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Research Article

EVALUATION OF FUNGICIDES AGAINST POWDERY MILDEW DISEASE OF GRAPES UNDER FIELD CONDITION

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Abstract- Powdery mildew disease of grapes caused by *Uncinula necator* is one of the most important diseases, which causes considerable yield loss in grapes production. In the absence of resistant cultivars, management of Powdery mildew disease has relied principally on application of synthetic fungicides. The present study evaluated the effects of fungicides on Powdery mildew disease of grapes and investigated the efficacy on the yield components and yield of grapes. The field experiment was laid in a randomized block design with five treatments and four replications in subtropical climatic condition of West Bengal at Regional Research Sub-Station (R & L Zone), Bidhan Chandra Krishi Viswavidyalaya, Sekhampur, Birbhum, West Bengal, India during 2018 and 2019. The highest disease control was in Picoxystrobin 22.52% SC @ 400 ml/ha (71.53% and 69.63%) followed by Azoxytrobin 23 % SC @ 500 ml/ha (61.85 % and 58.00 %), Kresoxim-methyl 44.3% SC @ 700 ml/ha (56.07 % and 46.57 %) and Hexaconazole 5% EC @ 1000 ml/ha (42.81 % and 35.03 %) on leaves and bunches, respectively at 15 days after 2nd spray. Highest marketable grapes yield was obtained by the spray of Picoxystrobin 22.52% SC @ 400 ml/ha as compared to other treatments.

Keywords- *Evaluation, Fungicides, Grapes, Powdery mildew disease*

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Introduction

Grapevine (*Vitis vinifera* L.) is an important commercial fruit crop and one of the most widely cultivated crop in temperate, sub-tropical and tropical regions of the world. The origin of the grape (*V. vinifera*) was Southern Caucasia, now occupied by North-west Turkey, Northern Iraq, Azerbaijan and Georgia [1]. The grape itself is used for a myriad of products, ranging from fresh fruit, preserves, juice, wine and raisins. In India grape is important cash crops. Many diseases attack grape and cause severe loss in yield. Powdery mildew in grape is caused by *Uncinula necator*, which is the most destructive disease of grapes. This is found that most of the grape growing areas of the world, including tropics the several fungicides are known to control this disease effectively [2]. Mildew symptoms usually appear on both lower surface of exposed leaves and both sides of well shaded leaves. Infected berries develop web like blemishes and finally covered with powdery growth. Severely infected berries are scarred, disturbed and often split. Berries are susceptible to infection until sugar content reaches about 8% although established infection continues to produce spores until the berries contain 15% sugar [3]. The maturity of severely infected bunches is retarded [4]. Grape berries are most susceptible to powdery mildew during the period from flowering to fruit set, and failure to control the disease during this period can result in serious crop loss. In the absence of resistant cultivars, chemical fungicides provide the most reliable means of disease control [5]. Therefore, the present study was conducted to determine the effective chemical fungicide against Powdery mildew disease of grapes in West Bengal.

Materials and methods

The investigation was carried in a randomized block design with five treatments and four replications in subtropical climatic condition of West Bengal at Regional Research Sub-Station (R & L Zone), Bidhan Chandra Krishi Viswavidyalaya, Sekhampur, Birbhum, West Bengal, India. The experiment was conducted on variety Arka Neelamoni after forward pruning during January, 2018 to June, 2018 and January, 2019 to June, 2019 and the age of crop is 6th and 7th year variety, respectively. Vines on this site were moderately vigor, trained in/trellis, planted on a spacing of 3 m x 3 m. Number of plants/treatment was 5 and row to row orientation was in north south direction. Standard agronomic practices were followed. The treatments were imposed as per details of spray schedules given in [Table-1]. Observations were recorded 15 days after spraying by randomly selecting 20 leaves and fruit bunches per replication were randomly observed for disease severity. Disease severity for was assessed using 0-5 scale [6] where,0= Leaves /fruits free from infection, 1= 1- 10 % of the leaf area/ fruit surface infected with powdery mildew, 2= 11-20% of the leaf area/ fruit surface infected with powdery mildew, 3=21-40 % of the leaf area/ fruit surface infected with powdery mildew, 4=41-60 % of the leaf area/ fruit surface infected with powdery mildew, 5= 61-80 % and above of the leaf area/ fruit surface infected with powdery mildew. Percentage Disease Index was worked out using the formula [7].

