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Effect of azoxystrobin 4.8% w/w + chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) on watermelon against downy mildew and leaf spot

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Abstract

Watermelon (*Citrullus lanatus*) belonging to the family Cucurbitaceae is one of the most widely cultivated crops in the world. Foliar diseases of watermelon have become a major constraint in watermelon growing areas causing qualitative as well as quantitative losses. Therefore, a field experiment was carried out on the effect of Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) against downy mildew and leaf spot during 2014-15 and 2015-16, at College of Horticulture, Hiriya. Experimental results revealed that all the treatments significantly reduced the leaf spot and downy mildew disease severity over untreated control. Amongst all the treatments in both season significantly least disease severity of leaf spot (5.67 and 5.33%, respectively) and downy mildew (5.23 and 5.16) was recorded with foliar sprays of Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC at 4ml/lit and highest yield of 30.33 and 17.86 t/ha, respectively followed by Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) at 3ml/lit.

Keywords: watermelon, downy mildew, leaf spot, azoxystrobin, chlorothalonil

Introduction

Watermelon (*Citrullus lanatus*) belonging to the family Cucurbitaceae is one of the most widely cultivated crops in the world. According to (Anon, 2016) [3] statistics, the world's largest producers of watermelon are China, Iran, Turkey, Brazil, and the United States, respectively. In India area under watermelon was 91.00 thousand ha with the production of 2182.00 thousand tonnes in the year 2016-17. (Anon., 2017) [2]. The global consumption of the crop is greater than that of any other cucurbit. Watermelon is also known as tarbuj, tarmuj, kalingad and kalindi in different parts of India. Though it is grown in the garden land, it is a major river-bed crop of Maharashtra, Uttar Pradesh, Rajasthan, Gujrat and Andhra Pradesh, Punjab, Haryana, Karnataka, Assam, West Bengal, Orissa, Himachal Pradesh, Tamil Nadu are major watermelon growing states. The watermelon fruit has a 78 per cent edible portion. The edible portion in watermelon fruits contains moisture (95.8 per cent), protein (0.2 per cent), minerals (0.3 per cent), carbohydrates (3.3 per cent) and energy (16 k. cal). It also contains 11 mg. of calcium, 0.02 mg. of thiamine, 0.04 mg. of riboflavin and 1 mg. of ascorbic acid per 100 grams of edible portion (Gopalan *et al.*, 1984) [4]. It is also an excellent source of vitamins. Watermelon is rich in antioxidants like lycopene which reduce the risk of diseases like asthma, atherosclerosis, diabetes, colon cancer and arthritis. It is highly nutritious and thirst-quenching and also contains vitamins C and A in the form of diseases-fighting beta-carotene. It is affected by several biotic and abiotic stresses, among the biotic factors fungal diseases like leaf spot and downy mildew are most destructive in nature. Leaf spot caused by *Cercospora* sp. produces a dark brown center and a yellow halo. Infected leaves are first observed at the crown of the plant. When the disease is severe, foliage loss will restrict fruit development and result in sunburn of fruit. Downy mildew (*Pseudoperonospora cubensis*) the causes, irregular yellowish to brown spots, often vague in outline, appear on upper leaf surface near the crown. Brown spots later become more distinct on both sides of the leaves. The disease appears annually during the cropping seasons (from December to April) in different parts of India and causes enormous loss to growers' upto 14 to 76 per cent. Therefore, keeping in view of economic losses caused by diseases, the present study was aimed at bottleneck for the management of foliar diseases.

Material and Methods

A field experiment on bio efficacy Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) against downy mildew and leaf spot of cauliflower were conducted at College of Horticulture, Hiriya during 2014-15 and 2015-16.

The experiments consisted of eight treatments *viz.*, untreated check, Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC - 2.0, 3.0 and 4.0 g/ litre) Azoxystrobin 23 SC (1.0 g/litre), chlorothalonil 75 WP (2.5 g/ litre), Carbendazim (3.0 g) and zineb (2.0g) and was laid-out in Randomized Block Design with three replication. A susceptible variety was used for the present investigations. The variety was grown as per packages of practices for higher yields. Treatments were imposed at the beginning of the disease appearance. Spray schedule was repeated at ten days intervals. The observation of leaf spot and downy mildew were recorded using a 0-5 scale. The Per cent disease index (PDI) was computed by selecting five plants at random and recording severity as per 0-5 scale (Verma and Saharan, 1994) [8] where 0, no disease; 1, 1-10%; 2, 11-25%; 3, 26-50%; 4, 51-75%; 5, 76-100% at before and after each spray. Average of all spray has been given in this and the data was statistically analyzed after suitable transformations.

