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Research Note

Evaluation of *Trichoderma viride* formulations against sore shin disease in Flue-Cured Virginia (FCV) tobacco nurseries

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ABSTRACT: Studies were conducted during 2009-10 to 2010-11 to evaluate talc and neem cake formulations of *Trichoderma viride* for controlling sore shin disease in FCV tobacco nurseries incited by *Rhizoctonia solani.* The pooled data analysis of two years indicated that *T. viride* in neem cake formulation was more effective than the talc formulation and reduced sore shin disease by 63.53%. This effective bio-intensive module reflected on the better yield of healthy transplants (835 m^{-2}) as against untreated (489 m^{-2}) check. The schedule gave an Incremental Cost Benefit Ratio (ICBR) of 1:10.27.

KEY WORDS: *Rhizoctonia solani*, FCV Tobacco, Hore shin, *Trichoderma viride*

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Flue-Cured Virginia (FCV) tobacco (*Nicotiana tabacum* L.) is the major commercial crop in light soils of southern transition zone of Karnataka called Karnataka Light Soil (KLS). Tobacco is cultivated in KLS in around 1.17 lakh ha extending from Mysore district up to Shimoga district. FCV tobacco nurseries in KLS are raised during pre-monsoon period (March-May). The seedlings are transplanted during the onset of southwest monsoon (May-June) (Devaki, 1991; Gopalachari, 1984; Shenoi and Nagarajan, 2000). During the pre-monsoon period the climatic conditions are congenial for the spread of several soil-borne fungal diseases in nursery beds. In recent years, sore shin disease caused by *Rhizoctonia solani* Kuhn is a major threat to the nurseries. The pathogen is gaining importance with severe damage to seedlings in isolated pockets as well as sporadically in tray nurseries. Several methods in practice for the control of soil-borne fungi are physical, chemical, cultural and biological (Wani *et al*. 2009; Susan, 1999). However, use of chemicals results in environmental pollution and related problems such as residual toxicity, development of resistance by the pathogen etc. (Mahalakshmi *et al.,* 2008). Thus, effective biocontrol formulations are screened in the field conditions to overcome many plant diseases. In view of this, two formulations of *Trichoderma viride* were compared with one chemical formulation and Incremental Cost Benefit Ratio (ICBR) was calculated.

T. viride strain isolated at Division of Plant pathology GKVK, Bangalore was used in this study. The pure culture was maintained on agar slants in *Trichoderma* selective medium (TSM) (Elad and Chet, 1983).

A mycelial disc of *T. viride* was inoculated into 100 ml of molasses yeast medium in 250 ml conical flasks and incubated at room temperature for 14 days. Five gram of Carboxy Methyl Cellulose (CMC) was added to 1 kg of talc and mixed well. The mycelial mat was homogenized and blended with talc powder at 1:2 ratio (Ramakrishnan *et al.,* 1994; Thiruvudainambi *et al*., 2010). For neem cake formulation, the mycelial mat was homogenized and mixed at 10gm along with 100gm of decomposed neem cake. Both the preparations were shade dried separately and packed in polypropylene bags, heat sealed and kept at room temperature. The population level at the time of packing was 22 x 10^7 CFUs g^{-1}.

The field experiment was laid at Central Tobacco Research Institute, Regional Station, Hunsur, Karnataka, India to test the efficacy of *T. viride* in talc and neem cake formulation against sore shin disease. The experiment was designed in randomized block design (RBD) with 8 treatments with a plot size of 1 m^2 each. The formulations were tested at 10, 20 and 30g m^{-2}. The trial was conducted by following recommended package of practices (Shenoi,

1998). The results were compared with recommended pesticide treatment involving propiconazole and an untreated check. The study was conducted for two consecutive seasons during 2009-10 to 2010-2011 and the data were pooled to draw conclusions. The disease ratings were done at regular intervals as per cent incidence. Transplants were pulled at regular intervals and pooled at the end to know total yield of healthy transplants. The data was subjected to pooled using Scheffe's Post Hoc test analysis for drawing conclusions.

The results from the nursery trial conducted revealed that the bioagent *T. viride*, both in talc and neem cake formulations exhibited antagonistic influence on *R. solani.* The pooled analysis data suggested that the neem cake formulation of *T. viride* performed well compared to talc formulation. Both the formulations of *T. viride* significantly controlled the disease compared to check. The disease control in *T. viride* treatment ranged from 32.4 to 75.2% initially at 30 DAS. The disease control at 60 DAS was 48.0 to 63.8% in talc and neem cake formulation treatments (Table 1). Among the treatments, talc formulation of *T. viride* at 30g m^{-2} was superior than two other lower dosages. Similarly, treatments with neem cake formulation of *T. viride* at 30g m^{-2} was superior than two other lower dosages and also superior over talc formulation. The recommended pesticides treatment gave 86.9% control but untreated check recorded 53% disease incidence. The yield of healthy transplants was in the range of 589 to 835 m^{-2} in *T. viride* treatment, maximum being recorded in neem cake formulation at 30g m^{-2}. The pesticide treatment gave 820 healthy transplants per m^2.

