



Management of Foliar Diseases of Cumin by Using Novel Fungicides

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ABSTRACT: Cumin (*Cuminum cyminum* L.) is an important economical seed spice crops of Rabi season. In India Rajasthan and Gujarat is the major cumin growing states. High humidity during flowering and fruit set creates favorable condition for more severity of fungal diseases in cumin crop. Blight (*Alternaria burnsii*) and powdery mildew (*Erysiphe polygoni*) are most severe diseases of cumin and which adversely affect the economic yield of farmers. The present study on management of foliar diseases of cumin by using novel fungicides revealed that spraying of Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 150g a.i/ha first at the time of incidence of the disease and second spray at 10 days interval significantly reduced the severity of alternaria blight and powdery mildew of cumin and also recorded the maximum yield as compared to control.

Keywords: Cumin, Alternaria blight, Powdery Mildew, Management.

INTRODUCTION

Cumin (*Cuminum cyminum* L.) is an important economical seed spice crops of Rabi season. Cultivated in India, Syria, United Arab Emirates, Turkey, Iran, Pakistan, Egypt and Italy and believed to have origin from Egypt. It belongs to family umbelliferae. Cumin has versatile uses and mainly used in flavouring foods. It is also used in Ayurvedic medicines and mainly as culinary purpose used in savory dishes, including curries, stews, rice and meat dishes. Cumin is a tropical plant. It grows well in sub-tropical climate too. In India Rajasthan and Gujarat is the major cumin growing states.

In recent years, the crop area under Rabi crops is increasing in Gujarat and is almost 40 lakh hectares. Moreover, farmers have sowing cumin seeds in around five lakh hectare area. Kutch has also registered record of sowing of cumin seeds in 62,100 hectares out of the total 1.46 lakh hectare total crop sown area in Rabi season. Soil in Rapar and Bhachau talukas of Kutch district are suitable for cumin seed cultivation. Irrigation facility is well established in these two regions and also getting sufficient irrigation water from canals of Narmada dam project. Therefore, farmers are increasing the area of Rabi crops.

High humidity during flowering and fruit set creates favorable condition for more severity of fungal diseases in cumin crop. Blight (*Alternaria burnsii*), wilt (*Fusarium oxysporum* f. sp. *cumini*) and powdery mildew (*Erysiphe polygoni*) are most severe diseases of

cumin (Dange, 1995) and which adversely affect the economic yield of farmers (Sharma *et al.*, 2010).

Alternaria blight alone recorded 70% yield loss in cumin crop (Holliday, 1980). It was first time recorded from Gujarat by Uppal *et al.* (1938) and from Rajasthan by Joshi (1955). Alternaria blight appears as dark brown spots on leaves and stems, these spots coalesce together and cover entire plant (Didwania, 2019). Affected plants fail to produce seeds (Wadud *et al.*, 2017). Conidia of the plants survive in the infected plant parts, soil and seeds and act as primary source of inoculum. Pathogen is air borne in nature spreads very fast (Didwania, 2019). Wadud *et al.* (2017) reported that the blight can be effectively managed by spraying systemic fungicide Amister Top at the rate of 0.1%. Crop was sprayed for six times at the interval of 8 days starting from pre-flowering stage. Shekhawat *et al.* (2013) reported that the disease can be effectively managed by spraying mixture of Tebuconazole + Azadirachtin.

Powdery mildew caused *Erysiphe polygoni* is one of the severe foliar disease, results in complete failure of the crop. The pathogen is air borne in nature and spreads easily and causes epidemics in cool and dry weather. The common practice for management of powdery mildew is spraying fungicides from one month crop to till maturity (Khunt *et al.*, 2017). The foliar application of metiram 55% + pyraclostrobin 5% WG @ 900 a.i.g ha (1500 g ha) or two sprays of tebuconazole 25 WG @ 750 g /ha or difenoconazole @ 250 ml/ha or

hexaconazole 5 EC @ 1000 ml/ha or kresoxim methyl 50 SC @ 375 ml/ha were recorded for effective management of powdery mildew disease of cumin (Patel, 2025).

