



## Management of Fungal Foliar Diseases of Bt. Cotton

*Kulkarni V.R.\* and Sabeena I.B.*

*Department of Plant Pathology,  
University of Agricultural Sciences, Dharwad (Karnataka), India.*

*(Corresponding author: Kulkarni V.R.\*)*

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**ABSTRACT:** Cotton is an important commercial crop vulnerable to many foliar diseases, among them grey mildew and *Alternaria* leaf blight are most severe and frequently occurring diseases and responsible for major yield loss. In recent years combiproductions are available in the market to manage more than one disease by using single chemical. So efforts were made to evaluate the combiproductions to manage the two important cotton fungal foliar diseases like *Alternaria* blight and grey mildew a field experiment was carried out under rainfed situation at agricultural research station Dharwad during 2017-18 and 2018-19. The Pooled and economic analysis of the two years data revealed that, three sprays of Trifloxystrobin 25% + Tebuconazole 50% @ 0.5g/l on 60, 75 and 90 DAS was found effective in management of *Alternaria* leaf blight and grey mildew diseases of Bt. cotton. Whereas the PDI of *Alternaria* leaf blight was 11.41% and grey mildew was 6.82% with highest yield of 1702.68 kg/ha and also gave B:C attractive ratio (2.05) with more net returns in comparison with control. Whereas, control recorded PDI of 46.11% and 36.30% for *Alternaria* leaf blight and grey mildew respectively by recording lowest yield (939.67 kg/ha). The spraying of Trifloxystrobin 25% + Tebuconazole 50% @ 0.5g/l can be recommended as one of component of integrated management of both the diseases in cotton.

**Keywords:** *Alternaria* blight, grey mildew, PDI, benefit cost ratio.

### INTRODUCTION

Cotton is one of the most important commercial crop of the world, which belongs to the botanical family “Malvaceae”. Cotton is referred to as “King of Fibres” and also known as “White Gold”. Cotton or “White Gold” is an important commercial cash crop of India. It plays a key role in national economy in terms of activities, employment and foreign exchange earnings. However, the production potential of the crop has not fully exploited due to several biotic and abiotic factors. The crop suffers from many fungal foliar diseases like *Alternaria* leaf spot, grey mildew bacterial leaf blight, angular leaf spot, boll rot and leaf curl (Kapadiya *et al.*, 2015). Among the various diseases *Alternaria* blight and grey mildew are major diseases responsible for loss of yield and quality parameters in cotton.

The worldwide area under cotton for the year 2020-21 was 31.66 million hectares (ha) and production and productivity accounted for 113.11 million bales and 778 kg/ha respectively. India is the largest cotton growing country and the crop is spread across 123.50 lakh hectares with a production of 340.62 lakh bales of cotton lint and average productivity of 469 kg/ha. Karnataka is reported to produce cotton lint of about

6.91 lakh bales with and an area of 18,33,000 hectares marking a average productivity of 451 kg/ha (Anon., 2022).

### MATERIALS AND METHODS

An experiment was undertaken to evaluate the new molecules against major foliar diseases (*Alternaria* blight and grey mildew) of cotton. In recent years combiproductions are available in the market to manage more than one disease by using single chemical. So efforts were made to evaluate the combiproductions to manage the two important cotton fungal foliar diseases like *Alternaria* blight and grey mildew a field experiment was carried out under rainfed situation at agricultural research station Dharwad during 2017-18 and 2018-19 a field trial was laid out at Agricultural Research Station, Dharwad during two consecutive years 2017-18 and 2018-19. Eight treatments were replicated thrice in plots of size 5.4×5.4 m with spacing of 90×60 cm in randomized block design. The chemicals used in the present investigation were Azoxystrobin 23% SC @ 1.0 g/l, Tebuconazole 25.9% SC @ 1.0 g/l, Hexaconazole 5% EC @ 1.0 g/l, Difenoconazole 25% EC @ 1.0 g/l, Propiconazole 25%

EC @ 1.0 g/l, Pyraclostrobin 5% + Metiram 55% @ 3.5 g/l and Trifloxystrobin 25% + Tebuconazole 50% at two different doses (0.5 g/l and 1 g/l).

