

BIO-EFFICACY OF NEW FUNGICIDE FENAMIDONE + MANCOZEB AGAINST DAMPING OFF DISEASE IN FCV TOBACCO NURSERIES

S. K. DAM¹ AND U. SREEDHAR²

¹ICAR Central Tobacco Research Institute Research Station, Dinhat - 736 135

²ICAR Central Tobacco Research Institute, Rajahmundry - 533 105

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Experiments were conducted to evaluate new fungicide fenamidone + mancozeb at three different concentrations for its efficacy against *Pythium aphanidermatum* (Edson) Fitzpatrick, the incitant of damping off disease, to select the most effective concentration for the management of the disease. Three fungicides were tested *in vitro* by poisoned food technique for their efficacy to inhibit mycelial growth of the pathogen. Fenamidone 10% + mancozeb 50% inhibited cent per cent mycelia growth at all the concentrations. Among the three fungicides tested under field conditions, fenamidone 10% + mancozeb 50% @ 0.3% was found to be the most effective dose in tobacco nurseries which could reduce the disease to an extent of 96.8 per cent with a corresponding maximum healthy transplantable seedlings (856 / sq. m.) when applied as a drench on the nursery beds at the time of sowing @ 0.1% followed by foliar spray @ 0.3% twice at 25 and 35 DAS. Metalaxyl 8% + mancozeb 64% when sprayed at 10 days interval could protect 95.6 per cent seedlings with a production of 793 / sq. m of healthy seedlings.

INTRODUCTION

Tobacco is one of the important commercial crops of India and contributes about Rs. 4,200 crores as foreign exchange and Rs. 17,100 crores revenue to the national exchequer annually. Diseases caused by fungal pathogens are major constraints in successful production of this exportable commodity. *Pythium aphanidermatum* (Edson) Fitzpatrick, causing damping off disease in tobacco nurseries is a major problem in the production of quality tobacco seedling (Nagarajan and Reddy, 1980). Heavy mortality of the seedlings in all types of tobacco including FCV tobacco nurseries due to this pathogen is a cause of concern.

Though effective management approaches are available, efforts are being constantly made to evaluate new class of fungicides for developing efficient IPM strategies. Metalaxyl + mancozeb have been recommended and is in use since three decades for the management of this disease in tobacco nurseries. To avoid resistance development and to find out alternative fungicides, the new fungicide was assessed for its bio-efficacy against damping off disease. The present studies on evaluation of a new fungicide Sectin 60 WG containing fenamidone 10% + mancozeb 50% against the pathogen, *P. aphanidermatum*, the incitant of damping off disease in FCV tobacco nursery were carried out with a view to select the most effective fungicide for the management of the disease.

MATERIALS AND METHODS

LABORATORY STUDIES

Poisoned food technique of Shervelle (1979) was followed to study the comparative efficacy of 3 fungicides at 100, 250, 500 and 1000 ppm of formulation against the virulent isolate of *P. aphanidermatum* in five replications. Required concentration of each of the fungicides from the commercial formulations was prepared with sterilized distilled water and added to autoclaved potato dextrose agar (PDA) medium to obtain desired dilutions. The medium without fungitoxicant served as control. The petri dishes containing PDA medium were inoculated with 5 mm discs from two days - old actively growing culture of *P. aphanidermatum* grown on PDA, the inoculated petri dishes were incubated at $28 \pm 2^{\circ}$ C temperature and growth of the mycelial colony was measured 42 hours after inoculation. Extent of inhibition of mycelial growth by each fungicide

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was calculated by estimating the per cent reduction in mean mycelial diameter over that of the control (Vincent, 1947). The data were subjected to statistical analysis.

NURSERY EXPERIMENT

The nursery experiment was conducted for two seasons 2008 and 2009 at ICAR- Central Tobacco Research Institute, Rajahmundry, Andhra Pradesh to test the bio-efficacy of new fungicides against damping off disease, *P. aphanidermatum* in FCV tobacco nurseries. The seedlings were raised as per standard agronomic practices during the nursery season (September to November).