Farmers are continuously using many systemic and contact fungicides for management of these diseases but continuous use of same fungicides without any authentic knowledge may create resistance problem and environmental hazards. However, the testing effectiveness of new molecules is essential for effective management of foliar diseases of cumin. A new chemical molecule with lower toxicity is present need of cumin diseases research. Hence the present investigation was undertaken on the “Evaluation of bioefficiency and Phytotoxicity of Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l 500 SC (Priaxor 500 SC) against alternaria and powdery mildew diseases of cumin” to know the effect of newer chemicals for managing the foliar diseases of cumin and effect of

dose of chemical on the disease severity and phytotoxicity.

MATERIAL AND METHODS

The experiment was conducted in the Rabi season of 2019-20 and 2020-21, at Regional Research Station, S. D. Agricultural University, Bhachau, Kachchh. The variety was GC-4 and crop was sown in the second week of November. The experiment was sponsored by the BASF India Limited, Navi Mumbai. The experiment was designed with RBD having seven treatments and control with three replications with a main aim of testing efficacy and phytotoxicity effect of newer chemical molecule Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC at different concentrations for the effective management of cumin blight and powdery mildew. The treatment details are as below given table.

Tr. No.	Treatment Details	Dosage per ha		
		g a.i.	Formulation (ml or g)	Water volume (L)
T1	Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC	50	100	500
T2	Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC	100	200	500
T3	Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC	150	300	500
T4	Fluxapyroxad 300 g/l SC	100	333	500
T5	Pyraclostrobin 20% WG	50	250	500
T6	Pyraclostrobin 133g/l + Epoxiconazole 50g/l SE	137.25	750	500
T7	Metiram 55% + Pyraclostrobin 5% WG	900-1050	1500-1750	
T8	Untreated control	-	-	-

Observations were recorded with the 25 randomly tagged plants for disease severity of alternaria blight and powdery mildew diseases by using a disease rating scale of 0–9 grade proposed by Mayee and Datar (1986) before spray and at 10 days after each spray. Per cent disease index (PDI) was calculated as per the formula suggested by McKinney (1923). Phytotoxicity observations recorded for chlorosis, necrosis, wilting, scorching, hyponasty and epinasty at 1, 3, 5, 7 and 10 days after spray. Cumin seed yield recorded plot wise and converted to into kg/ha. All the data are statistically analyzed by ANOVA

RESULTS AND DISCUSSION

The results pertaining to per cent disease severity for alternaria and powdery mildew diseases and seed yield of cumin in different treatments are presented in Table 1 and 2 during 2019-20 and 2020-21 respectively. The result revealed that, all the test fungicides and doses were found effective in reducing the disease severity and significantly superior over untreated control.

During 2019-20, before the spray the disease severity of alternaria blight and powdery mildew was observed in all the treatments with no significant difference. Ten days after the first spray, the significant difference in the PDI was observed in different treatments. Treatment T3 (Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 150g a.i/ha) recorded the lowest PDI for alternaria blight (14.12%) and powdery mildew (12.16%) which was followed by the treatment T2 (Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 100 g a.i/ha), with the PDI of 19.13% and 16.30% for alternaria blight and

powdery mildew respectively and T2 was found at par with the T7 and T6. Lowest disease control was observed with the treatment T4 (Fluxapyroxad 300 g/l SC at 10 ga.i/ha) which recorded the PDI of 30.18% and 27.81% for alternaria blight and powdery mildew respectively. The second spray was done at 10 days after the first spray and significant disease reduction was observed. Treatment T3 (Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 150g a.i/ha) recorded the lowest PDI for alternaria blight (15.23%) and powdery mildew (13.82%) which was followed by the treatment T2 (Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 100 g a.i/ha) and T2 was found at par with the T7 and T6. Lowest disease control was observed with the treatment T4 (Fluxapyroxad 300 g/l SC at 10 ga.i/ha) which recorded the PDI of 32.91% and 31.83% for alternaria blight and powdery mildew respectively. The treatment T3 recorded the highest per cent disease control of 69.95% of alternaria blight and 70.06% of powdery mildew. The treatment T3 also recorded highest seed yield of 440.18 kg/ha.

