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Evaluation of bio-efficacy of tebuconazole 25 WG 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 during rabi 2014-15 and rabi 2015-16 to determine the effectiveness of tebuconazole 25 WG against blight and powdery mildew on cumin. Different eight treatments with their prefixed concentrations were compared with control. On the basis of the two years of investigation it has been concluded that tebuconazole 25 WG @ 750 g/ha was found effective against Alternaria blight (*Alternaria burnsii*) and powdery mildew (*Erysiphe polygoni*) diseases of cumin with increase in the yield. Higher dose of tebuconazole 25 WG @ 1500 g/ha did not produce any phytotoxic symptoms on cumin crop at different crop stages during sprays. This indicated that tebuconazole 25 WG is non-phytotoxic to cumin crop.

Key words: Cumin, Alternaria blight, Powdery mildew disease management

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Cumin (*Cuminum cyminum*) 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 ha with 4.86 lakh T production and 0.64 T per ha productivity in India, where as, in Gujarat cumin was grown in 2.79 lakh ha with 2.91 lakh T production and 1.05 T per ha 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 medicinal 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 alte.*), and powdery mildew (*Erysiphe polygoni*) are in moderate to severe form. (Sharma *et al.*, 2013)

Blight (*Aternaria burnsii alte.*) 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). 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 the 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), Patel N.R (2011), 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 is very 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 during rabi 2014-15 and rabi 2015-16 to evaluate the bio–efficacy of tebuconazole 25 WG 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 eight treatments (Table 1). The size of each plot measured 4.0 × 3.0 m^2. Gujarat Cumin 4 was sown keeping spacing at 30 cm. All the recommended agronomic practices were adopted as per package of practices except fungicidal sprays. The fungicidal application was done at initiation of disease in the crop. Total two sprays were applied at 20 days interval. Observations were recorded from ten randomly selected plants as per the disease scale (0-4 scale) (Rathore and Rathore, 1995) and from that percent disease intensity (PDI) was calculated as under, analyzed and given in tabular form.

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.

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 Treatment details of the trial with test chemicals and the dosage

Sr. No.	Treatment	Dose of formulation (g or ml/ha)
1	Tebuconazole 25WG #	500
2	Tebuconazole 25WG #	750
3	Tebuconazole 25WG #	1000
4	Tebuconazole 25WG *	1500
5	Tebuconazole 25WG *	3000
6	Difenoconazole 25EC	50 ml / 100 L water
7	Mancozeb 75WP	330 g / 100 L water
8	Untreated control	

T_1, T_2, T_3, T_6, T_7 and T_8 for bio-efficacy study

*T_4 and T_5 for Phytotoxicity study.

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:

It revealed from the data presented in Table-3 that all the treatments of tebuconazole 25 WG were found significantly superior over untreated control. The lowest percent disease intensity (PDI) of Alternaria blight was recorded in the treatment of tebuconazole 25 WG @ 750 g /ha i.e 13.22, 16.58, 20.82 and 23.81 per-cent at 10 and 20 days after 1st and 2nd spray respectively during 2014-15.While during the year 2015-16, all the treatments of tebuconazole 25 WG were found significantly superior over untreated control. The lowest percent disease intensity (PDI) of Alternaria blight was recorded in the treatment of tebuconazole 25 WG @ 750 g /ha i.e 13.08, 16.88, 21.60 and 22.95 percent at 10 and 20 days after 1st and 2nd spray respectively. Mancozeb 75 WP @ 1650 g/ha also recorded significantly the low Alternaria blight intensity (Table 4). The results obtained in the present study can be corroborated with the findings of earlier workers (Dange, 1995; Akbari *et al.*, 1996; Sharma *et al.*, 2013 and Patel *et al.*, 2017).