PDI = [Sum of numerical rating/total number of observations taken x maximum disease score] x 100.

The PDI values were transformed by angular transformation and analyzed statistically. The yield data was also analyzed statistically. Harvesting of grapes was done manually at full maturity during last week of May to first week of June under West Bengal condition. Yield recorded kg /vine has been expressed as t /ha in the report. Finally, the disease severity percent and yield over the control were also calculated.

Table-1 *Treatments details of fungicides*

Treatments	Fungicides	Dosage/ha (Formulation)
T_1	Azoxystrobin 23% SC	500 ml
T_2	Picoxystrobin 22.52% SC	400 ml
T_3	Kresoxim-methyl 44.3% SC	700 ml
T_4	Hexaconazole 5% EC	1000 ml
T_5	Untreated control (Water only)	--

Table-2 *Effect of fungicides on powdery mildew disease of grapes during 2018 and 2019 under natural condition*

Treatments	Fungicides	Dose (ml/ha)	Pooled analysis of 2018 and 2019							
			PDI (before 1st spray)		PDI (before 2nd spray)		PDI (15 days after 2nd spray)		Percent disease control (Terminal)	
			Leaves	Bunches	Leaves	Bunches	Leaves	Bunches	Leaves	Bunches
T_1	Azoxystrobin 23% SC	500 ml	3.55(10.86)	0.00(0.00)	7.85(16.27)	4.38(12.08)	12.26(20.50)	8.56(17.01)	61.85	58.00
T_2	Picoxystrobin 22.52% SC	400 ml	3.72(11.1)	0.00(0.00)	6.38(14.63)	3.25(10.39)	9.15(17.61)	6.19(14.41)	71.53	69.63
T_3	Kresoxim-methyl 44.3% SC	700 ml	3.15(10.22)	0.00(0.00)	8.25(16.69)	6.57(14.85)	14.12(22.07)	10.89(19.27)	56.07	46.57
T_4	Hexaconazole 5% EC	1000 ml	3.27(10.42)	0.00(0.00)	11.23(19.58)	8.13(16.57)	18.38(25.39)	13.24(21.34)	42.81	35.03
T_5	Untreated control (Water only)	--	3.35(10.5)	0.00(0.00)	15.27(23.00)	12.25(20.49)	32.14(34.54)	20.38(26.84)	0.00	0.00
SEm (±)			0.414	NA	0.45	0.661	0.389	0.563		
CD 5%			NS	NA	1.39	2.04	1.2	1.74		

Values are mean of 4 replications, Figures in parentheses arc sine transformed values, NS – Non significant

Table-3 *Yield of grapes for different fungicide treatments against powdery mildew disease during 2018 and 2019*

Treatments	Pooled analysis of 2018 and 2019				
	Fungicides	Dose (ml /ha)	Marketable Yield (kg/vine)	Marketable Yield (t/ ha)	Yield increases over control (%)
T_1	Azoxystrobin 23% SC	300 ml	5.82	6.48	69.63
T_2	Picoxystrobin 22.52% SC	400 ml	6.14	6.81	78.27
T_3	Kresoxim-methyl 44.3% SC	500 ml	5.47	6.06	58.64
T_4	Hexaconazole 5% EC	400 ml	4.86	5.36	40.31
T_5	Untreated control (Water only)	700 ml	3.28	3.82	0.00
SEm (±)			0.67	0.41	
CD 5%			2.08	1.25	