The same trend has been observed in the year 2020-21. The results indicating that the systemic fungicides are best known for the management of foliar diseases of cumin. These results are in accordance with the Sharma *et al.* (2024) who reported that the spray of Tebuconazole 25% wg @750 g/ha, combiprduct of Pyraclostrobin + Epoxiconazole @750 ml/ha and Tebuconazole 25% wg @500 g/ha effectively reduced cumin blight (76–80%). These results indicate that the combi-products and systemic fungicides can reduce the disease severity upto 70-80%. Spraying Azoxystrobin

+ Tebuconazole @1 litre/ha (Jat *et al.*, 2021) and spraying mixture of Tebuconazole + Azadirachtin @1ml/lit (Shekhawat *et al.*, 2013) found effective against cumin blight. Spraying Amister Top at the rate of 0.1% for six times at the interval of 8 days starting from pre-flowering stage was also reported for the effective management of blight (Wadud *et al.*, 2017). Khunt *et al.* (2017) evaluated the different fungicides for management cumin powdery mildew among them, propiconazole (0.025%) was the most effective fungicide with mean 4.43 per cent disease intensity and maximum disease control of 79.28 per cent and also recorded the highest yield of 798 kg/ha. Chhata *et al.* (2022) reported that the alternaria blight and powdery mildew of cumin caused by *Alternaria burnsii*, *Erysiphe polygoni* respectively can be managed effectively by spraying CAVIET (Tebuconazole 25WG) @ 0.10 per cent. Patel (2025) evaluated the many fungicides for management of powdery mildew

of cumin and reported that mainly the systemic fungicides like are metiram 55% + pyraclostrobin 5% WG @ 900 a.i.g ha (1500 g ha) or two sprays of tebuconazole 25 WG @ 750 g/ha or difenoconazole @ 250 ml/ha or hexaconazole 5 EC @ 1000 ml/ha or kresoxim methyl 50 SC @ 375 ml/ha effectively managed the powdery mildew of cumin with maximum yield.

Observations on phytotoxicity. The visual phytotoxicity observations recorded at 1, 3, 5, 7 and 10 days after first spray and second spray. No phytotoxicity symptoms were observed in the treatments with foliar application of Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l 500 SC at 150 and 300 g a.i/ha during both the year. Many scientists reported that the newer systemic fungicidal molecules are not having any phytotoxicity effect on the cumin crop (Patel, 2025; Khunt *et al.*, 2017).

Table 1: Evaluation of bioefficacy and phytotoxicity of Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC against Alternaria and powdery mildew diseases on Cumin (2019-20).

Tr. No.	Treatments	Per cent Disease Index at before spray		Per cent Disease Index at 10 days after 1 st spray		Per cent Disease Index at 10 days after 2 nd spray		Percent Disease Control over untreated control		Seed yield (kg/ha)
		Alternaria	Powdery mildew	Alternaria	Powdery mildew	Alternaria	Powdery mildew	Alternaria	Powdery mildew	
T ₁	Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 50 g a.i/ha	13.45 (21.51)	11.28 (19.62)	29.18 (32.70)	26.71 (31.12)	30.81 (33.72)	30.71 (33.65)	38.57	33.82	230.92
T ₂	Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 100 g a.i/ha	12.83 (20.99)	10.93 (19.31)	19.13 (25.94)	16.30 (23.81)	20.10 (26.64)	20.39 (26.84)	59.83	57.71	377.12
T ₃	Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 150 g a.i/ha	14.29 (22.21)	11.78 (20.07)	14.12 (22.07)	12.16 (20.41)	15.23 (22.97)	13.82 (21.82)	69.95	70.06	440.18
T ₄	Fluxapyroxad 300 g/l SC @ 10 g a.i/ha	12.65 (20.83)	12.20 (20.44)	30.18 (33.32)	27.81 (31.83)	32.91 (35.01)	31.83 (34.36)	35.40	31.26	229.02
T ₅	Pyraclostrobin 20% WG @ 50 g a.i/ha	13.29 (21.38)	12.71 (20.89)	29.18 (32.70)	24.88 (29.92)	30.43 (33.48)	30.91 (33.78)	38.96	35.70	254.75
T ₆	Pyraclostrobin 133g/l + Epoxiconazole 50 g/l SE @ 137.5 g a.i/ha	12.05 (20.31)	11.20 (19.55)	20.18 (26.69)	18.71 (25.63)	20.81 (27.14)	21.02 (27.29)	58.03	54.21	406.42
T ₇	Metiram 55% + Pyraclostrobin 5% WG @ 1050 g a.i/ha	13.85 (21.85)	12.79 (20.95)	19.18 (25.97)	17.72 (24.89)	20.03 (26.59)	20.28 (26.77)	59.85	56.20	401.83
T ₈	Untreated control	12.89 (21.04)	11.83 (20.12)	48.34 (44.05)	42.39 (40.62)	49.32 (44.61)	45.28 (41.77)	-	-	125.18
SEm±		0.57	0.73	0.93	0.92	0.81	1.00	-	-	8.2
CD at 5%		NS	NS	2.80	2.81	2.46	3.04	-	-	25.51
CV (%)		9.58	9.44	10.61	9.20	10.32	9.00	-	-	11.28