The fungicide fenamidone 10% + mancozeb 50% (Sectin) at different concentrations was applied to the nursery as drenching nursery beds @ 500 ml/m² at the time of sowing and spray @ 100 ml/m² at 25 and 35 DAS along with recommended check metalaxyl 8% + mancozeb 64% @ 0.2% and copper oxychloride 50% @ 0.2% for evaluation under nursery conditions. The experiment was laid out in a randomized block design (RBD) with an untreated check. There were 6 treatments with four replications with a plot size of 1 m². The popular cultivar Siri was used in the experiment. Regular disease observations on damping off and phytotoxicity were recorded, while healthy transplant count was recorded at each pulling of the seedlings. Germination count was taken at 15 days after sowing (DAS) at random in ten squares each with a dimension of 100 sq.cm. from which mean was calculated.

RESULTS AND DISCUSSION

LABORATORY STUDIES

Among the three fungicidal compounds evaluated against *P. aphanidermatum* all were found inhibitory to the fungus with varied degree of inhibition. The results presented in Table 1 indicate that out of the three fungicides evaluated against the test pathogen, fenamidone + mancozeb was most effective as it checked cent per cent growth of fungus even at 100 ppm followed by metalaxyl + mancozeb 87.56%. Whereas, copper oxychloride, was found to be less effective even at 1000 ppm concentration, which was in confirmity with the results of Yadav and Joshi (2012) who studied different concentrations of fenamidone +

mancozeb against *P. aphanidermatum* *in vitro*. With the rise in concentration from 100 to 1000 ppm, effectiveness of the fungicide in respect to mycelial growth also increased in cases of metalaxyl + mancozeb and copper oxychloride. Whereas, fenamidone 10% + mancozeb 50% inhibited 100% growth of fungus even at 100 ppm concentration.

NURSERY EXPERIMENT

The pooled data (Table 2) indicated that among the different concentrations of the new fungicide fenamidone 10% + mancozeb 50% (Sectin 60 WG) @ 0.1% drench & 0.3% spray was effective and on par with the recommendation in vogue i.e. metalaxyl 8% + mancozeb 64% WP @ 0.2% two sprays as shown by reduced disease incidence and increase in the number of healthy transplants. Similar results were recorded by several workers; Vankar (1999) and Yadav and Joshi (2012) reported that fenamidone + mancozeb 60 WG was equally effective as metalaxyl + mancozeb 72 WP in completely suppressing the growth of *P. aphanidermatum* in bidi tobacco. The incidence of damping off was less in fenamidone 10% + mancozeb 50% @ 0.3% treatment as shown by significantly less damage of seedlings (2.74/m²) as compared to control (17.85/m²) and it was on par with metalaxyl 8% + mancozeb 64% WP @ 0.2% (3.68/ m²). Numbers of healthy transplantable tobacco seedlings recorded were highest (856/m²) with fenamidone 10% + mancozeb 50% @ 0.3% followed by metalaxyl 8% + mancozeb 64% WP @ 0.2% (793/m²). The fungicide fenamidone 10% + mancozeb 50% (Sectin) did not show any phytotoxicity at any of the concentrations, even 3 days after spraying. No significant difference was observed among the treatments for seed germination.

Fungicide treatments reduced the intensity of disease, 51.54% in case of fenamidone + mancozeb drenching @ 0.1% and spray @ 0.1%, 66.95% in fenamidone + mancozeb drenching @ 0.1% and spray @ 0.2%, 82.69% in fenamidone + mancozeb drenching @ 0.1% and spray @ 0.3%, 79.38% for metalaxyl + mancozeb and in copper oxychloride 47.11% as compared to untreated plots.

The economic analysis (Table 3) revealed that a net returns of Rs. 1,05,204 per ha with a C:B ratio of 1.45 was recorded in fenamidone + mancozeb drenching @ 1g/lit and spray @ 3g/lit

Table 1: Effect of different fungicides on the mycelial growth inhibition of *Pythium aphanidermatum*

Fungicides	% inhibition of mycelial growth over control/ concentrations (ppm)				Mean
	100	250	500	1000	
Fenamidone + Mancozeb 60% WG	100 (90.00)	100 (90.00)	100 (90.00)	100 (90.00)	100 (90.00)
Metalaxyl + Mancozeb 72% WP	87.56 (69.34)	93.08 (74.73)	97.30 (83.95)	99.77 (88.75)	94.43 (79.19)
Copper oxychloride 50% WP	62.24 (52.08)	92.64 (74.24)	94.46 (77.77)	94.62 (77.96)	85.99 (70.51)
Mean	83.27 (70.46)	95.24 (79.65)	97.26 (83.90)	98.13 (85.56)	
	Fungicides (F) Conc. (C)				
SEm ±	0.84	0.78	1.68		
C. D at 5%	0.97	2.69	4.67		
C. V. (%)	4.71				