The recorded grade values were converted into Percent Disease Index (PDI) by using following formula proposed by Wheeler (1969) [9].

$$\text{Per cent disease Index (PDI)} = \frac{\text{Sum of the individual disease ratings}}{\text{Number of leaves observed} \times \text{Maximum disease grade}} \times 100$$

The observation on fruit yield expressed in terms of t/ha was also recorded.

Results and Discussion

A field experiment was conducted at College of Horticulture, Hiriyur as explained in 'material methods' to find out the effect of chemical for management of leaf spot and downy mildew of watermelon during the *kharif* 2014-15 and 2015-16. Totally four sprays were given at ten days intervals starting from initiation of disease. The Observations were recorded at ten days after spray (DAS) by using a 0-5 scale and converted into per cent disease index (PDI) using the formula given by Wheeler (1969), and calculated yield was statistically analyzed, data were presented in Table 1 and 2.

Per cent disease index

Leaf spot

The first season experiment (2014-15) on the effect of test fungicides Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) and other comparing fungicides on leaf spot of watermelon revealed that the treatments differed significantly over the study period. Leaf spot severity was significantly low in Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) treated plots. At the terminal stage of disease after fourth spray recorded 5.67 and 7.43 disease severity was measured when treated with Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) at 4ml/lit and 3ml/lit respectively, which indicated 80.22 and 74.08 reduction in leaf spot, respectively compared to control (28.67% disease severity) and significantly superior over other molecules. The leaf spot severity in Chlorothalonil 75 WP and carbendazim 50 WP were 23.33 and 24.33 and inferior to the all the doses of Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC).

During the second year experiment (2015-16) the disease severity before treatment imposition was non-significant and all the treatments remained on par or almost uniform with each other. On the contrary, treatments started differed significantly over untreated control are presented in Table 1.

Disease severity recorded at ten days after I, II, III and IV spray in 2015-16. Maximum mean disease severity was recorded in untreated control after four spray (29.96%) while minimum mean disease severity was recorded after ten days of the fourth spray in Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) at 4ml/lit (5.33%) followed by Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) at 3ml/lit (6.20%) and leaf spot severity in Chlorothalonil 75 WP and carbendazim 50 WP were 21.33 and 22.33 and inferior to the all the doses of Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC).

Downy mildew

During first year experiments (2014-15) the effect of test fungicides Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) other comparing fungicides on downy mildew of watermelon revealed that the disease severity before the treatment imposition was non-significant, and all the treatments remained on par or almost uniform with each other. At terminal stage of disease record downy mildew severity were 6.13 and 5.23 in Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) treated plots applied through foliar application at 3 ml/lit and 4 ml/lit, respectively and these treatments were significantly comparable with other treatments and the per cent disease reduction by those treatments compared to untreated check (29.47% disease severity) were 79.19 and 82.25 per cent respectively. The next best treatment was Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) at 1ml/lit.

The second season experiment (2015-16) on the effect of test fungicides Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) and other comparing fungicides on downy mildew of watermelon revealed that the treatments differed significantly over the study period. Downy mildew severity were 5.86 and 5.16 in Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) treated plots applied through foliar application at 3 ml/lit, and 4 ml/lit, respectively and these treatments were significantly comparable with the other treatments. The per cent disease reductions by those treatments compared to untreated check were 79.46 and 81.91 respectively.

Results of the present study showed that all fungicide treatments significantly controlled the leaf spot and downy mildew infection on watermelon as compared to untreated control. Among the different fungicides Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) at all concentration recorded least disease severity. The results obtained concur with the results obtained by many workers: Anand *et al.* (2010) [1] evaluated azoxystrobin against septoria leaf spot diseases of tomato and found it is most effective chemical with no phytotoxic effect on the crop even on increasing the recommended dose by four times. Mazur *et al.* (2002) [5] who found that azoxystrobin was found effective in controlling the diseases caused by *Alternaria tenuissima*. Sendhil Vel (2003) [7] studied the *in vitro* efficacy of azoxystrobin against the spore germination of downy mildew of grapes and found that even at a concentration of 100 ppm, it was able to reduce the germination up to 90 percent, with an increasing concentration of the chemical (250, 500, 750 and 1000 ppm) complete inhibition of germination. Nithyameenakshi *et al.* (2006) [6] reported that *in vitro* study of spore germination revealed that azoxystrobin at 0.05% arrest the spore propagules of downy mildew, powdery

mildew and anthracnose of grapes. Azoxystrobin grouped under strobilurins group of fungicides which acts as mitochondrial electron transport inhibitors.

