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MANAGEMENT OF ROOT-KNOT NEMATODE, MELOIDOGYNE INCOGNITA IN FCV TOBACCO THROUGH BIO-AGENTS ENRICHED TRAY SEEDLINGS

S. RAMAKRISHNAN AND S.S. SREENIVAS

ICAR Central Tobacco Research Institute, Research Station, Hunsur-571105

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Flue-Cured Virginia (FCV) tobacco is a major rainfed crop with lot of export potential grown in light soil regions of Karnataka. Root knot nematode, *Meloidogyne incognita* pose major threat to FCV tobacco cultivation in both nursery and in main field. Though chemical control measures are available, their use is neither cost effective nor eco-friendly. Use of Bio-control agents against nematodes and other soil borne diseases is a well proven technology. Similarly tray seedlings are widely used for raising tobacco crop in Karnataka by majority of farmers. In an attempt to provide a sustained root-knot management in field crop, bio-agents enriched tray seedlings were evaluated. Bio-agents *Pseudomonas fluorescens, Trichoderma viride and Paecilomyces lilacinus* were enriched singly @ 25 and 50g / 1.2 kg of tray medium and were evaluated for their bio-efficacy against root knot nematodes under sick field condition. Significant reduction in root knot nematode in terms of (Root-Knot Index) RKI ranging from 1.89 to 2.40 as against 3.90 in control was recorded in bio-agent treatments. The per cent control in treatments ranged from 43.1 to 51.5% with *P. lilacinus* @ 50g/tray media significantly reduced the RKI to the tune of 51.5% and recorded significantly higher cured leaf yield of 1539 kg/ha, with an increase of 12.1% compared to check. *P. lilacinus* @ 50g/tray medium when tested in bulk recorded 14.7% increase in cured leaf yield over check with ICBR of 1:5.9. The technology helps in easy delivery of bio-agents into the field and helps in managing root-knot nematode in eco-friendly manner.

INTRODUCTION

Flue-Cured Virginia (FCV) tobacco is an important commercial crop grown in Southern-transitional zone of Karnataka (KLS) in an area of 70000 ha as rainfed crop. The crop is highly remunerative and has lot of export potential. Root knot nematode, *Meloidogyne incognita is* the major limiting factor both in nursery and field crop (Hussaini, 1983). The nematode infection in early stage of the crop has tremendous influence on the quantity and quality of tobacco. Nematodes also, form disease complex by interacting with other plant pathogens. Root-knot infection results in root decay and necrosis often in association with other fungal and bacterial groups. It predisposes FCV tobacco crop to wilt disease caused by *Fusarium oxysporum f. sp. nicotianae* causing significant yield loss. (Ramakrishnan *et al.*, 2008). Conventional nurseries are more prone to root-knot infection leading to poor quality and root knot infected transplants. Such infected transplants fail to establish and result in uneven crop resulting in poor yields. Chemical control methods are readily available for root knot nematode management in FCV tobacco nurseries (Ramakrishnan *et al.,* 1998). Since they are not cost effective and eco-friendly, an attempt was made to evaluate bio agents by enriching them into the tray media used for raising FCV tobacco seedlings. Moreover, tray technology for raising FCV tobacco seedlings was standardised (Mahadevaswamy *et al.*,2007) and is widely used by majority of FCV tobacco growers in Karnataka. Bio-agents are reported to be effective against root-knot nematodes in many field crops (Sobita Devi and Pandey, 2001; Mani *et al.*,1998; Ramakrishnan and Nagesh, 2011; Ramakrishnan and Seenivas, 2012; Ramakrishnan and Panduranga Rao. 2013). Hence, an attempt was made to evaluate commercial formulation of *Pseudomonas fluorescens, Trichoderma viride* and *Paecilomyces lilacinus* as enrichment to cocopeat medium in tray for the management of root-knot nematode, *M. incognita* in FCV tobacco.

Key Words: FCV tobacco, Tray nursery, root-knot nematode, *Meloidogyne* spp., *Pseudomonas fluorescens, Trichoderma viride and Paecilomyces lilacinus*

MATERIALS AND METHODS

The replicated trial was conducted under root knot nematode sick field conditions with average initial population of 150 second staged juveniles per 100 g soil at CTRI Research Station, Hunsur for three years period. HIPS plastic trays of 52 x 24 cm dimension having 98 cups were filled with bio-agents enriched cocopeat @ 1.2 kg per tray. Commercial formulation of *Pseudomonas fluorescens*, *Trichoderma viride* and *Paecilomyces lilacinus* formulated as wettable powder with a spore load 2×10^6 spores/g were mixed with tray medium @ 25 and 50g as per treatment. About 25 days old seedlings raised under conventional nursery were transplanted in trays filled with cocopeat. The trays were maintained with all agronomical practices and planted in main field at 45 days after resetting in trays. Similarly, seedlings from untreated conventional nursery and tray nursery maintained without bio-agents served as control. Conventional seedling with carbofuran @ 1g / plant was also, tested as standard check. Observations on yield parameters, root-knot index (0-5 scale), number of egg mass per g. root and soil population per 100g. soil were recorded at the end of the crop harvest. A bulk evaluation of the treatment involving *P.lilacinus* @ 50g/tray was also done to standardize the methodology and to evolve cost economics of the schedule.