Per cent disease intensity of powdery mildew:

The data presented in Table-3 revealed that all the doses of tebuconazole 25 WG were found significantly superior over control against powdery mildew of cumin. The percent disease intensity was recorded in tebuconazole 25 WG @ 750 g/ha i.e. 15.42, 19.79, 21.28 and 23.26 percent at 10 and 20 days after 1st and 2nd spray, respectively. Difenaconazole 25 EC @ 250 ml/ha also significantly reduced powdery mildew intensity over control plot during 2014-15. While during the year 2015-16 also, all the doses of tebuconazole 25 WG were found significantly superior over control against powdery mildew of cumin. The percent disease intensity was recorded in tebuconazole 25 WG @ 750 g/ha i.e. 16.11, 21.53, 22.97 and 24.60 per cent at 10 and 20 days after 1st and 2nd spray, respectively. Difenaconazole 25 EC @ 250 ml/ha also recorded significantly the lowest powdery mildew intensity (Table 4). Similar results were also recorded earlier by Nandha Kumar *et al.*, (2012) and Patel *et al.*, (2013).

Phytotoxicity of Caviet 25 WG on cumin crop:

Phytotoxicity symptoms such as chlorosis, necrosis, wilting, scorching, epinasty and hyponasty (Table 6.1 to 6.6) were recorded on cumin crop sprayed with tebuconazole 25 WG @ 1500 g /ha during 2014-15 and 2015-16. From the present study it can be concluded that, tebuconazole 25 WG @ 1500 g /ha does not exhibit any phytotoxicity symptoms in cumin crop.

Cumin seed yield:

Yield parameter was also recorded as per the procedure mentioned in the methodology, separately for both the years from each plot, converted into ha basis, analysed and presented in Table-5. Application of tebuconazole 25 WG @ 750 g/ha significantly increased cumin yield (274.0 kg/ha and 541.0 kg/ha, in 2014-15 and 2015-16, respectively) in both the years over untreated control (184.0 kg/ha and 251.0 kg/ha, in 2014-15 and 2015-16, respectively).

CONCLUSION

On the basis of the two years of investigation it has been concluded that tebuconazole 25 WG @ 750 g/ha was found effective against Alternaria blight (*Alternaria burnsii*) and powdery mildew (*Erysiphe*

polygoni) diseases of cumin with increase in the yield. Higher dose of tebuconazole 25 WG @ 1500 g/ha did not produce any phytotoxic symptoms on cumin crop at different crop stages during sprays. This indicated that tebuconazole 25 WG is non-phytotoxic to cumin crop.

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Table 3 Bio-efficacy of tebuconazole 25 WG against Alternaria blight and powdery mildew diseases of cumin (2014-15)

Treatment	Dose (g/ha)	Per cent disease intensity (PDI)									
		Before spray		10 DA 1st spray		20 DA 1st spray		10 DA 2nd spray		20 DA 2nd spray	
		AB	PM	AB	PM	AB	PM	AB	PM	AB	PM
Tebuconazole 25 WG	500	12.14 (4.42)	12.38 (4.60)	13.59 (5.52)	16.22 (7.80)	16.86 (8.41)	20.55 (12.32)	20.97 (12.80)	22.10 (14.15)	23.93 (16.45)	23.74 (16.21)
Tebuconazole 25 WG	750	11.93 (4.27)	12.34 (4.57)	13.22 (5.23)	15.42 (7.07)	16.58 (8.14)	19.79 (11.47)	20.82 (12.63)	21.28 (13.17)	23.81 (16.30)	23.26 (15.60)
Tebuconazole 25 WG	1000	12.17 (4.45)	11.78 (4.17)	13.25 (5.26)	15.23 (6.90)	16.64 (8.20)	20.44 (12.20)	21.36 (13.27)	22.30 (14.40)	23.87 (16.37)	23.40 (15.77)
Tebuconazole 25 WG	1500	12.15 (4.43)	12.48 (4.67)	13.24 (5.25)	15.89 (7.50)	16.84 (8.39)	21.30 (13.20)	21.72 (13.70)	22.41 (14.53)	24.43 (17.10)	23.68 (16.13)
Tebuconazole 25 WG	3000	12.32 (4.55)	11.54 (4.00)	13.26 (5.26)	15.86 (7.47)	16.86 (8.42)	21.36 (13.27)	21.53 (13.47)	22.25 (14.33)	24.55 (17.27)	23.21 (15.53)
Difenoconazole 25EC	50 ml / 100 L water	12.15 (4.43)	12.57 (4.73)	13.94 (5.80)	16.07 (7.67)	17.22 (8.77)	21.25 (13.13)	21.25 (13.13)	22.30 (14.40)	26.45 (19.83)	23.99 (16.53)
Mancozeb 75WP	330 g / 100 L water	12.05 (4.36)	11.73 (4.13)	13.50 (5.45)	19.00 (10.60)	16.87 (8.42)	26.64 (20.10)	21.16 (13.03)	29.80 (24.70)	25.70 (18.80)	33.50 (30.47)
Untreated control	--	12.59 (4.75)	12.57 (4.73)	21.33 (13.23)	22.06 (14.10)	24.20 (16.80)	29.85 (24.77)	28.50 (22.77)	36.27 (24.70)	36.29 (35.03)	41.48 (43.87)
S.Em. +		0.27	0.48	0.57	0.53	0.36	0.94	0.53	0.75	0.50	0.92
C.V. at 5%		NS	NS	1.70	1.60	1.10	2.80	1.60	2.30	1.70	2.80

