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Bio-intensive integrated disease management of FCV tobacco nursery in Karnataka light soils

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ABSTRACT: **A commercial bio-pesticide, "Kalisena" containing *Aspergillus niger* (strain AN 27 of IARI) was evaluated as seed pelleting and in slurry form. The results indicated that Kalisena in slurry form was effective and feasible giving 100 % control of damping off, 85% control of blight and 90% control of black shank diseases in FCV tobacco nursery. The results are comparable to recommended chemical schedule of Ridomil MZ 72 WP. This effective bio-intensive module reflected on the better yield of healthy transplants (912 / sq. m.) as against the recommended Ridomil MZ schedule and untreated (846 and 562 per sq. m.) check, respectively. The schedule gave an incremental cost-benefit ratio of 1: 8.2.**

KEY WORDS: *Aspergillus niger*, integrated disease management, Kalisena, soil solarization, tobacco nursery

INTRODUCTION

Flue-Cured Virginia (FCV) tobacco nurseries in Karnataka are predisposed to two major soil-borne fungal diseases caused by *Pythium aphanidermatum* and *Phytophthora parasitica* var. *nicotianae* due to favourable weather factors prevailing during seed bed phase (Shenoi and Nagarajan, 2000). The diseases occur at different stages of nursery resulting in poor yield of transplants. Several chemical control modules (Shenoi and Abdul Wajid, 1982), due to their indiscriminate use, have resulted in the development of pathogen resistance and associated health hazards. Further efforts made have helped in the development of integrated nursery disease management schedule involving non-chemical methods such as soil solarization, soil amendment with neem cake and need-based chemical spray (Abdul Wajid *et al.*, 1995).

The recent studies conducted helped to develop a biointensive module replacing chemical active ingredients in this integrated schedule. The present paper deals with the bioefficacy of *Aspergillus niger* as a bioagent for the management of soil-borne fungal pathogens in tobacco nursery in commercial form 'Kalisena' in a integrated schedule.

MATERIALS AND METHODS

A replicated nursery trial was conducted at CTRI Research Station, Hunsur, during 2003-05 to evaluate 'Kalisena', the commercial formulation of *Aspergillus niger* (IARI strain AN 27). The product available in two formulations, *viz.*, seed pelleting

and slurry form, was evaluated by integrating with soil solarization and neem cake amendment. Soil solarization of the nursery bed was done with white LDPE 50 G sheet after incorporating powdered neem cake @ 400g / sq.m for six weeks. Seed pelleting was done with Kalisena SD @ 0.5%. The slurry form of the bioagent, Kalisena SL was incorporated through enriched FYM at different rates of application. The enrichment with Kalisena SL was done by heaping the FYM (6.3 x 1ft) in shade @ 20g / mt. with optimum moisture. The heap was turned at regular intervals and allowed for 10 days incubation before application to the nursery. The nursery was raised by following all other recommended agronomic practices (Shenoi, 1998). The efficacy was rated against recommended check, metalaxyl + mancozeb formulation (Metalaxyl MZ 72 WP) @ 0.1% pre-sowing spray drench + 0.2% foliar spray at 30 &45 DAS schedule.

Observations on damping off, blight and black shank were recorded at regular intervals. Number of healthy transplants at each pulling was recorded from each treatment. The data were subjected to pooled analysis to draw conclusions.

RESULTS AND DISCUSSION

The results from the two-year investigation indicated that 'Kalisena' is very effective in controlling soil-borne fungal diseases (Tables 1 and 2).

The study resulted in the identification of two biointensive modules comprising Kalisena SL and Kalisena SD. Treatments comprising eco-friendly and bio-intensive components such as soil solarization, soil amendment with neem cake and 'Kalisena' (*Aspergillus niger*) SD or Kalisena SL treatments consistently performed on par with recommended Ridomil MZ schedule, for controlling the two soil-borne fungal diseases in the nursery (Shenoi and Wajid, 1992). These two bio-intensive modules exhibited >90% control of damping off disease and >80% of blight and black shank diseases without the chemical component over untreated check and were on par with recommended chemical control module. The yield of healthy transplants was more in these two modules (912 and 924 / sq.m) than in chemical control module (846 / sq.m). The per cent increase in healthy transplants over untreated check was 38. However, the bio-agent's performance was low and erratic in the other treatments, which were significantly inferior and where soil solarization was not imposed to the beds prior to the application of *A. niger*. This is attributed to insufficient load of *A. niger* due to less colonization in treatments where soil solarization is not done.