The first spray was done immediately after the appearance of disease and successive two sprays at 15 days intervals. The severity of Alternaria blight and grey mildew was scored at 7 days interval after each spray. The disease severity was recorded by using 0-4 disease rating scale where 0= No diseases, 1= less than 5% disease, 2= 6-20% disease, 3= 20-40% disease and 4= more than 40% of leaf area was diseased (Mayee and Datar 1986) and Based on disease scores per cent disease intensity (PDI) was calculated by using below mentioned formula (Wheeler, 1969).

$$PDI = \frac{\text{Sum of individual disease ratings}}{\text{Total No. of leaves observed} \times \text{Maximum disease rating}}$$

**Statistical analysis:** All the data related to disease severity and yield was statistically analyzed. Calculations were made after applying the test of significance of the means (Panse and Sukhtame 1978).

## RESULT AND DISCUSSION

The field experiment was conducted with total nine treatments including the control during 2017-18 and 2018-19. In case of Alternaria blight during the year 2017-18 data revealed that, Trifloxystrobin 25% + Tebuconazole 50% @ 1.0g/l was found effective in controlling both Alternaria blight (11.90%) and grey mildew(6.73%), followed by Trifloxystrobin 25% + Tebuconazole 50% @ 0.5 g/l with disease severity of 12.50% and 7.45% of Alternaria blight and grey mildew respectively. Whereas, Difenconazole 25% EC @ 1.0 g/l (28.70% PDI for Alternaria blight and 14.50% PDI for grey mildew) was found least effective followed by Hexaconazole 5% EC @ 1.0 g/l (26.70% PDI for Alternaria blight and 13.70% PDI for grey mildew). However the control recorded significantly higher per cent disease index of 47.60 and 37.80 for Alternaria blight and grey mildew respectively (Table 1).

During year 2018-19 data revealed that, Trifloxystrobin 25% + Tebuconazole 50% @ 1.0g/l was found effective in controlling Alternaria blight and grey mildew by recording disease severity of 9.47 and 5.90 respectively. The next best effective treatment was Trifloxystrobin 25% + Tebuconazole 50% @ 0.5 g/l (10.33 for Alternaria blight and 6.20 for grey mildew). Whereas, Difenconazole 25% EC @ 1.0 g/l was found least effective with the disease severity of 26.43% and 13.40% for Alternaria blight and grey mildew respectively, followed by Hexaconazole 5% EC @ 1.0 g/l (24.83% for Alternaria blight and 12.23% for grey mildew). However control recorded significantly higher per cent disease index in controlling Alternaria blight (44.63%) and grey mildew (34.80%) (Table 1).

Two years of pooled data indicated that, Trifloxystrobin 25% + Tebuconazole 50% @ 1.0g/l was found effective

in controlling Alternaria blight (10.68%) and grey mildew (6.31%), followed by Trifloxystrobin 25% + Tebuconazole 50% @ 0.5 g/l (11.41% for Alternaria blight and 6.82% for grey mildew). Difenconazole 25% EC @ 1.0 g/l was found least effective (27.56% for Alternaria blight and 13.95% for grey mildew), followed by Hexaconazole 5% EC @ 1.0 g/l with disease severity of 25.76 and 12.96 for Alternaria blight and grey mildew respectively. However the control recorded significantly higher per cent disease index (46.11% for Alternaria blight and 36.30% for grey mildew) (Table 1).

During the year 2017-18 with respect to yield data revealed that, Trifloxystrobin 25% + Tebuconazole 50% @ 0.5 g/l was cost effective with highest yield of 1609.90 kg/ha followed by, Trifloxystrobin 25% + Tebuconazole 50% @ 1g/l (1587.73 kg/ha). Whereas, lowest yield was recorded in Difenconazole 25% EC @ 1.0 g/l (1408.58 kg/ha). However, control was recorded lowest yield of 924.79 kg/ha.

During the year 2018-19 data revealed that, Trifloxystrobin 25% + Tebuconazole 50% @ 1g/l was cost effective with highest yield of 1825.65 kg/ha followed by, Trifloxystrobin 25% + Tebuconazole 50% @ 0.5 g/l (1795.46 kg/ha). Whereas, lowest yield was recorded in Difenconazole 25% EC @ 1.0 g/l (1490.15 kg/ha). However, control was recorded lowest yield of 954.56 kg/ha.

Pooled data revealed that, Trifloxystrobin 25% + Tebuconazole 50% @ 0.5 g/l was cost effective with highest yield of 1702.68 kg/ha and Trifloxystrobin 25% + Tebuconazole 50% @ 1g/l (1705.69 kg/ha) were on par with each other. Whereas, lowest yield was recorded in Difenconazole 25% EC @ 1.0 g/l (1408.58 kg/ha). However, control was recorded yield of 939.67 kg/ha (Table 1).