DA: Days After, AB: Alternaria Blight, PM: Powdery mildew

Figures in parenthesis are re-transformed values of Arc cine transformation

Table 4 Bio-efficacy of tebuconazole 25 WG against Alternaria blight and powdery mildew diseases of cumin (2015-16)

Treatment	Dose (g/ha)	Per cent disease intensity (PDI)									
		Before spray		10 DA 1st spray		20 DA 1st spray		10 DA 2nd spray		20 DA 2nd spray	
		AB	PM	AB	PM	AB	PM	AB	PM	AB	PM
Tebuconazole 25 WG	500	10.61 (3.39)	12.25 (4.50)	13.55 (5.49)	16.78 (8.33)	16.89 (8.44)	21.51 (13.45)	20.76 (12.56)	23.22 (15.55)	23.30 (15.65)	25.29 (18.25)
Tebuconazole 25 WG	750	10.48 (3.31)	12.25 (4.50)	13.08 (5.12)	16.11 (7.70)	16.88 (8.43)	21.53 (13.47)	21.60 (13.56)	22.97 (15.23)	22.95 (15.65)	24.60 (17.33)
Tebuconazole 25 WG	1000	10.72 (3.46)	12.11 (4.40)	13.16 (5.18)	15.68 (7.30)	17.02 (8.56)	21.30 (13.20)	21.77 (13.76)	23.08 (15.37)	23.08 (15.37)	24.97 (17.82)
Tebuconazole 25 WG	1500	10.68 (3.44)	12.20 (4.47)	13.17 (5.19)	16.22 (7.80)	17.00 (8.54)	21.16 (13.03)	21.83 (13.83)	23.18 (15.50)	23.03 (15.30)	24.80 (17.60)
Tebuconazole 25 WG	3000	10.82 (3.53)	12.25 (4.50)	13.25 (5.19)	16.07 (7.67)	16.88 (8.43)	21.42 (13.33)	21.92 (13.93)	23.08 (15.37)	23.18 (15.50)	24.80 (17.60)
Difenoconazole 25EC	50 ml / 100 L water	10.68 (3.44)	12.11 (4.40)	13.45 (5.41)	15.64 (7.27)	17.22 (8.77)	20.39 (12.13)	22.75 (14.96)	22.81 (15.03)	25.96 (19.17)	23.85 (16.35)
Mancozeb 75WP	330 g / 100 L water	10.61 (3.44)	12.20 (4.47)	13.48 (5.43)	19.25 (10.87)	17.67 (9.21)	27.25 (20.97)	20.80 (12.61)	30.72 (26.10)	22.08 (14.13)	35.35 (33.47)
Untreated control	--	10.72 (3.46)	12.29 (4.53)	20.70 (13.55)	22.30 (14.40)	23.22 (15.54)	30.37 (25.57)	28.01 (22.06)	36.67 (35.67)	33.23 (30.03)	40.18 (41.63)
S.Em. ±		0.30	0.40	0.54	0.51	0.26	0.83	0.41	0.77	0.47	0.84
C.D. at 5%		NS	NS	1.60	1.60	0.80	2.50	1.20	2.30	1.40	2.50

