



Bioefficacy of Cymoxanil and Mancozeb against downy mildew of cucumber (*Cucumis sativus*) caused by *Pseudoperonospora cubensis**

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Globally, cucumber (*Cucumis sativus* L.) is grown in an area of 2 566.29 million ha with a production of 44 240.33million tonnes. In India, cucumber covers an acreage of 18 million ha, with a production of 120 million tonnes (FAO 2009). Major cucumber growing states are Bihar, Haryana, Madhya Pradesh, Punjab, Uttar Pradesh, West Bengal and Karnataka. However, this crop is severely damaged by a number of diseases.

Curzate M8 is formulated as a 72% wettable powder (WP) consisting of 8% Cymoxanil and 64% Mancozeb. Cymoxanil a unique cyanoacetamide, is chemically unrelated to any other commercial disease control agent, and the biochemical mode of action is also different. The risk of resistance is considered low. The chemical inhibits sporulation of the pathogen thereby reducing the spread of the disease. It is highly active on and specific to one particular group of fungi, the Oomycetes.

Downy mildew (*Pseudoperonospora cubensis* (Berk. and Curt.) (Rostov.) is an important disease in most cucumber-growing areas worldwide (Shetty *et al.* 2002). In India, cucumber crop is severely affected by downy mildew disease with the onset of monsoons (Sharma *et al.* 2003). The disease has become a major limiting factor in cucumber production (Kagadi *et al.* 2002, Gaikwad and Meher 1994, Pappas 1982, and 1985, Gupta *et al.* 2003). In the absence of suitable resistant cucumber cultivars and downy mildew being an aggressive and destructive disease, chemical control is highly recommended to prevent crop loss (Anand *et al.* 2009). Systemic fungicides from the phenylamide group were initially effective in controlling the disease.(Cohen 1979, Sharma *et al.* 2003, Shahid A U N P 2000) The systemic fungicide, fosetyl-aluminium was also found to give good control of downy mildew disease (Khetmalas and Memane

2003). However, continuous use of metalaxyl and fosetyl-aluminium, strains of the fungus *P. cubensis* resistant to fungicides have occurred (Cohen *et al.*1983).

Therefore, in the present study, a combination product, viz Cymoxanil (8%)+Mancozeb (64%) 72WP along with Cymoxanil 50 WP was evaluated and compared with the most commonly used standard fungicides, viz Mancozeb 75WP, Metalaxyl (8%)+Mancozeb (64%)72WP, against downy mildew disease of cucumber.

Field experiment was conducted in two consecutive years in rainy season of 2005 and 2006 at Indian Institute of Horticultural Research, Bangalore. The experiment was laid out in randomized block design with four replications. Cymoxanil 50 WP at two concentrations, viz 90 and 120 g a i/ha, and Cymoxanil (8%)+Mancozeb (64 %) 72 WP at 810, 1080, and 1350 g ai/ha, were evaluated against downy mildew of cucumber Cv Malini. This chemical was compared with commonly used Mancozeb 75WP, Metalaxyl Mancozeb 72WP and an untreated control. A total of four sprays were given at seven days interval from the onset of the disease. Incidence of disease was recorded by selecting 10 plants from each plot excluding the border plants,. The observations were recorded one day prior to each foliar application of fungicides by following 0-5 scale (Gaikwad and Meher 1994) and per cent disease index (PDI) was calculated as described by Wheeler (1969). The economics of fungicide was worked out by considering the prevailing rates of inputs, produce and labour charges. Two years data on PDI, yield and cost : benefit ratio are presented in Tables 1, 2.

Grade per cent leaf area infected

0	Nil
1	1to10
2	11 to 20
3	21 to 30
4	31 to 50
5	>51

The PDI was calculated using the formula of Wheeler

*Short note

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Table 1 Efficacy of cymoxanil 50 WP and cymoxanil 8%+ mancozeb 64% 72 WP on downy mildew and yield of cucumber

Treatment	2005		Per cent over control		2006		Per cent over control		Pooled mean	
	PDI	Yield	PDI	Yield	PDI	Yield	PDI	Yield	PDI	Yield
	(tonnes/ha)	(tonnes/ha)	<	>	(tonnes/ha)	(tonnes/ha)	<	>	(tonnes/ha)	(tonnes/ha)
Cymoxanil 50 WP 90g ai/ha	20.33 (26.78)	10.70	33.78	0.7	30.90 (33.77)	10.80	15.3	16.0	25.62	10.75
Cymoxanil 50 WP 120g ai/ha	18.33 (25.33)	12.08	40.29	13.6	27.53 (31.63)	11.06	24.5	18.8	22.93	11.57
Cymoxanil 8%+ Mancozeb 64% WP 810 g ai/ha	26.33 (30.85)	11.37	14.23	7.0	25.67 (30.46)	11.18	29.6	20.1	26.00	11.28
Cymoxanil 8%+ Mancozeb 64% WP 1080 g ai/ha	21.33 (27.49)	13.71	30.52	29.0	22.71 (28.45)	11.26	37.7	20.9	22.02	12.49
Cymoxanil 8%+ Mancozeb 64% WP 1350 g ai/ha	18.60 (25.55)	11.30	39.41	6.3	22.34 (28.18)	10.81	38.7	16.1	20.47	11.06
Mancozeb 75 WP 1500g ai/ha	25.60 (30.40)	12.30	16.61	15.7	21.76 (27.83)	12.68	40.3	36.2	23.68	12.49
Metalaxyl 8% + Mancozeb 64% WP	24.30 (29.53)	11.00	20.85	3.5	23.15 (28.73)	11.15	36.5	19.8	23.73	11.08
Control	30.70 (33.65)	10.63			36.47 (37.11)	9.31			33.59	9.97
CD (P=0.05)	5.12	1.90			1.56	1.45			1.60	0.82
CD (P=0.01)	6.79	2.63			2.12	1.96			2.22	1.12