RESULTS AND DISCUSSION

The pooled analysis data of the study revealed that tested bio-agents significantly reduced the root-knot nematode infection with RKI ranging from 1.89 to 2.40. Conventional seedlings with carbofuran @ 1g / plant recorded 40.8% reduction in RKI as against 38.5% in treatment with untreated tray seedlings. Treatment with *P. lilacinus* @ 50g/tray recorded significant decrease in RKI to 1.89 as compared to 3.90 in check. Subsequent increase in cured leaf yield was to the tune of 12.1% compared to check. The treatment was also, on par with *P. fluorescens* @ 50g/tray. Similar yield increase in okra plants grown in root-knot sick soil due to soil application of *P.lilacinus* was reported by Dhawan *et al.* (2004). Reddy and Khan (1988) reported increase in tomato yields by effective control of root-knot by *P.lilacinus.* The results are also, in confirmation with Nagesh *et al.* (2001) who reported significant increased yield of chrysanthemum flowers to the tune of 23-28% by use of talc-formulation of *P.lilacinus* @ 4-6 kg/ac against root-knot nematodes. Zaki & Bhatti (1990) reported that the fungus *P.lilacinus* affects the egg masses, engulfs and penetrates the eggs and proliferates within them by consuming the egg contents. In the present investigations, treatment involving *P.lilacinus* @ 50 g/tray also recorded 49.3% reduction in egg mass/g root and 48.3% reduction in soil nematode population compared to un-treated control. Similarly, Jonathan and Rajendran (2000) reported decrease in root-knot nematode soil population due to application of *P. lilacinus* in banana. Hence the promising treatment involving *P.lilacinus* enriched tray media @ 50g/tray was evaluated under bulk studies to confirm its performance under large scale and to work out cost benefit ratio. The results from the confirmation trial also revealed increased cured leaf yield to the tune of 14.7% over control with ICBR of 1:5.9. The bio-agent being safe to handle and multiplies easily in the soil reducing root-knot nematode population can be a good non-chemical and eco-friendly approach to manage root-knot nematodes in main field.

REFERENCES

Dhawan, S.S., R. Narayana, & N.P. Babu. 2004. Biomanagement of root-knot nematode, *Meloidogyne incognita* in okra by *Paecilomyces lilacinus*. ***Annals.Plant.Protect. Sci.*** 12: 356-359.

Ekanayake, H.M.R.K. and N.J. Jayasundara. 1994. Effect of *Paecilomyces lilacinus* and *Beauveria bassiana* in controlling *Meloidogyne incognita* on tomato in Sri Lanka. Nematologia Mediteranea 22: 87-88.

Hussaini, S.S. 1983. Quantification of root-knot nematode damage *Meloidogyne* spp. on FCV Tobacco. Tob. Res. 19: 61-65.

Jonathan, E.I., D. Padmanabhan, & A. Ayyamperumal.1995. Biological control of root-knot nematode on betel vine, *Piper betel* by *Paecilomyces lilacinus*. Nematologia Mediterranea 23: 191-193.

Table 1: Effect of bio agents enriched tray media on FCV tobacco yield and root knot disease incidence under field conditions (Pooled)

S.N	Treatment details	Green leaf yield (kg/ha)	Cured leaf yield (kg/ha)	% Inc. over check	Root knot index	% Dec. over check	No.of egg mass per g. root	Soil population per 100 g. soil
1.	*Pseudomonas. fluorescens* @ 25g / tray media	13107	1454	6.0	2.22	43.1	15.0	84.3
2.	*Pseudomonas. fluorescens* @ 50g / tray media	13151	1478	7.7	2.00	48.7	12.0	82.5
3.	*Trichoderma viride* @ 25g / tray media	13020	1432	4.4	2.43	37.7	17.3	100.5
4.	*Trichoderma viride* @ 50g / tray media	13020	1385	1.0	2.22	43.1	15.3	96.0
5.	*Paecilomyces lilacinus* @ 25g / tray media	12783	1488	8.5	2.00	48.7	12.9	81.3
6.	*Paecilomyces lilacinus* @ 50g / tray media	13220	1539	12.1	1.89	51.5	12.3	75.0
7.	Un-treated tray media	12147	1377	-	2.40	38.5	15.3	118.0
8.	Conventional seedling + Carbofuran @ 1g / plant	12134	1451	-	2.31	40.8	14.6	108.0
9.	Un-treated check	11940	1372	-	3.90	-	24.3	145.0
	S.Em	78.58	10.3	-	0.19	-	1.02	3.17
	CD (5%)	236.7	30.9	-	0.57	-	2.75	9.54

