



Management of fungal foliar diseases of cotton

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ABSTRACT : The effect of fungicides and bio agents on cotton against foliar diseases and yield were assessed in field experiment conducted at cotton research station Junagadh Agricultural University Junagadh during 2015, 2016 and 2017. Results of three years pooled data indicated that all fungicides and bioagents were suppressed disease intensity as compared to control. Significantly minimum fungal leaf spots were recorded (7.25%) in spraying of Mencozeb 63WP+ carbendazim 12 WP and it was *at par* with Pyrethrin 5WG + Metiram 55 WG (8.22%). In case of bacterial leaf blight minimum (3.74%) disease was recorded in spraying of *Pseudomonas fluorescens*. Statistically significantly higher seed cotton yield (2158 kg/ha) was recorded in spraying of Mancozeb 63WP + Carbendazim 12 WP and it was statistically at par with Pyrethrin 5WG+ Metiram 55WG (2092 kg/ha). While Pyrethrin 5WG+ Metiram 55WG was at par with spraying of *Pseudomonas fluorescens* (1932 kg/ha). The minimum seed cotton yield of 1409 kg/ha was recorded in control. The maximum ICBR (1:6.16) was obtained in spraying of Mancozeb 63WP + Carbendazim 12 WP. However, ICBR among the next best treatments were obtained in spraying of *Pseudomonas fluorescens* and Carbendazim 50WP 1:5:68 and 1:5:37, respectively.

Key words : Mencozeb 63WP+ carbendazim 12 WP, Pyrethrin 5WG+ Metiram 55WG, *Pseudomonas fluorescens*

Cotton is one of the most important fiber and commercial cash crops of India. It plays a key role in national economy in terms of activities, employment and foreign exchange earnings. In the cotton growing states, Gujarat has a place in the forefront. Cotton cultivated area in Gujarat (2016-2017) was 24 lac ha and production was 91.80 lac bales (Anonymous 2016). Several diseases attack the leaves of cotton and cause lesions that under favorable conditions can cause considerable damage. The important foliar diseases are bacterial blight caused by *Xanthomonas axonopodis* pv. *malvacearum* (E.F.Smith), leaf spots, caused by *Alternaria macrospora* Zimm. The diseases are seen in all cotton growing areas, but more

serious in Maharashtra, Gujarat, Karnataka, Andhra Pradesh and Tamil Nadu and estimated loss cause upto 26.6 per cent (Monga *et al.*, 2013), Grey mildew disease (*Ramularia areola* Atk) is commonly occurring in Maharashtra, Madhya Pradesh, Karnataka, Andhra Pradesh and Tamil Nadu. There was reduction of loss upto 29.20 per cent at Dharwad, Guntur and Nanded during 2009-2011 (Monga *et al.*, 2013). This disease was occurs in heavy rainy periods with serious defoliation occurring. Foliar diseases account upto 20 to 30 per cent losses in cotton (Maye and Mukewar, 2007). More specifically the diseases are at best a secondary issue following a reduction in leaf potassium as a result of boll set. Nutrients shifting from the leaves (course)

to the bolls (sink) reduce the concentration of nutrients in the leaves and make them easy targets for weak pathogens. Boll rot incidence is a completely different issue and will likely be the focus of a blog update later in the season. Moreover, spots can develop on leaves, the stem, and bolls as a result of any of the foliar diseases listed above.

MATERIALS AND METHODS

The field trial was conducted at Cotton Research Station, Junagadh Agricultural University, Junagadh in randomized block

design (RBD) with 8 treatments along with three replications having plot size of 6.30 x 4.8 m. and variety G.Cot hy 8 BG-II with spacing of 1.20 x 0.45 m. All the recommended agronomical practices were followed during experimentation.

