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Bio-efficacy of Kresoxim methyl 50 SC against Alternaria blight and powdery mildew diseases of cumin

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ABSTRACT

Blight and powdery mildew are very destructive diseases of cumin and they may cause complete failure of crop, if proper and timely precautionary measures are not taken. For the effective and economic management of cumin blight and powdery mildew, field trial was undertaken at Centre for Research on Seed Spices, Jagudan during rabi 2012–13 and 2013–14 to determine the effectiveness of Kresoxim methyl 50 SC against blight and powdery mildew on cumin. Different eight treatments with their prefixed concentrations were compared with control (water spray and untreated check). On the basis of the two years of investigation, it has been observed that Kresoxim methyl 50 SC @ 200 g a.i./ha was found effective against blight disease of cumin with increase in the yield. Higher dose of Kresoxim methyl 50 SC@ 250 g a.i./ha did not produce any phytotoxic symptoms on cumin crop at different crop stages during sprays. This indicated that Kresoxim methyl 50 SC is non-phytotoxic to cumin crop.

Key words: Cumin, blight, powdery mildew, disease, management

Cumin (*Cuminum cyminum* L.) is grown in India on large scale besides several other countries like Bulgaria, Egypt, Argentina, Turkey, Bangladesh, Iran, China, Italy, Pakistan etc. It is an important crop of Rajasthan and Gujarat and some adjoining states. Therefore it is known as Bowl of seed spices. During 2016-17, cumin was grown in 7.60 lakh hectares with 4.86 lakh tones production and 0.64 tons per hectare productivity in India, where as, in Gujarat cumin was grown in 2.79 lakh hectares with 2.91 lakh tones production and 1.05 tons per hectare productivity (Anon, 2017). It is exported to many countries including Bangladesh, Japan, Malaysia, Nepal, Pakistan, Singapore, USA etc. Its value added products viz., oleoresins, oils etc are exported to USA, UK, Germany etc. Demand of cumin seed as whole or as value added products increased in many fold during recent past but main constraint for export is only pesticides residues. Cumin seeds contain 2.5-4.0% volatile oil, aldehydes, cuminol which attributes to its medicina properties. The crop is subjected to many pathogens causing diseases which negatively influence the yield (Dange, 1995 and Sharma *et al.*, 2010). In cumin-growing districts of Rajasthan and Gujarat, incidence of wilt (*Fusarium oxysporum* f.sp. *cumini*), blight (*Aternaria burnsii*), and powdery mildew (*Erysiphe polygoni*) are in moderate to severe form. (Sharma *et al.*, 2013)

Blight (*Aternaria burnsii*) was reported first time in Gujarat by Uppal *et al.*1938. Now, it is a common disease in all the cumin growing areas favored by humid and cloudy weather. Small necrotic spots develop on all the aerial parts which enlarge, coalesce and turn brown to black. Under humid conditions stem and flowers are also infected which may be killed. Either seeds are not formed on diseased plants or produced they remain small, shriveled, and blackish. 23-28°C temperature is optimum for disease development (Ghemawat and Prasad, 1972).

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The powdery mildew disease caused by *Erysiphe polygoni* DC reduced seed yield up to 50 per cent under favourable weather conditions. Under severe disease condition, the total failure of the crop has been observed (Champawat and Singh, 2008).As there is no resistant variety available against this disease, it has become inevitable to go for the use of fungicides for the management of diseases. Few fungicides were reported earlier for the management of disease by Akbari *et al.* (1996), Solanki *et al.* (1973), Dange *et.al* (2012), Sharma *et.al* (2013) and Patel *et.al* (2017) but under favorable environmental conditions the disease is still causing severe yield losses as well as posed pesticides residue problem in cumin. To overcome pesticides residue problem, fungicides having less residue effect isvery essential. Hence, spraying of fungicides was tested under field conditions to find out their efficacy against blight and powdery mildew as well as low fungicidal load.