Figures in the parantheses are the arcsine transformed values of percentage

Table 2 Economics and cost benefit ratio of fungicides used in the management of downy mildew of cucumber

Treatment	Pooled yield (tonnes/ha)	Gross income @ ₹ 8 000/tonnes (₹)	Cost of for for four sprays/ha (₹)	Benefit (₹)	Additional benefit over control/ha (₹)	Cost: benefit ratio
Cymoxanil 50 WP 90g ai/ha	10.75	86 000	900	85 100	5 340	1:5.93
Cymoxanil 50 WP 120g ai/ha	11.57	92 560	1200	91 360	11 600	1:9.66
Cymoxanil 8%+ Mancozeb 64% WP 810 g ai/ha	11.27	90 200	5625	84 575	4 815	1:0.86
Cymoxanil 8%+ Mancozeb 64% WP 1080 g ai/ha	12.48	99 880	7500	92 380	12 620	1:1.68
Cymoxanil 8%+ Mancozeb 64% WP 1350 g ai/ha	11.05	88 440	9375	79 065	-695	-0.07
Mancozeb75 WP1500g ai/ha	12.49	99 920	1760	98 160	18 400	1:10.45
Metalaxyl 8% + Mancozeb 64% WP	11.07	88 600	1440	87 160	7 400	1:5.13
Control	9.97	79 760				

(1969).

$$PDI = \frac{\text{Sum of all the disease rating}}{\text{Number of observations}} \times \frac{100}{\text{Maximum disease rating}}$$

Cymoxanil 50 WP and Cymoxanil (8%)+Mancozeb (64%) 72WP at all concentrations, standard fungicides Metalaxyl Mancozeb 72 WP and Mancozeb 75 WP were found significantly effective in reducing the disease and in increasing

the yield as compared to untreated control in both the years. The results of the pooled data indicated that Cymoxanil (8%)+Mancozeb (64%) 72 WP @1 080 g ai/ha was significant and recorded a PDI of 22.02 and an highest yield of 12.49 tonnes/ha as against a PDI of 33.59 and yield 9.97tonnes/ha in untreated control. The results are in confirmity with (Robak 1995, 2001) and (Maheshwari and Gupta 1990). The individual component of the combination product, cymoxanil 50WP @120g ai/ha was the next best treatment and was on par with Cymoxanil (8%)+Mancozeb (64%) 72 WP @1080g

ai/ha, in decreasing the disease by recording a PDI of 22.93 and an yield of 11.57 tones/ha . However, the standard fungicide Metalaxyl Mancozeb 72WP was also found statistically at par with Cymoxanil (8%)+Mancozeb (64 %) 72 WP @1080 g ai/ha and cymoxanil 50WP @120g ai/ha recording a PDI of 23.68 and an yield of 12.49 tonnes/ha. The pooled data on economics and cost: benefit ratio was worked out and shown in Table 2. The data revealed that maximum additional benefit was obtained in Mancozeb 75 WP1500g a i/ha (₹ 18 400), followed by Cymoxanil (8%)+Mancozeb (64%)72 WP 1080 g ai/ha (₹12 620) and Cymoxanil 50 WP 120g a i/ha (₹ 11 600). Further, it was observed that the highest cost: benefit ratio was recorded in Mancozeb 75 WP1500g ai/ha (1:10.45), followed by Cymoxanil 50WP 120g ai/ha (1:9.66). Thus, among the above fungicides, Mancozeb 75 WP1 500g ai/ha and Cymoxnil50WP 120g ai/ha applied at weekly interval recorded the highest cost : benefit ratio of 1:10.45 and 1:9.66 respectively.

SUMMARY

Cymoxanil (8%)+Mancozeb (64%) 72WP , a combination product of systemic and contact fungicide, was evaluated against downy mildew disease of cucumber caused by *Pseudoperonospora cubensis*(Berk. and Curt.) (Rostov.). Cymoxanil 50 WP and Cymoxanil (8%)+Mancozeb (64 %) 72WP at all concentrations, were found significantly effective in reducing the disease and in increasing the yield as compared to untreated control in both the years. The results of the pooled data analysis indicated that Cymoxanil (8%)+Mancozeb (64 %) 72 WP @1080 g ai/ha was significant and recorded a PDI of 22.02 and an highest yield of 12.49 tonnes/ha as against a PDI of 33.59 and yield 9.97tonnes/ha in untreated control. Since the price of the combined product is more, the cost benefit ratio was found highest in their individual components. The highest cost: benefit ratio was recorded in Mancozeb 75 WP1500 g ai/ha (1:10.45), followed by Cymoxanil 50WP 120g ai/ha (1:9.66). Thus, among the evaluated fungicides, Mancozeb 75 WP 1500g ai/ha and Cymoxanil50 WP 120g ai/ha applied at weekly interval recorded the highest cost :benefit ratio of 1:10.45 and 1:9.66 respectively.

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