Three foliar spray were carried out at 30, 60 and 90 DAS. Data on foliar diseases including bacterial leaf blight and Alternaria leaf spot were recorded at 0-4 scale as per Raj (1988). Based upon the disease scores per cent disease intensity (PDI) was calculated by using the formula:

Details of Treatment

Sr	Details of treatment	Concentration (%)	Quantity in 10 l of water
T ₁	Carbendazim 50WP	0.05	10 g
T ₂	Hexaconazole 5 SC	0.0075	15 ml
T ₃	Mancozeb 63WP + Carbendazim 12 WP	0.15	20 g
T ₄	Pyraclostrobin (5%) + Metiram (55%)	0.18	30 g
T ₅	Trifloxystrobin (25%) + Tebuconazole (50%)	0.053	7 g
T ₆	<i>Pseudomonas fluorescens</i> 1WP	0.0025	50 ml
T ₇	<i>Bacillus subtilis</i> 1WP	0.0025	50 ml
T ₈	Control	—	—

$$\text{Per cent Disease Intensity (PDI)} = \frac{\text{Sum of numerical ratings}}{\text{Total no. of leaves observed} \times \text{Maximum grade}}$$

Based upon the PDI percent disease control in each treatment was computed. Data on seed cotton yield was recorded in each treatment. *Pseudomonas fluorescens* was obtained in Department of Plant Pathology JAU, Junagadh that is local strain.

RESULTS AND DISCUSSION

The field experiment was conducted with

total eight treatments including the control during *kharif* 2015, 2016 and 2017.

The three years pooled results presented in Table 1 revealed that all fungicidal treatments were found effective to suppress the fungal foliar diseases of cotton. Significantly minimum fungal leaf spots were recorded (7.25 %) in spraying of Mancozeb 63WP + Carbendazim 12 WP and it was *at par* with Pyrethrin 5WG+ Metiram 55WG (8.22%). Similar results with Mancozeb 63WP + Carbendazim 12 WP were reported by Sangeetha (2013). The spraying of Carbendazim 50 WP was found next best fungicide and it was *at par* with *Pseudomonas fluorescens*. While rest of the

Table 1. Effect of different fungicides on fungal leaf spot of cotton (Pooled: 2015-2016, 2016-2017 and 2017-2018)

Sr. No.	Treatments	Fungal leaf spot PDI (%)			Mean Pooled
		2015-2016	2016-2017	2017-2018	
T ₁	Carbendazim 50WP	4.13 (17.06)	2.99 (8.96)	3.03 (9.16)	3.18 (10.09)
T ₂	Hexaconazole 5 SC	3.68 (13.57)	3.29 (10.80)	3.32(11.00)	3.20 (10.26)
T ₃	Mancozeb 63WP + Carbendazim 12 WP	2.63 (6.90)	2.49 (6.20)	2.15 (4.64)	2.69 (7.25)
T ₄	Pyrethoconazole 5WG+ Metiram55WG	2.93 (8.60)	2.67 (7.15)	2.61 (6.79)	2.87 (8.22)
T ₅	Trifloxystrobin (25%) + Tebuconazole (50%) (Nativo75WG)	3.79 (14.39)	3.34 (11.13)	3.48 (12.11)	3.25 (10.58)
T ₆	<i>Pseudomonas fluorescens</i> 1WP	3.88 (15.08)	2.91 (8.47)	3.44 (11.81)	3.19 (10.18)
T ₇	<i>Bacillus subtilis</i> 1WP	4.13 (17.06)	3.38 (11.40)	3.47 (12.02)	3.31 (10.93)
T ₈	Control	4.92 (24.24)	4.10(16.81)	4.83 (23.33)	3.72 (13.84)
S. Em.±		0.24	0.17	0.24	0.14
C.D. (p=0.05)		0.71	0.51	0.73	0.43
C.V. (%)		10.93	9.27	12.75	7.96
Y					
S.Em.±0.10					
C.D. (p=0.05)		0.28			
Y x T					
S.Em.±0.17					
C.D. (p=0.05)		NS			