MATERIALS AND METHODS

A field experiment was conducted at Centre for Research on Seed Spices, Jagudan, Gujarat during rabi 2012–13 and 2013–14 to evaluate the bio–efficacy of Kresoxim methyl 50 SC against Alternaria blight (*Alternaria burnsii*) and powdery mildew (*Erysiphe polygoni*) diseases of cumin. The trial was laid out in a randomized block design (RBD) with ten treatments and three replications (Table 1). The size of each plot measured 4.0 m × 3.0 m. Gujarat Cumin 4 was spaced at 30cm. All the recommended agronomic practices were adopted as per package of practices except fungicidal sprays. Three foliar sprays of respective fungicides were given by means of manually operated knapsack sprayer. First spray was made at 40 days after germination of crop and subsequent two sprays were advocated at an interval of fifteen days. Observations were recorded from ten randomly selected plants as per the disease scale (0-4 Point scale) (Rathore and Rathore, 1995) and from that percent disease index (PDI) was calculated, analyzed and given in tabular form. The data recorded on yield parameter after harvesting of the crop. The individual plant was kept for sun drying for a day and yield was recorded plot wise and later extrapolated to per hectare basis and statistically analyzed.

Table 1 Details of the treatment evaluated against Alternaria blight and powdery mildew disease of cumin

Sr. No.	Treatment	Dose(g a.i./ha)	Formulation(g or ml/ha)
1	Kresoxim methyl 50 SC	200.0	400
2	Kresoxim methyl 50 SC	250.0*	500
3	Taqat 75 WP	480.0	625
4	Taqat 75 WP	576	750
5	Hexaconazole 5 SC	25	500
6	Mancozeb 75 WP	1250	1667
7	WettableSulphur 80 WP	1000	1250
8	Difenaconazole 25 EC	125	500
9	Control (water spray)	-	-
10	Control (Untreated)	-	-

*For Phytotoxicity and Residue studies.

Alternaria blight and powdery mildew disease intensity was recorded as per the standard procedure of plant disease incidence assessment using 0-4 rating scale were recorded from ten randomly selected plants from each replicate prior to and 7and 15 days after each spray and percent disease index (PDI) were calculated using standard formula and yield was recorded using standard agronomical methods.

Disease scale employed for observations on Alternaria blight and powdery mildew

Alternaria blight		Powdery mildew	
0	0-1% (No disease),	0	No Symptoms
1	1-6% (Slight),	1	1 - 10%
2	6-9% (Moderate),	2	11-25%,
3	10-49% (severe)	3	25 - 50%,
4	>49% (Very severe)	4	>51% inflorescence coverage by powdery mildew.

$$\text{Percent Disease Index (PDI)} = \frac{\text{Sum of Numerical Grade Rating}}{\text{(Total no. of leaves examined) X (Maximum Grade rating value)}} \times 100$$

Phytotoxicity symptoms were recorded using scale (0-10) at 1, 3, 7 and 10 days after each spray. Ten plants were selected at random from each plot and the total number of leaves and those showing Phytotoxicity symptoms such as leaf tip and surface injury, wilting, vein clearing, necrosis, epinasty and hyponasty were rated and converted into percentage and given in tabular form.

Table 2 Scores used for effect on crop health

Score	Percent crop affected	Score	Percent crop affected
0	No adverse effect	6	51-60
1	1-10	7	61-70
2	11-20	8	71-80
3	21-30	9	81-90
4	31-40	10	91-100
5	41-50		

RESULTS AND DISCUSSION

Percent disease intensity of blight:

The data on the efficacy of fungicides against Alternaria blight disease presented in table-3. It is revealed from data that all the treatments were found significantly superior over untreated control. The lower percent disease index (PDI) was recorded in the treatment of Kresoxim methyl 50 SC @ 200 g a.i./ha i.e 5.27, 8.35, 9.98, 10.79 , 11.80 and 12.92 per-cent after 7 and 15 days after 1st and 2nd and 3rd spray respectively during 2012-13.

