. bataticola on cowpea cv. pusa bahar in pots

Formulations / treatments	Seed germination (%)	Increase in germination (%)	Plant mortality (%)	Disease control (%)
BLST-1	60.00 (50.76)	33.33 (35.01)	22.22 (22.86)	61.11 (56.28)
BLST-2	66.66 (54.98)	40.00 (38.85)	27.78 (27.10)	55.56 (53.03)
BLST-3	73.33 (59.21)	46.67 (42.70)	08.33 (12.70)	75.00 (65.00)
BLST-4	86.66 (72.29)	60.00 (51.14)	06.67 (11.56)	76.67 (66.14)
BLST-5	53.33 (46.92)	20.67 (27.50)	11.11 (13.45)	72.22 (63.25)
BLST-6	60.00 (50.76)	33.33 (35.01)	22.22 (22.86)	61.11 (56.28)

BLST-7	100.0 (90.00)	73.33 (59.21)	00.00 (04.05)	83.33 (75.00)
BLST-8	93.33 (81.44)	66.67 (54.99)	06.67 (11.56)	76.67 (66.14)
ST – 9 control	26.66 (30.78)	–	83.33 (75.00)	–
Mean	68.89 (59.65)		20.93 (22.34)	
LSD (P=0.05)	15.71		27.84	

The formulations significantly prevented R. bataticola on cowpea cv. pusa bahar in pots. It allowed a stand comparable to the uninfested control.

The effect of bacterial formulations BLST-8 and BLST-7 were significantly greater than control in the experiment.

Table: 2. Effect of different formulations of B.licheniformis in suppressing R. bataticola on cowpea cv. pusa bahar in pots

Formulations / treatments	Seed germinatio n (%)	Increase in germination (%)	Plant mortality (%)	Disease control (%)
BLST-1	60.00 (50.76)	33.33 (35.01)	22.22 (22.86)	61.11 (56.28)
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Discussion

Nematodes have the greatest impact on crop productivity when they attack the roots of seedlings immediately after seed germination (Ploeg, 2001). Also, infested nursery seedlings carry infestation of root knot nematode to newer sites causing yield losses. Hence prevention of nematode at nursery level becomes an important part in the management of nematode in transplanted crops. Some plants are known to produce allelochemicals as polythienyls, glucosinolates, alkaloids, terpenoids and phenolics that function as nematostatic or nematocidal chemicals. In the present studies, incorporation of B. rapa and E. sativa in seed beds of tomato reduced gall numbers in seedlings of tomato. Decrease in gall numbers in B. rapa and E. sativa incorporated plots was observed to be 56-58 % in first year and 43-46 % in second year respectively. Mojumdar & Mishra (1991) have also reported nematicidal nature of mustard cakes and it was found to reduce hatching of eggs and reduced penetration of second stage juveniles. Rape or mustard plantings in rotation with strawberries have checked the increase of some nematodes (Brown & Morra, 1997). Brassicaes (rapeseed, mustard) have been earlier reported by researchers to have nematode suppressive effects. The mustard effect is attributed to enzymatically induced breakdown products of glucosinolates into isothiocyanates similar to that of V AP AM (met am sodium). Incorporation of these amendments had also increased growth parameters, which could be due to improvement in soil structure and fertility, alteration of nemato-toxins or increased population of nematode antagonistic agents. Oil radish (Raphanus sativus L. var. oleiferus (Stokes) Metzg.) as green manure has been observed to reduce stubby root nematode (Trichodorus) and root lesion nematode (Pratylenchus) in Idaho potato fields and winter rapeseed and canola incorporation in early spring has been recommended for reduction in nematodes (Cardwell & Ingham, 1996). Chopped parts of leaves, stems and flowers such as neemun, marigold cassia subabool, periwinkle and datura etc have also shown good promises for nematode control (Mishra & Prasad, 1978; Haseeb et al., 1984).

The present studies reveal that the incorporation of Brassica rapa and Eruca sativa can be successfully used to decrease root-knot nematode infestation in seed beds of tomato and to raise healthier seedlings.

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