Values are mean of 4 replications

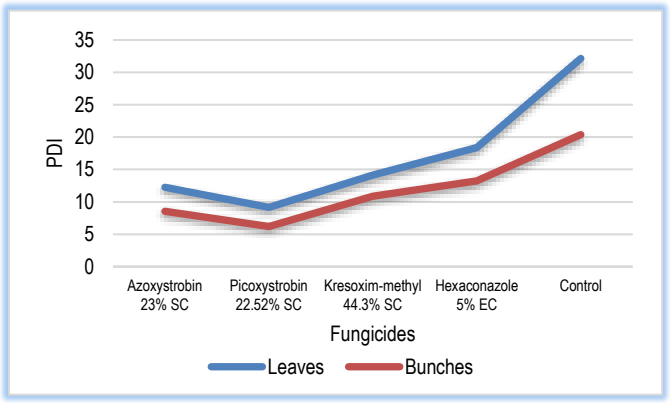

Fig-1 Percent disease index (PDI) in different fungicides against Powdery mildew disease of grapes

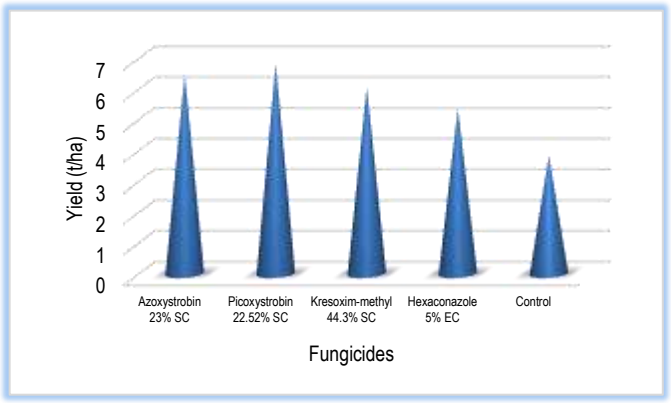

Fig-3 Effect of fungicides on marketable yield

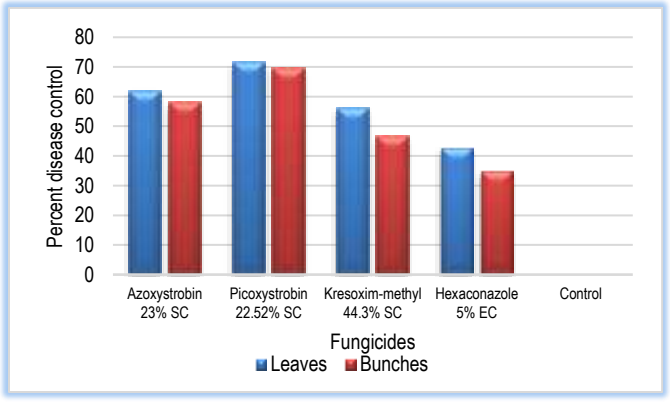

Fig-2 Influence of fungicides on Powdery mildew disease control in grapes

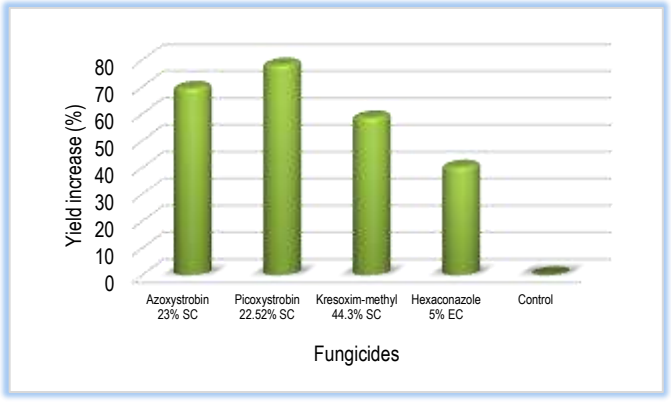

Fig-4 Effect of fungicides on marketable yield increase

Results and discussion

Results presented in [Table-2] and Fig-1] from the experimental trials revealed that all the treatments reduced the disease severity of powdery mildew disease over (T_5) control. Depending on the prevailing weather conditions, maximum disease severities 32.14 % and 20.38 % were recorded on leaves and bunches in control, respectively at 15 days after 2nd spray. Among the treatments T_2: Picoxystrobin 22.52% SC @ 400 ml/ha (9.15 % and 6.19 %) exhibited minimum disease severity on leaves and bunches, respectively followed by T_1: Azoxytrobin 23 % SC @ 500 ml/ha (12.26 % and 8.56 %), T_3: Kresoxim-methyl 44.3% SC @ 700 ml/ha (14.12 % and 10.89 %) and T_4: Hexaconazole 5% EC @ 1000 ml/ha (18.38 % and 13.24 %) at 15 days after final spray, respectively. Results among these four treatments (T_1, T_2, T_3 & T_4) were found statistically significant and showed good efficacy against the disease over control.

The per cent reduction in terminal PDI was also calculated over control [Table-2 and Fig-2]. The data revealed that highest disease control was in T_2: Picoxystrobin 22.52% SC @ 400 ml/ha (71.53% and 69.63%) followed by T_1: Azoxytrobin 23 % SC @ 500 ml/ha (61.85 % and 58.00 %), T_3: Kresoxim-methyl 44.3% SC @ 700 ml/ha (56.07 % and 46.57 %) and T_4: Hexaconazole 5% EC @ 1000 ml/ha (42.81 % and 35.03 %) on leaves and bunches, respectively at 15 days after 2nd spray. All treatments controlled effectively the powdery mildew disease in grapes.