DA: Days After, AB: Alternaria Blight, PM: Powdery mildew

Figures in parenthesis are re-transformed values of Arc cine transformation

Table 5 Seed yield (kg/ha) of cumin in different treatments (2014-15 and 2015-16)

Treatment	Dose (g/ha)	Cumin seed yield (kg/ha)	
		2014-15	2015-16
Tebuconazole 25 WG	500	268	533
Tebuconazole 25 WG	750	274	541
Tebuconazole 25 WG	1000	272	542
Tebuconazole 25 WG	1500	274	531
Tebuconazole 25 WG	3000	272	534
Difenoconazole 25EC	50 ml / 100 L water	274	542
Mancozeb 75WP	330 g / 100 L water	267	531
Untreated control		184	251
S.Em. +		11.45	13.45
C.D. at 5%		34.70	40.80

Evaluation of phytotoxicity of tebuconazole 25 WG on cumin (2014-15 and 2015-16):

Table 6.1 Evaluation of phytotoxicity of tebuconazole 25 WG on chlorosis

No.	Treatment	Dose g /ha	Days after 1st spray					Days after 2nd spray				
			1	3	5	7	10	1	3	5	7	10
1	Tebuconazole 25 WG	750	0	0	0	0	0	0	0	0	0	0
2	Tebuconazole 25 WG	1500	0	0	0	0	0	0	0	0	0	0
3	Untreated control	-	0	0	0	0	0	0	0	0	0	0

Table 6.2 Evaluation of phytotoxicity of tebuconazole 25 WG on necrosis

No.	Treatment	Dose g /ha	Days after 1st spray					Days after 2nd spray				
			1	3	5	7	10	1	3	5	7	10
1	Tebuconazole 25 WG	750	0	0	0	0	0	0	0	0	0	0
2	Tebuconazole 25 WG	1500	0	0	0	0	0	0	0	0	0	0
3	Untreated control	-	0	0	0	0	0	0	0	0	0	0

Table 6.3 Evaluation of phytotoxicity of tebuconazole 25 WG on wilting

No.	Treatment	Dose g /ha	Days after 1st spray					Days after 2nd spray				
			1	3	5	7	10	1	3	5	7	10
1	Tebuconazole 25 WG	750	0	0	0	0	0	0	0	0	0	0
2	Tebuconazole 25 WG	1500	0	0	0	0	0	0	0	0	0	0
3	Untreated control	-	0	0	0	0	0	0	0	0	0	0

Table 6.4 Evaluation of phytotoxicity of tebuconazole 25 WG on scorching

No.	Treatment	Dose g /ha	Days after 1st spray					Days after 2nd spray				
			1	3	5	7	10	1	3	5	7	10
1	Tebuconazole 25 WG	750	0	0	0	0	0	0	0	0	0	0
2	Tebuconazole 25 WG	1500	0	0	0	0	0	0	0	0	0	0
3	Untreated control	-	0	0	0	0	0	0	0	0	0	0

Table 6.5 Evaluation of phytotoxicity of tebuconazole 25 WG on hyponasty

No.	Treatment	Dose g /ha	Days after 1st spray					Days after 2nd spray				
			1	3	5	7	10	1	3	5	7	10
1	Tebuconazole 25 WG	750	0	0	0	0	0	0	0	0	0	0
2	Tebuconazole 25 WG	1500	0	0	0	0	0	0	0	0	0	0
3	Untreated control	-	0	0	0	0	0	0	0	0	0	0

Table 6.6 Evaluation of phytotoxicity of tebuconazole 25 WG on epinasty

No.	Treatment	Dose g /ha	Days after 1st spray					Days after 2nd spray				
			1	3	5	7	10	1	3	5	7	10
1	Tebuconazole 25 WG	750	0	0	0	0	0	0	0	0	0	0
2	Tebuconazole 25 WG	1500	0	0	0	0	0	0	0	0	0	0
3	Untreated control	-	0	0	0	0	0	0	0	0	0	0

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