In the present study, the significance of variations among the treatments implies that a single isolate of the antagonist can be highly effective against *R. solani.* Bioefficacy of fungal bioagent *Trichoderma* spp. in controlling *R. solani* has been established earlier by Elad *et al*. (1980) in beans, Amal *et al*. (2005) in cotton, Mathivanan *et al*. (2005) in rice and Nawar (2007) in squash. Though, Propiconazole is highly effective in controlling sore shin disease in FCV tobacco nurseries (Shenoi, 2010), its irrational use may pose threat to environment. During present study, enhancement in the yield of healthy transplants was observed by using neem cake formulation of *T. viride* against sore shin of tobacco. The neem cake has been exploited in FCV tobacco

Table 1. Efficacy of different formulations of *Trichoderma viride* against *Rhizoctonia solani* (Pooled for 2 seasons)

Sl. No.	Treatments	20 DAS (Percent incidence)	% Disease control over check	30 DAS (Percent incidence)	% Disease control over check	50 DAS (Percent incidence)	% Disease control over check	60 DAS (Percent incidence)	% Disease control over check	Yield of healthy transplant/ m^2	ICBR
1	*Trichoderma viride* (talc formulation) @10g/m^2	4.0833^{c*}	68.90	22.4583^{d}	32.29	23.2916^{d}	48.04	28.1666^{e}	46.86	589	1:2.33
2	*Trichoderma viride* (talc formulation) @20g/m	2.0833^{b}	84.14	19.5833^{d}	41.02	23.7500^{d}	51.48	24.7916^{d}	53.22	590	1:2.37
3	*Trichoderma viride* (talc formulation) @30g/m	1.6667^{b}	87.34	16.7917^{c}	49.42	20.7500^{d}	52.97	22.8750^{cd}	56.84	639	1:4
4	*Trichoderma viride* (neem cake) @10g/m	0.4166^{a}	95.57	14.0000^{b}	57.83	19.1666^{c}	57.26	22.0000^{c}	58.49	752	1:7.77
5	*Trichoderma viride* (neem cake) @20g/m	0.1666^{a}	97.48	11.5416^{b}	65.24	17.4167^{c}	61.16	19.6667^{b}	62.90	778	1:8.63
6	*Trichoderma viride* (neem cake) @30g/m	0.0000^{a}	100	8.2500^{a}	75.15	13.7917^{b}	69.23	19.2083^{b}	63.77	835	1:10.27
7	Propiconazole@0.05%	0.0000^{a}	100	4.9166^{a}	85.21	7.3750^{a}	83.56	9.0833^{a}	86.86	820	1:10.30
8	Check	13.1250^{d}	—	33.2083^{e}	—	44.8333^{e}	—	53.0000^{f}	—	489	—

* Figures having the same letters are not significantly different according to Schelfe's Post Hoc analysis ($P = 0.05$).

nurseries to control soil borne fungal pathogens (Shenoi and Sreenivas, 2007). The synergistic effect of neem cake and bioagent may be the reason for enhanced control of sore shin disease and better yield of healthy transplants. By this module, there will be steady increase in the bioagent propagules in the soil over a period of time and will maintain threshold levels of soil-borne fungal pathogens without incorporation of chemical active ingredients.

The total cost of biointensive module during this study was ₹ 3650 as against 3200 per 100m^2. Thus, the schedule incurs an additional cost of 450 yielding 82,700 transplants per 100m^2 as against 42,900 in conventional nursery. The returns from the excess transplants was 5070 at 150 per 1000 seedlings. The net returns in biointensive module was 4620 from the transplants grown in 100m^2. This was obtained from the schedule involving neem cake formulation which gave an ICBR of 1:10.27 and it was comparable to chemical schedule (Table 2).

The study thus conclusively demonstrated that sore shin of tobacco can be effectively and economically managed by using neem cake formulation (22 x 10^7 CFU g^{-1}) of *T. viride* (at 30g m^{-2}) in FCV tobacco nurseries.

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Table 2. Economics of Biointensive module for the control of sore shin disease in FCV tobacco nurseries (for 100 m^2)

Sl. No.	Particulars	Conventional Nursery in ₹	Biointensive module in ₹
1	Seed bed preparation, seed, sowing, watering and fertilizers	1800	1800
2	Cost of Farm Yard Manure	500	500
3	Cost of bioagent	–	450
4	Weeding	900	900
5	Total cost	3200	3650
6	Additonal cost over check	–	450
7	Number of Healthy seedlings / 100 sq m	48900	82700
8	Number of excess transplants	–	33800
9	Returns from excess transplants at Rs. 150 /- per 1000 seedling	–	5070
10	Net returns over check	–	4620
Incremental Cost Benefit Ratio (ICBR)		–	1:10.27

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