NS: Non-significant, Figures in parenthesis are Arcsine transformed values

Table 2: Evaluation of bioefficacy and phytotoxicity of Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC against Alternaria and powdery mildew diseases on Cumin (2020-21).

Tr. No.	Treatments	Per cent Disease Index at before spray		Per cent Disease Index at 10 days after 1 st spray		Per cent Disease Index at 10 days after 2 nd spray		Percent Disease Control over untreated control		Seed yield (kg/ha)
		Alternaria	Powdery mildew	Alternaria	Powdery mildew	Alternaria	Powdery mildew	Alternaria	Powdery mildew	
T ₁	Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 50 g a.i/ha	10.93 (19.31)	9.47 (17.92)	18.29 (25.32)	17.28 (24.56)	28.29 (32.13)	29.33 (32.79)	46.80	43.87	273.15
T ₂	Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 100 g a.i/ha	9.78 (18.22)	8.91 (17.37)	15.29 (23.02)	15.92 (23.52)	23.93 (29.29)	21.82 (27.85)	55.21	54.55	397.20
T ₃	Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 150 g a.i/ha	11.00 (19.37)	9.52 (17.97)	12.11 (20.36)	10.73 (19.12)	13.11 (21.22)	11.18 (20.43)	71.20	72.41	452.11
T ₄	Fluxapyroxad 300 g/l SC @ 10 g a.i/ha	10.53 (18.94)	10.10 (18.53)	17.22 (24.52)	16.92 (24.29)	30.28 (33.39)	29.56 (32.94)	45.75	44.03	231.10
T ₅	Pyraclostrobin 20% WG @ 50 g a.i/ha	9.69 (18.14)	8.69 (17.14)	16.83 (24.22)	18.25 (25.29)	26.13 (30.74)	25.35 (30.23)	50.94	47.50	230.18
T ₆	Pyraclostrobin 133g/l + Epoxiconazole 50 g/l SE @ 137.5 g a.i/ha	10.54 (18.94)	9.72 (18.17)	13.24 (21.34)	14.28 (22.20)	19.28 (26.05)	15.12 (22.88)	62.86	64.60	410.16
T ₇	Metiram 55% + Pyraclostrobin 5% WG @ 1050 g a.i/ha	11.03 (19.40)	10.06 (18.49)	14.25 (22.18)	14.82 (22.64)	18.53 (25.50)	16.10 (23.66)	62.56	62.76	404.04
T ₈	Untreated control	10.59 (18.99)	9.52 (17.97)	36.43 (30.81)	24.39 (29.59)	51.12 (43.81)	46.25 (42.85)	-	-	128.43
	SEM+	0.82	0.71	0.62	0.72	1.28	1.13	-	-	10.2
	CD at 5%	NS	NS	1.88	2.20	3.41	3.37	-	-	31.3
	CV (%)	10.15	9.41	9.10	8.92	9.91	9.22	-	-	10.32

NS: Non-significant, Figures in parenthesis are Arcsine transformed values

CONCLUSIONS

Different fungicides were tested at different concentrations for management of powdery mildew and alternaria blight of cumin. Among them the treatment T₃ (Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC @ 150g a.i/ha) recorded the lowest PDI with highest seed yield of cumin. Till now the fungicides combination of Fluxapyroxad+Pyraclostrobin on cumin is not yet reported and these are promising for effective management of foliar diseases of cumin.

FUTURE SCOPE

The present study highlighted the promising efficacy of Fluxapyroxad+Pyraclostrobin against foliar diseases of cumin however there remains considerable scope for future research. Research should be focused on Mmlti-location trials on different agro-climatic conditions and resistance management strategies for long term usage of chemicals. Further investigations on IPM modules together with integration of biological control management strategies need to be studied.

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