#Transformed square root values, numerals in parenthesis are retransformed value

Table 2. Effect of different fungicides on bacterial leaf blight of cotton (Pooled: 2015-2016, 2016-2017 and 2017-2018)

Sr. No.	Treatment	BLB PDI (%)			Mean Pooled
		2015-2016	2016-2017	2017-2018	
T ₁	Carbendazim 50WP	1.73 (2.98)	1.82(3.30)	1.67 (2.79)	2.28 (5.21)
T ₂	Hexaconazole 5 SC	1.34 (1.80)	2.04(4.15)	2.48 (6.17)	2.40 (5.76)
T ₃	Mancozeb 63WP + Carbendazim 12 WP	1.33 (1.77)	1.62(2.62)	2.11 (4.44)	2.24 (5.00)
T ₄	Pyrethoconazole 5WG+ Metiram55WG	1.41 (1.99)	1.51(2.28)	2.22 (4.94)	2.26 (5.09)
T ₅	Trifloxystrobin (25%) + Tebuconazole (50%) (Nativo75WG)	1.45 (2.11)	1.87(3.48)	2.41 (4.94)	2.38 (5.68)
T ₆	<i>Pseudomonas fluorescens</i> 1WP	1.19 (1.42)	1.21(1.46)	1.33 (1.77)	1.93 (3.74)
T ₇	<i>Bacillus subtilis</i> 1WP	1.40 (1.97)	1.27(1.60)	1.39(1.93)	2.01 (4.05)
T ₈	Control	2.16 (4.65)	3.19(10.15)	4.06 (16.46)	3.04 (9.24)
S. Em.±		0.13	0.13	0.16	0.20
C.D. (p=0.05)		0.41	0.39	0.48	0.60
C.V. (%)		15.47	12.30	12.33	11.04
Y					
S.Em.±0.04					
C.D. (p=0.05)		0.12			
Y x T					
S.Em.±0.12					
C.D. (p=0.05)		0.34			

#Transformed square root values, numerals in parenthesis are retransformed value

Table 3. Effect of different fungicides on Seed cotton yield of cotton (Pooled: 2015-2016, 2016-2017 and 2017-2018)

Sr. No.	Treatments	Seed cotton yield (kg/ha)			Pooled
		2015-2016	2016-2017	2017-2018	
T ₁	Carbendazim 50WP	1726	1914	1872	1837
T ₂	Hexaconazole 5 SC	1830	1881	1807	1840
T ₃	Mancozeb 63WP + Carbendazim 12 WP	1980	2339	2155	2158
T ₄	Pyrethoconazole 5WG+ Metiram55WG	1867	2298	2112	2092
T ₅	Trifloxystrobin (25%)+Tebuconazole (50%) (Nativo75WG)	1817	1896	1807	1840
T ₆	<i>Pseudomonas fluorescens</i> 1 WP	1799	2071	1927	1932
T ₇	<i>Bacillus subtilis</i> 1 WP	1712	1860	1794	1789
T ₈	Control	1360	1451	1416	1409
S.Em.±		81.94	128.29	97.17	50.74
C.D. (p=0.05)		249	389	295	145
C.V. (%)		8.09	11.32	9.04	8.17
Y					
S.Em.±		31.07			
C.D. (p=0.05)		88.71			
YxT					
S.Em.±		87.88			
C.D. (p=0.05)		NS			

* Transformed square root values, Numerals in parenthesis are retransformed value

Table 4. The initiation of diseases of cotton (Pooled: 2015-2016, 2016-2017 and 2017-2018)

Sr.	Foliar Disease	Time of initiation of diseases		
		2015-2016	2016-2017	2017-2018
1	Fungal foliar diseases	18.11.15	12.12.16	14.10.17
2	Bacterial blight disease	14.08.15	16.08.16	10.07.17

remaining treatments were found statistically *at par* with each other against fungal foliar diseases in *Bt* cotton G.Cot. Hy.-8 BGII at CRS, Junagadh. The maximum diseases (13.84%) was recorded in control.