The data on the efficacy of fungicides against Alternaria blight disease presented in table-4. It is revealed from data that all the treatments were found significantly superior over untreated control. The lower percent disease index (PDI) was recorded in the treatment of Kresoxim methyl 50 SC @ 200 g a.i./ha i.e 5.43, 8.25, 10.54, 11.79, 13.13 and 15.57 per-cent after 7 and 15 days after 1st and 2nd and 3rd spray respectivelyduring 2013-14. The results obtained in the present study can be corroborated with the findings of earlier workers (Mehta and Solaki.1990, Dange S.R.S. 1995, Akbari et al.1996, Sharma et al. 2013 and Patel et al. 2017).

Percent disease intensity of powdery mildew:

It is observed from table-4 that all the treatments were found significantly superior over control against powdery mildew of cumin. The percent disease index was recorded in Kresoxim methyl 50 SC @200 g.a.i./ha i.e. 7.73, 7.98, 8.82, 9.54, 12.34 and 15.21 per -cent at 7 and 15 days after 1st and 2nd and 3rd spray, respectively. Hexaconazole 5% SC@ 25 g a.i./ha, wettablesulphur 80% WP@ 1000 g a.i/ha, difenaconazole 25 EC @ 125 g a.i./ha, Taqat 75 WP @ 480 and 576 g a. i. /ha also significantly reduced powdery mildew index over control plot during 2013-14. Similar results were also recorded earlier by Patel *et al.* (2013).Phytotoxicity of Kresoxim methyl 50 SC on cumin crop:

The data on different aspects of phytotoxicity for the year 2012-13 and 2013-14 are presented in tabular form (Table -5). Phytotoxicity symptoms such as chlorosis, necrosis, wilting, scorching, epinasty and hyponasty were recorded on cumin crop sprayed with Kresoxim methyl 50 SC @ 250 g a.i./ha. From the present study it can be concluded that, Kresoxim methyl 50 SC @ 250 g a.i./ha does not exhibit any phytotoxicity symptoms in cumin crop.

Cumin seed yield:

Application of Kresoxim methyl 50 SC @ 200 g a.i./ha significantly increased cumin yield (592.0 Kg/ha and 472.0 Kg/ha, in 2012-13 and 2013-14, respectively) in both the years over untreated control (277.0 Kg/ha and 262.0 Kg/ha, in 2012-13 and 2013-14, respectively)

Similar results were also recorded earlier by Patel *et al.* (2017).

Table 3 Bio-efficacy of Kresoxim methyl 50 SC against Alternaria blight disease of cumin (2012-13)

Treatment	Dose (g.a.i/ha)	Alternaria blight Per cent disease index (PDI)						
		Before spray	7 DA 1st spray	15 DA 1st spray	7 DA 2nd spray	15 DA 2nd spray	7 DA 3rd spray	15 DA 3rd spray
Kresoxim methyl 50 SC	200.0	11.50 (3.97)	13.27 (5.27)	16.80 (8.35)	18.42 (9.98)	19.17 (10.79)	20.09 (11.80)	21.06 (12.92)
Kresoxim methyl 50 SC	250.0*	12.30 (4.54)	14.67 (6.42)	16.62 (8.18)	18.18 (9.73)	18.97 (10.57)	19.33 (10.96)	20.19 (11.91)
Taqat 75 WP	480.0	12.18 (4.45)	20.62 (12.40)	26.23 (19.53)	27.58 (21.43)	30.45 (25.69)	32.08 (28.21)	33.33 (30.19)
Taqat 75 WP	576	12.39 (4.60)	21.47 (13.40)	28.73 (23.10)	30.90 (26.37)	31.69 (27.60)	32.68 (29.15)	33.50 (30.46)
Hexaconazole 5 SC	25	12.48 (4.67)	24.03 (16.58)	31.91 (27.93)	37.56 (37.17)	39.58 (40.60)	40.35 (41.92)	43.32 (47.06)
Mancozeb 75 WP	1250	12.88 (4.97)	15.65 (7.28)	20.39 (12.13)	21.97 (14.00)	23.05 (15.33)	24.55 (17.27)	26.79 (20.32)
Wettable Sulphur 80 WP	1000	12.83 (4.93)	26.95 (20.53)	33.52 (30.50)	35.93 (34.43)	38.14 (38.13)	40.49 (42.16)	43.19 (46.85)
Difenaconazole 25 EC	125	12.01 (4.33)	21.67 (13.63)	27.88 (21.87)	29.51 (24.27)	31.33 (27.03)	32.10 (28.23)	32.48 (28.84)
Control (water spray)	-	12.52 (4.70)	28.16 (22.27)	34.15 (31.52)	38.27 (38.37)	40.55 (42.27)	45.95 (51.66)	49.11 (57.16)
Control (Untreated)	-	12.52 (4.70)	29.52 (24.27)	37.18 (36.52)	42.53 (45.70)	55.10 (67.27)	62.25 (78.32)	63.71 (80.38)
S.Em. ±		0.42	0.82	0.69	0.65	0.53	0.59	0.45
C.D. at 5%		NS	2.40	2.10	1.90	1.60	1.70	1.30