**Economics:** Comparison of efficacy between different treatments indicated that, spraying of Trifloxystrobin 25% + Tebuconazole 50% @ 0.5g/l was found superior to suppress both the diseases (Alternaria blight and grey mildew) and also recorded maximum net returns (Rs. 48157.40) and cost benefit ratio (2.05:1). The next best treatment was spraying of Trifloxystrobin 25% + Tebuconazole 50% @ 1g/l with net returns of Rs.42832.95 with B:C of 1.84:1 followed by Propiconazole 25% EC @ 1.0 g/l with net returns of Rs. 42015.10 and B:C ratio of 1.99:1 (Table 2).

During *kharif* 2009-10 and 2010-11 a field experiment was conducted to evaluate the bio efficacy of triazole fungicides. Among the triazoles evaluated, penconazole @ 0.1 % showed low disease severity of (6.10 PDI) and (10.30 PDI) for Alternaria blight and grey mildew respectively. This was followed by difenconazole (AB 7.10, GM 11.10 PDI), hexaconazole (AB 8.20, GM 11.0) and tridemefan (AB 11.3, GM 13.5) @ 0.1 % were effective in reducing the disease severity (Ashtaputre *et al.*, 2011).

Anil (2013) conducted field experiment by using nine different chemical fungicides to manage *Alternaria* blight of cotton, of which propineb @ 0.2 % showed best disease control and high yield in field condition. Next best were difenconazole and penconazole.

Kapadiya *et al.* (2015) concluded that, three sprays of taqat @ 0.113% at fortnight interval was found effective in management of *Alternaria* leaf blight of cotton by showing minimum disease severity (9.43%) and higher cotton seed yield (1523kg/ha) with cost benefit ratio of 7.75.

Dighule *et al.*, (2011) reported that, mancozeb(0.3%) and Propiconazole (0.1%) were effective in reducing the losses due to leaf spot diseases (*Alternaria* leaf blight, *Myrothecium* leaf spot, *Helminthosporium* leaf spot) and increased the seed cotton yield. Difenconazole@ 0.125 kg a.i/ha and tebuconazole @0.187 kg a.i/ha suppressed *Alternaria* leaf spot and increased yield (15.6 -39% increase) in cotton.

Rajani *et al.*, (2019) concluded that, farmers of south Saurashtra are advised to spray Mancozeb 63WP + Carbendazim 12 WP@ (0.15%) or Pyrethrin 5WG + Metiram 55WG @ (0.18%) or *Pseudomonas fluorescens* @2x10<sup>8</sup> cfu/g (0.0025%) for management of foliar disease of cotton.

Sangeetha *et al.*, (2018) observed that, both hexaconazole and Propiconazole at 0.1% concentration to be effective in managing the *Alternaria* leaf spot by recording yield of 15.37 and 14.84q/ha with a benefit cost ratio of 2.04 and 1.70, respectively. Combination of propiconazole + mancozeb and biocontrol agents *Trichoderma viride* gives maximum protection against *Alternaria* Leaf Spot of Cotton (Venkatesh and Darwin 2016).

Based on these results we can conclude that, Trifloxystrobin 25% + Tebuconazole 50% @ 0.5 g/l was found effective in management of both the foliar diseases (*Alternaria* blight and grey mildew) in cotton.