In case of bacterial leaf blight, the three years pooled results indicated all treatments were found statistically *at par* with each other than the control to suppress the bacterial leaf blight. The minimum disease was (3.74) recorded in spraying of *Pseudomonas fluorescens*. The maximum bacterial leaf blight (9.24%) was recorded in control. However, statistically

significantly minimum disease was recorded minimum in spraying of *Pseudomonas fluorescens* and it was *at par* with spraying of *Bacillus subtilis* during the *kharif* 2016 and 2017 in G.Cot. Hy 8.BG II as compared to the control.

Three years pooled data indicated that the statistically significantly higher seed cotton yield (2158 kg/ha) was recorded in spraying of Mancozeb 63WP + Carbendazim 12 WP and it was statistically *at par* with Pyrethoconazole 5WG+ Metiram 55WG (2092 kg/ha). While Pyrethoconazole 5WG+ Metiram 55WG was *at par* with spraying of *Pseudomonas fluorescens* (1932 kg/ha). The

Table 5. Statement showing economics of various treatments in management of fungal foliar diseases of cotton (2017-2018)

S. No.	Treatment / Module	Seed yield (kg/ha) Pooled	Yield increase over control (kg/ha)	Additional income (Rs) (From column No.4)	Cost of treatment of (Pesticides, labor charge etc (Rs/ha)	Net realization	ICBR	Cost as per Packing available (Rs)
1	2	3	4	5	6	7 (5-6)	8 (5/6)	
T ₁	Carbendazim 50WP	1837	428	22256	4144	18112	1:5.37	290/500g
T ₂	Hexaconazole 5 SC	1840	431	22412	4276	18136	1:5.24	540/1 lit
T ₃	Mancozeb 63WP + Carbendazim 12 WP	2158	749	38948	6320	32628	1:6.16	700/1 kg
T ₄	Pyrethlostobin 5WG+ Metiram55WG	2092	683	35316	7891	27425	1:4.48	1050/600g
T ₅	Trifloxystrobin (25%)+Tebuconazole (50%) (Nativo75WG)	1840	431	22412	6496	15916	1:3.45	750/100g
T ₆	<i>Pseudomonas fluorescens</i> 1 WP	1932	523	27196	4790	22406	1:5.68	150 1 kg
T ₇	<i>Bacillus subtilis</i> 1 WP	1789	380	19760	3965	15795	1:4.98	150/1 kg
T ₈	Control	1409	—	—	—	—	—	—

(1) Labor charge for one spray/ha : Rs 500

(2) Price of seed cotton: Rs 52/kg

(3) Labor charge for soil application of treat./ha : Rs 500

(4) Picking charge: Rs 110/20 kg seed cotton.

minimum seed cotton yield of 1409 kg/ha was recorded in control. Efficacy of both *Pseudomonas fluorescens* isolates against bacterial blight and fungal leaf spot was reported (Bhattiprolu, 2010)

Economics : Comparison of the efficacy between different treatments indicated that in spraying of Mancozeb 63WP + Carbendazim 12 WP@ (0.15%) was found superior to suppress the fungal foliar diseases which also gave maximum net realization (Rs 32628 /ha) and ICBR (1:6.2). The next best treatment was spraying of Pyrethrin 5WG+ Metiram 55WG @ (0.18%) and spraying of *Pseudomonas fluorescens* @ 2×10^8 cfu/g. Which gave net realization Rs 27425/ha, Rs. 22406/ha and ICBR 1:4.5, 1:5.7 against fungal foliar diseases respectively.

Management of bacterial leaf blight, the spraying of *Pseudomonas fluorescens* @ 2×10^8 cfu/g was found significantly superior to suppress the disease and gave Rs 22406/ ha net realization and 1:5.7 ICBR.

CONCLUSION

The 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* @ 2×10^8 cfu/g (0.0025%) for management of foliar disease of cotton.

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