Several fungal and bacterial groups were translated into commercial formulations (Nagarajan, 1998; Whipps, 1997). Successful colonization by the bioagent leads to production of variety of metabolites like siderophores (Loper, 1988) and organic acids (Patibanda and Sen, 2005). *A. niger* AN27 has been reported to produce both hydroxamate and catecholate groups of siderophores ((Bineeta Sen, 2000). Role of siderophores in antagonistic activity, rhizosphere competence and plant growth promotion is well documented (Loper and Buyer, 1991). The results obtained are also indicative of the high efficacy of the bioagent against soil-borne fungal pathogens as also reported by Sen *et al.* (1995). The efficacy of the strain may be attributed to the better establishment and antagonistic activity due to siderophore production. The scope for faster multiplication of *A. niger* in solarized soil is higher as compared to its multiplication in bare soil. Among the two formulations, Kalisena in slurry form was found more feasible and practical. Though Kalisena SD formulation was also found effective, given the seed size, the slurry form was more ideal for tobacco nurseries as the application can go along with recommended incorporation of FYM. The module identified is soil solarization with 50G WTP to the neem cake amended beds (@ 400g / sq.m.) and application of 200g/sq.m FYM enriched with Kalisena SL before sowing. The added advantages of this type of incorporation will be steady increase in the bioagent propagules in the soil over a period

Table 1. Evaluation of Kalisena, an eco-friendly bio-pesticide, against soil-borne fungal diseases in FCV tobacco nursery (2003-2005) (Pooled analysis)

Treatment details	Avg. germination per sq.m	% Damping off incidence at 35 DAS		% Damping off incidence at 45 DAS	
		1	2	1	2
Kalisena SD	22.7	3.3	79.1	8.3	53.9
Kalisena SL enriched FYM @ 100g/sq.m	21.1	5.4	65.8	13.1	27.2
Kalisena SL enriched FYM @ 150g/sq.m	23.1	4.1	74.0	10.6	41.1
Kalisena SL enriched FYM @ 200g/sq.m	21.8	3.3	79.1	10.1	43.9
Kalisena SD +Kalisena SL enriched FYM @ 100g/sq.m	19.4	8.6	45.6	22.3	-
Kalisena SD +Kalisena SL enriched FYM @ 200g/sq.m	20.9	1.4	91.1	10.6	41.1
SS+NC+ Kalisena SD	20.0	0.3	98.1	1.4	92.2
SS+NC+ Kalisena SL @ 200g/sq.m	21.9	0.0	100.0	1.5	91.7
Ridomil MZ 72 WP recommended Schedule	21.8	0.0	100.0	0.0	100.0
Untreated check	20.7	15.8	0.0	18.0	-
SEM±	1.07	1.80		2.49	
CD at 5%	NS	5.0		6.91	
CV%	16.63	168.79		71.12	
Season mean (2003-04)	18.84	4.82		5.86	
Season mean (2004-05)	23.8	3.57		12.29	
SEM±	0.56	1.12		1.08	
CD (P = 0.05)	1.94	NS		3.73	
CV%	14.22	121.42		73.66	
S x T interaction SEM±	1.52	2.55		3.53	
CD (P = 0.05)	NS	NS		9.77	

1 = Original mean; 2 = % control over check; SS = soil solarization, NC = neem cake amendment

of time and maintenance of threshold levels of soil-borne fungal pathogens without the incorporation of chemical active ingredients. The schedule gave an incremental cost-benefit ratio of 1: 8.2 over conventional nursery (untreated check) in a bulk demonstration trial (Table 3).