Yield

The yield obtained on effect different fungicides treated plots during 2014-15 and 2015-16 as presented in Table 3. Among the different fungicides Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) at 4ml/lit recorded highest fruit yield 30.33 and 17.86 t/ha respectively, in both season which was followed by azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) at 3ml/lit (27.67 and 16.30 t/ha).

The lowest yield of 2.17 and 9.48 t/ha, obtained in the untreated plot.

Conclusion

Based on the two year experimentation it has been found that, Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) at 4ml/lit is most effective in management of foliar diseases (leaf spot and downy mildew) of watermelon, which was on par with the same fungicides at 3ml/lit.

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Table 1: Effect of Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) against leaf spot of watermelon during 2014-15 and 2015-16

Sl No.	Treatments	Dosage g or ml/lit of water	Disease severity of Days After spray (DAS)								Per cent disease reduction	
			1 st		2 nd		3 rd		4 th		2014-15	2015-16
			2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16		
1	Untreated check	-	1.32	0.46	8.33	2.73	17.46	10.66	28.67	20.96	-	-
2	Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC	2.0	1.82	0.24	2.56	0.83	4.06	1.76	11.00	10.43	61.63	66.14
3	Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC	3.0	1.86	0.76	1.60	0.60	3.63	0.96	7.43	6.20	74.08	79.46
4	Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC	4.0	1.30	0.42	1.43	0.43	3.40	0.76	5.67	5.33	80.22	81.91
5	Azoxystrobin 23 SC	1.0	1.98	0.16	2.23	0.96	4.76	1.16	14.50	12.36	49.42	58.78
6	Chlorothalonil 75 WP	2.5	1.32	0.94	4.20	1.43	6.73	3.83	23.33	21.33	18.62	28.28
7	Carbendazim 50 WP	2.5	1.44	0.42	5.06	1.45	8.23	4.46	24.33	22.33	15.13	24.53
8	Zineb 75 WP	2.0	1.72	0.16	8.46	2.23	12.10	8.35	26.00	25.46	9.31	13.56
	SEm±		NS	0.06	0.18	0.06	0.43	0.19	0.65	0.30	-	-
	CD (0.05%)			0.20	0.55	0.20	1.30	0.59	1.96	0.90	-	-
	CV			11.47	10.12	11.47	13.54	10.37	6.86	4.25	-	-

Table 2: Effect of Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC) against downy mildew of watermelon during 2014-15 and 2015-16

Sl No.	Treatments	Dosage g or ml/lit of water	Disease severity of Days After spray (DAS)								Per cent disease reduction	
			1 st		2 nd		3 rd		4 th		2014-15	2015-16
			2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16		
1	Untreated check	-	0.56	0.46	6.66	8.33	15.53	20.13	29.47	28.53	-	-
2	Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC	2.0	0.52	0.24	1.06	2.56	2.93	4.13	10.66	9.66	63.82	66.14
3	Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC	3.0	0.22	0.76	0.46	1.63	0.86	3.63	6.13	5.86	79.19	79.46
4	Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC	4.0	0.14	0.42	0.23	1.46	0.66	3.43	5.23	5.16	82.25	81.91
5	Azoxystrobin 23 SC	1.0	0.26	0.16	0.96	2.16	1.36	4.70	13.76	11.76	53.30	58.78
6	Chlorothalonil 75 WP	2.5	0.70	0.94	2.20	4.16	4.36	8.63	21.46	20.46	27.18	28.28
7	Carbendazim 50 WP	2.5	0.10	0.42	4.06	8.06	10.50	15.16	23.83	21.53	19.13	24.53
8	Zineb 75 WP	2.0	0.62	0.16	2.76	9.46	7.36	16.43	25.33	24.66	14.04	13.56
	SEm±		NS	NS	0.15	0.19	0.19	0.34	0.32	0.25	-	-
	CD (0.05%)				0.47	0.58	0.58	1.04	0.97	0.75	-	-
	CV				15.98	9.57	8.28	8.56	4.49	3.68	-	-

Table 3: Effect of Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC (Amistar opti 560w/v SC)

Sl. No.	Treatments	Dosage g or ml/lit of water	Yield	
			2014-15	2015-16
1	Untreated check	-	2.17	9.48
2	Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC	2.0	22.00	14.36
3	Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC	3.0	27.67	16.30
4	Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC	4.0	30.33	17.86
5	Azoxystrobin 23 SC	1.0	20.33	14.33
6	Chlorothalonil 75 WP	2.5	8.00	11.66
7	Carbendazim 50 WP	2.5	11.00	12.53
8	Zineb 75 WP	2.0	4.50	10.83
	SEm±		0.97	0.71
	CD (0.05%)		2.91	2.14
	CV		9.44	12.55

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