*Figures in parentheses are angular transformations

Table 2: Bio-efficacy of Fenamidone + Mancozeb against damping off disease in FCV tobacco nurseries

Treatment details	Average germination			No. of seedlings / m ²						
	at 15 DAS* /m ²			Damped off				Transplantable		
	2008	2009	Pooled	2008	2009	Pooled	% control over check	2008	2009	Pooled
Fenamidone + Mancozeb drenching @ 0.1% and spray @ 0.1%	42.5	58.5	50.5	110.00 (10.43)	48.75 (6.87)	74.87 (8.65)	51.54	578	678	628
Fenamidone + Mancozeb drenching @ 0.1% and spray @ 0.2%	51.5	64.3	57.9	58.75 (7.62)	18.50 (4.24)	35.25 (5.93)	66.95	616	679	648
Fenamidone + Mancozeb drenching @ 0.1% and spray @ 0.3%	47.3	59.5	53.4	17.25 (3.56)	5.00 (1.90)	7.48 (2.73)	82.69	843	868	856
Metalaxyl + Mancozeb spray @ 0.2%	49.3	56.3	52.8	22.75 (4.65)	7.50 (2.69)	13.52 (3.67)	79.38	812	775	793
Copper oxychloride spray @ 0.2%	48.3	59.8	54.0	74.50 (8.59)	114.25 (10.29)	89.16 (9.44)	47.11	630	525	578
Control (Untreated)	47.0	59.3	53.1	188.00 (13.44)	498.00 (22.26)	318.76 (17.85)	-	398	294	346
SEm±	2.21	3.43	2.04	0.79	0.93	0.33	-	33.22	58.83	33.78
CD at 5%	NS	NS	NS	2.40	2.80	0.96	-	100.11	177.31	97.56
CV%	9.30	11.54	10.79	19.80	23.16	11.74	-	10.28	18.47	14.89
S x T interaction										
SEm±	-	-	2.89	-	-	0.47	-	-	-	47.78
CD at 5%	-	-	NS	-	-	1.36	-	-	-	NS

Figures in parentheses are square root transformations

* DAS = Days after sowing

Table 3: Economics of damping off disease control in FCV tobacco nurseries with fenamidone + mancozeb

Treatment Details	Transplantable seedlings/ha	Cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	C : B Ratio
Fenamidone + Mancozeb drenching @ 0.1% and spray @ 0.1%	35,79,600	2,31,140	2,50,572	19,432	1:1.08
Fenamidone + Mancozeb drenching @ 0.1% and spray @ 0.2%	36,93,600	2,33,740	2,58,552	24,812	1:1.11
Fenamidone + Mancozeb drenching @ 0.1% and spray @ 0.3%	48,79,200	2,36,340	3,41,544	1,05,204	1:1.45
Metalaxyl + Mancozeb spray @ 0.2%	45,20,100	2,30,240	3,16,407	86,167	1:1.37
Copper oxychloride spray @ 0.2%	32,94,600	2,28,440	2,30,622	2,182	1:1.01
Check (untreated)	19,72,200	2,27,240	1,38,054	-89,186	1:0.61

followed by metalaxyl + mancozeb spray @ 2g/lit with a net returns of Rs. 86,167 and a C:B ratio of 1.37. The maximum economic loss was recorded in untreated check (Rs. -89,186 and C:B ratio of 0.61). In case of copper oxychloride, the economic analysis revealed a net returns of Rs 2,182 with C:B ratio of 1.01. The study clearly identified the economic advantage of using either fenamidone + mancozeb drenching @ 0.1% followed by spray @ 0.3% or metalaxyl + mancozeb spray @ 0.2%.

From the *in vitro* studies and the field experiments conducted during 2008 and 2009 nursery seasons on the efficacy of fenamidone 10% + mancozeb 50% (Sectin) at different concentrations in controlling damping off disease, it may be concluded that all the concentrations of the fungicide, controlled damping off disease and protected the transplantable seedlings. However, among the three concentrations, fenamidone 10% + mancozeb 50% @ 0.1% drench and 0.3% spray twice was superior over the other two concentrations and copper oxychloride and was found to be on par with metalaxyl + mancozeb @ 0.2% in terms of disease control as well as economics and hence can be recommended for management of the damping off disease in tobacco nurseries as an alternative to metalaxyl + mancozeb.

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