**Table 1: Management of *Alternaria* blight and Grey mildew of Bt. Cotton.**

Sr. No.	Treatment	AB PDI			PDOC	GM PDI			PDC	Yield Kg/ha			YIOC
		2017-18	2018-19	Pooled		2017-18	2018-19	Pooled		2017-18	2018-19	Pooled	
T <sub>1</sub>	Azoxystrobin 23% SC @ 1.0 g/l	24.30 (29.52)	22.27 (28.14)	23.28 (28.83)	49.51	13.00 (21.12)	10.93 (19.29)	11.96 (20.22)	67.05	1392.33	1548.50	1471.92	56.64
T <sub>2</sub>	Tebuconazole 25.9% SC @ 1.0 g/l	22.20 (28.09)	19.72 (26.35)	20.96 (27.23)	54.54	9.70 (18.13)	7.73 (16.13)	8.71 (17.15)	76.00	1447.25	1553.15	1500.2	59.65
T <sub>3</sub>	Hexaconazole 5% EC @ 1.0 g/l	26.70 (31.10)	24.83 (29.87)	25.76 (30.48)	44.13	13.70 (21.71)	12.23 (20.46)	12.96 (21.09)	64.29	1393.42	1519.72	1456.56	55.00
T <sub>4</sub>	Difenconazole 25% EC @ 1.0 g/l	28.70 (32.38)	26.43 (30.92)	27.56 (31.65)	44.52	14.50 (22.37)	13.40 (21.46)	13.95 (21.92)	61.57	1327.00	1490.15	1408.58	49.90
T <sub>5</sub>	Propiconazole 25% EC @ 1.0 g/l	23.10 (28.71)	20.90 (27.19)	22.00 (27.96)	52.28	10.90 (19.27)	9.93 (18.36)	10.41 (18.81)	71.32	1471.60	1598.03	1534.82	63.33
T <sub>6</sub>	Trifloxystrobin 25% + Tebuconazole 50% @ 0.5 g/l	12.50 (20.69)	10.33 (18.74)	11.41 (19.73)	75.25	7.45 (15.83)	6.20 (14.41)	6.82 (15.13)	81.21	1609.90	1795.46	1702.68	75.87
T <sub>7</sub>	Trifloxystrobin 25% + Tebuconazole 50% @ 1.0g/l	11.90 (20.17)	9.47 (17.91)	10.68 (19.06)	76.83	6.73 (15.03)	5.90 (14.05)	6.31 (14.54)	82.61	1587.73	1825.65	1705.69	81.52
T <sub>8</sub>	Pyraclostrobin 5% + Metiram 55% @ 3.5 g/l	19.70 (26.33)	18.20 (25.24)	18.95 (25.79)	58.90	7.90 (16.31)	7.40 (15.77)	7.65 (16.05)	78.92	1487.08	1723.87	1605.47	70.85
T <sub>9</sub>	Control	47.60 (43.60)	44.63 (41.90)	46.11 (42.75)	-	37.80 (37.92)	34.80 (36.13)	36.30 (37.03)	-	924.79	954.56	939.67	-
	<b>SEm±</b>	<b>0.81</b>	<b>0.95</b>	<b>0.86</b>		<b>0.72</b>	<b>0.88</b>	<b>0.97</b>		<b>55.57</b>	<b>57.01</b>	<b>54.64</b>	
	<b>CD at 5%</b>	<b>2.44</b>	<b>2.87</b>	<b>2.58</b>		<b>2.17</b>	<b>2.64</b>	<b>2.91</b>		<b>167.87</b>	<b>172.56</b>	<b>162.87</b>	

**Table 2: Economics (B: C ratio) of Management of *Alternaria* blight and Grey mildew of Bt. Cotton.**

Sr. No.	Treatment	Yield Kg/ha	Total cost (Rs/ha)	Total Returns (Rs)	Net Returns(Rs)	B:C ratio
T <sub>1</sub>	Azoxystrobin 23% SC @ 1.0 g/l	1471.92	47500	80955.60	33455.60	1.70:1
T <sub>2</sub>	Tebuconazole 25.9% SC @ 1.0 g/l	1500.2	43840	82511.00	38671.00	1.88:1
T <sub>3</sub>	Hexaconazole 5% EC @ 1.0 g/l	1456.56	40945	80110.80	39165.80	1.95:1
T <sub>4</sub>	Difenconazole 25% EC @ 1.0 g/l	1408.58	46750	77471.90	30721.90	1.65:1
T <sub>5</sub>	Propiconazole 25% EC @ 1.0 g/l	1534.82	42400	84415.10	42015.10	1.99:1
T <sub>6</sub>	Trifloxystrobin 25% + Tebuconazole 50% @ 0.5g/l	1702.68	45490	93647.40	48157.40	2.05:1
T <sub>7</sub>	Trifloxystrobin 25% + Tebuconazole 50% @ 1.0g/l	1705.69	50980	93812.95	42832.95	1.84:1
T <sub>8</sub>	Pyraclostrobin 5% + Metiram 55% @ 3.5 g/l	1605.47	50500	88300.85	37800.00	1.74:1
T <sub>9</sub>	Control	939.67	40000	51681.85	11681.85	1.29:1

## CONCLUSION

Trifloxystrobin 25% + Tebuconazole 50% @ 0.5 g/l was found cost effective with high cost benefit ratio of 2.05, followed by Propiconazole 25% EC @ 1.0 g/l (1.99). Whereas, Difenconazole 25% EC @ 1.0 g/l was least cost effective with cost benefit ratio of 1.65:1.

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