The yield data has been presented in [Table-3] and [Fig-3]. The results revealed that maximum yield was obtained from T_2: Picoxystrobin 22.52% SC @ 400 ml/ha (6.14 kg/vines and 6.81 t/ha) followed by T_1: Azoxytrobin 23 % SC @ 500 ml/ha (5.82 kg/vines and 6.48 t/ha), T_3: Kresoxim-methyl 44.3% SC @ 700 ml/ha (5.47 kg/vines and 6.06 t/ha) and T_4: Hexaconazole 5% EC @ 1000 ml/ha (4.86 kg/vines and 5.36 t/ha) for Marketable yield/vine and Marketable yield/ha respectively. The yield in all these T_1, T_2, T_3 and T_4 treatments were statistically significant. The lowest yield was recorded in control (3.28 kg/vines and 3.82 t/ha). Highest increase of marketable yield was recorded from T_2: Picoxystrobin 22.52 % SC @ 400 ml/ha (78.27 %) followed by T_1: Azoxytrobin 23 % SC @ 500 ml/ha (69.63%), T_3: Kresoxim-methyl 44.3% SC @ 700 ml/ha (58.64 %) and T_4: Hexaconazole 5% EC @ 1000 ml/ha (40.31 %) presented in [Table-3] and [Fig-4]. Azoxystrobin is the currently available fungicide to provide effective control of powdery mildew (*U. necator*), which is most important fungal diseases of grapevine [8,9]. Kresoxim methyl @ 300 to 350 g ai ha^{-1} was found to be effective in reducing the severities of both powdery mildew and downy mildew diseases of grapevine [10]. Picoxystrobin 22.52 % SC was very effective against Leaf blight Pathogen of Lilium [11].

So, the findings of the present investigation are comparable with the findings of the previous researchers. Based on findings of the present study, it may be concluded that two times foliar spray with Picoxystrobin 22.52% SC @ 400 ml/ha at an interval of 15 days may be recommended to control of Powdery mildew disease of grapes.

Application of research: The fungicide Picoxystrobin 22.52% SC@ 400 ml/ha will be very effective for management of powdery mildew disease of grapes.

Research Category: Plant disease management by chemical fungicide.

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Study area / Sample Collection: Regional Research Sub Station (Red & Laterite Zone), Sekhampur, P.O. Gadadharpur, Birbhum, 731129

Cultivar / Variety / Breed name: Arka Neelamani

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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