Table 2: Cost economics in bio-management of Root-knot nematode disease in FCV tobacco crop with *Paecilomyces lilacinus*

		Check (Crop from conventional nursery)	Bio-management schedule (Crop from Tray nursery with bio-agent enriched medium)
1	Cost of raising one ha crop (Rs/-)	1,20,000/-	1,20,000/-
2	Cost for raising nursery for one ha crop	2500/-	6500/-
3	Total cost of raising one ha crop	1,22,500/-	1,27,000/-
4	Additional cost involved per ha crop	-	4,500/-
5	Cured leaf yield per ha crop (Kg)	1298	1489
6	Additional yield per ha crop (Kg)	-	191
7	Average price per kg Cured tobacco	140/-	140/-
8	Revenue per ha crop	1,81,720/-	2,08,460/-
9	Additional revenue per ha crop		26,740/-
	ICBR		1:5.9

Jonathan, E.I. & G. Rajendran. 2000. Biocontrol potential of the fungus *Paecilomyces lilacinus* against root knot nematode *Meloidogyne incognita* in banana. **J. Biolog. Control.** 14: 67-69.

Mani, M.P., S. Rajeswari and C.V. Sivakumar. 1998. Management of potato cyst nematodes, *Globadeva* spp., through plant rhizosphereic bacterium *Pseudomonas fluorescens*. J**J. Biolog. Control.** 12:131-134.

Mahadevaswamy, M. M, M.M. Shenoi, S. S. Sreenivas and S. Ramakrishnan. 2007. Studies on production of tray nursery seedlings of FCV tobacco under KLS situation. **Tob. Res.** 33 (1&2): 17-20.

Nagesh, M., Hussaini, S.S. & Gopinatha, K.V. 2001. Management of root knot nematode, *Meloidogyne incognita* in chrysanthemum using formulations of *Paecilomyces lilacinus* in combination with neem cake. In: *Proc. 2nd National symposium in Integrated Pest Management in Horticultural Crops- New Molecules, Biopesticide & Environment" IPM in Horticultural Crops: Emerging Trends in the New millennium* (Eds. A. Verghese and P. Parvatha Reddy), AAPMHE, UHR, Bangalore. pp. 149-150.

Reddy, P.P. and R. M. Khan. 1988. Evaluation of *Paecilomyces lilacinus* for the biological control of *Rotylenchulus reniformis* infecting tomato, compared with carbofuran. **Nematologia Mediteranea** 16: 113-115.

Ramakrishnan, S., S.S. Hussaini, S.M. Viswanath and M. M. Shenoi. 1998. Effect of Basamid G for the control of root knot nematodes in FCV tobacco nursery. In: *Proc. Nat. Symp. Rational approaches in nematode managementfor sustainable agriculture.* (Eds. Dhawan, S. C and Kaushal, K. K). GAU, Anand, pp. 121-124.

Ramakrishnan, S., M. M. Shenoi and S. S. Sreenivas. 2008. Influence of root knot nematode, *Meloidogyne* spp. on fusarium wilt disease of tobacco. **Tob.Res.** 34:91- 92.

Ramakrishnan, S. & Nagesh, M. 2011. Evaluation of beneficial fungi in combination with organics against root-knot nematode in FCV tobacco nurseries. **J. Biolog. Control.** 24: 164-167.

Ramakrishnan, S and C. Panduranga Rao. 2012. Evaluation of *Paecilomyces lilacinus for the* management of root-knot nematode, *Meloidogyne incognita* in FCV tobacco nursery. ***Indian J. Nematol.* 43:65-69.**

Ramakrishnan, S and S. S. Sreenivas. 2012. Bio-management of Fusarium wilt disease complex with *Pseudomonas fluorescens* and *Aspergillus niger*. **J. Biolog. Control.** 26 (4):368-372.

Ramakrishnan, S and S.S.Sreenivas. 2015. Biological control of soil-borne fungal and root-knot nematode disease complex in FCV tobacco nursery. **J. Biolog. Control.** 29 (4): 203-206.

Sobita Devi, L, R.C. Pandey. 2001. Bio-agents for the management of *Meloidogyne incognita* and *Fusarium oxysporum .F.*sp. *ciceri* on chickpea (Abstract), pp.147-148. Nat.Congress on Centenary of Nematology in India: Appraisal and future plans. IARI, New Delhi, India. 5th-7th Dec.

Zaki, F.A. and D.S. Bhatti. 1990. *In-vivo* parasitism of *Meloidogyne javanica* by an ovi parasitic fungus, *Paecilomyces lilacinus.* Nematologia Mediteranea 18:141-143.