DA: Days After

Figures in parenthesis are original values

Table 4 Bio-efficacy of Kresoxim methyl 50 SC against *Alternaria* blight and powdery mildew diseases of cumin (2013-14)

Treatment	Dose (g.a.i/ha)	Per cent disease index (PDI)													
		Before spray		7 DA 1st spray		15 DA 1st spray		7 DA 2nd spray		15 DA 2nd spray		7 DA 3rd spray		15 DA 3rd spray	
		AB	PM	AB	PM	AB	PM	AB	PM	AB	PM	AB	PM	AB	PM
Kresoxim methyl 50 SC	200.0	12.35 (4.58)	12.25 (4.50)	13.48 (5.43)	16.15 (7.73)	16.69 (8.25)	16.41 (7.98)	18.94 (10.54)	17.27 (8.82)	20.08 (11.79)	17.99 (9.54)	21.25 (13.13)	20.57 (12.34)	23.24 (15.57)	22.95 (15.21)
Kresoxim methyl 50 SC	250.0*	12.37 (4.59)	13.10 (5.13)	15.02 (6.71)	15.27 (6.93)	16.76 (8.31)	15.49 (7.13)	18.40 (9.97)	16.15 (7.73)	19.03 (10.63)	17.39 (8.93)	20.23 (11.96)	20.50 (12.27)	21.62 (13.57)	23.40 (15.78)
Taqat 75 WP	480.0	12.63 (4.78)	11.19 (3.77)	20.96 (12.80)	11.39 (3.90)	26.25 (19.57)	11.78 (4.17)	27.46 (21.27)	12.11 (4.40)	29.81 (24.71)	13.89 (5.77)	32.92 (29.54)	14.94 (6.65)	37.89 (37.72)	17.10 (8.65)
Taqat 75 WP	576	12.39 (4.60)	12.48 (4.67)	21.75 (13.73)	12.70 (4.83)	27.81 (21.77)	12.92 (5.00)	29.13 (23.70)	13.18 (5.20)	31.16 (26.77)	14.73 (6.47)	34.95 (32.81)	16.16 (7.75)	39.79 (40.96)	16.89 (8.44)
Hexaconazole 5 SC	25	12.53 (4.71)	10.09 (3.07)	24.53 (17.24)	10.30 (3.20)	31.91 (27.93)	10.41 (3.27)	33.94 (31.17)	10.68 (3.43)	37.43 (36.93)	11.34 (3.87)	38.79 (39.25)	12.01 (4.33)	40.70 (42.52)	13.37 (5.34)
Mancozeb 75 WP	1250	12.79 (4.90)	13.85 (5.73)	15.25 (6.92)	14.14 (5.97)	16.39 (7.97)	14.34 (6.13)	18.75 (10.33)	14.92 (6.63)	20.99 (12.83)	16.64 (8.20)	23.00 (15.27)	19.21 (10.83)	25.52 (18.56)	22.44 (14.58)
Wettable Sulphur 80 WP	1000	12.89 (4.98)	10.20 (3.13)	24.75 (17.53)	10.41 (3.27)	26.45 (19.83)	10.68 (3.43)	28.27 (22.43)	10.94 (3.60)	32.46 (28.80)	11.24 (3.80)	34.55 (32.16)	13.18 (5.20)	38.07 (38.03)	14.26 (6.07)
Difenaconazole 25 EC	125	12.33 (4.56)	12.11 (4.40)	21.67 (13.63)	12.15 (4.43)	20.09 (11.80)	12.61 (4.77)	22.06 (14.10)	12.92 (5.00)	22.81 (15.03)	13.18 (5.20)	23.76 (16.23)	14.14 (5.97)	25.65 (18.74)	15.01 (6.71)
Control (water spray)	-	12.66 (4.80)	13.39 (5.37)	28.26 (22.42)	21.58 (13.53)	33.97 (31.22)	22.63 (14.80)	35.08 (33.03)	23.55 (15.97)	37.62 (37.27)	26.04 (19.27)	40.20 (41.66)	27.65 (21.53)	44.34 (48.85)	29.96 (24.94)
Control (Untreated)	-	12.83 (4.93)	13.81 (5.70)	29.87 (24.80)	22.81 (15.03)	34.26 (31.70)	24.20 (16.80)	36.69 (35.70)	25.82 (18.97)	38.61 (38.93)	27.46 (21.27)	41.36 (43.66)	28.79 (23.20)	45.25 (50.43)	30.21 (25.32)
S.Em. ±		0.42	0.45	0.76	0.56	0.64	0.56	0.58	0.54	0.66	0.35	0.60	0.50	0.52	0.49
C.D. at 5%		NS	NS	2.30	1.70	1.90	1.70	1.70	1.60	2.00	1.00	1.80	1.50	1.50	1.50

DA: Days After, **AB:** *Alternaria* blight, **PM:** Powdery mildew
Figures in parenthesis are original values

Evaluation of phytotoxicity of Kresoxim methyl 50 SC on cumin:

Table 5 Evaluation of phytotoxicity of Kresoxim methyl 50 SC on.....

(a) Chlorosis:

No	Treatment	Dose g a.i/ha	Days after 1st spray					Days after 2nd spray					Days after 3rd spray				
			1	3	5	7	10	1	3	5	7	10	1	3	5	7	10
1	Kresoxim methyl 50 SC	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Untreated control	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(b) Necrosis

No.	Treatment	Dose g a.i/ha	Days after 1st spray					Days after 2nd spray					Days after 3rd spray				
			1	3	5	7	10	1	3	5	7	10	1	3	5	7	10
1	Kresoxim methyl 50 SC	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Untreated control	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(c) Wilting

No.	Treatment	Dose g a.i/ha	Days after 1st spray					Days after 2nd spray					Days after 3rd spray				
			1	3	5	7	10	1	3	5	7	10	1	3	5	7	10
1	Kresoxim methyl 50 SC	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Untreated control	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(d) Scorching

No.	Treatment	Dose g a.i/ha	Days after 1st spray					Days after 2nd spray					Days after 3rd spray				
			1	3	5	7	10	1	3	5	7	10	1	3	5	7	10
1	Kresoxim methyl 50 SC	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Untreated control	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(f) Epinasty

No.	Treatment	Dose g a.i/ha	Days after 1st spray					Days after 2nd spray					Days after 3rd spray				
			1	3	5	7	10	1	3	5	7	10	1	3	5	7	10
1	Kresoxim methyl 50 SC	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Untreated control	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6 Seed yield (kg/ha) of cumin in different treatments

Treatment	Dose (g.a.i/ha)	Cumin seed yield(Kg/ha)	
		2012-13	2013-14
Kresoxim methyl 50 SC	200.0	592	472
Kresoxim methyl 50 SC	250.0*	605	546
Taqat 75 WP	480.0	401	357
Taqat 75 WP	576	413	376
Hexaconazole 5 SC	25	212	324
Mancozeb 75 WP	1250	589	523
Wettable Sulphur 80 WP	1000	390	374
Difenaconazole 25 EC	125	568	558
Control (water spray)	-	273	266
Control (Untreated)	-	277	262
S.Em. ±		29.12	47.50
C.D. at 5%		86.50	141.00

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