

Chemical control of rust disease of *Bt* cotton

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ABSTRACT : Field experiments were conducted for three years during *kharif*, 2006-2007, 2007-2008 and 2008-2009 at Agricultural Research Station, Dharwad Farm to evaluate the fungicides, namely, Hexaconazole (0.1%), Propiconazole (0.1%), Chlorothalonil (0.2%), Tridemifon (0.1%), Difenconazole (0.1%) and Mancozeb (0.2%) for the control rust disease in cotton. The pooled data indicated that the least per cent disease index (27.70 PDI) and maximum disease control (35.88 PDC) was observed in Propiconazole (0.1%) followed by Hexaconazole (0.1%) (27.90 PDI and 35.42 PDC) and Difenconazole (0.1%) (29.80 PDI and 31.02 PDC). The pooled maximum yield of 2352.18 kg/ha was recorded in Propiconazole (0.1%) followed by Hexaconazole (0.1%) (2310.30 kg/ha) and Difenconazole (0.1%) (2208.10 kg/ha). Highest incremental benefit cost ratio of 5.42 was obtained with Hexaconazole (0.1%) followed by Mancozeb (0.2%) (4.38)

Key words: Cotton, fungicides, rust.

Cotton is one of the most ancient and important commercial crops next only to food grains and is the principal raw material for a flourishing textile industry. In Karnataka, the area under cotton cultivation is 4.66 lakh ha with a production of 10.15 lakh bales and an average productivity of 370 kg/ha (Anonymous, 2011). However, the production potential of the crop has not been fully exploited due to several biotic and abiotic factors. The crop suffers from many fungal diseases, of which foliar diseases take a heavy toll. Among the foliar diseases Grey mildew (*Ramularia areola*), Alternaria blight (*Alternaria macrospora*), rust (*Phakopsora gossypii*) and Bacterial blight (*Xanthomonas axonopodis* pv. *malvacearum*) are important. Rust was considered to be of minor importance as it generally affects the crop during maturity rather at boll bursting and by aiding defoliation, hastens the maturation of the bolls. However in the recent past the disease has been found appearing early in the season. The use of fungicides has become inevitable in controlling the rust disease in the absence of suitable resistant cultivars. In view of these, fungicides need to be evaluated for their efficacy against rust disease under field conditions.

MATERIALS AND METHODS

Field experiments were conducted for three years during *kharif*, 2006-2007, 2007-2008 and 2008-2009 at Agricultural Research Station,

Dharwad Farm under rainfed conditions. A randomized block design (RBD) with 7 treatments replicated thrice with a plot size of 5.4 x 4.5 m was adopted. The Bunny *Bt* (NCS 145) variety was sown during third week of June with a spacing of 90 x 60 cm. The fungicides, Hexaconazole (0.1%), Propiconazole (0.1%), Chlorothalonil (0.2%), Tridemifon (0.1%), Difenconazole (0.1%) and Mancozeb (0.2%) were sprayed thrice at an interval of 15 days starting from the initial appearance of the disease symptoms. Untreated plot was maintained as control. In the experiments, per cent disease index was recorded by using 5 randomly selected plants in a plot by adopting 0 - 4 grading scale (Sheo Raj, 1988). These grades were converted into per cent disease indices (PDI). Yield was recorded in each treatment.

RESULTS AND DISCUSSION

The results of 2006-2007 revealed that the Propiconazole (0.1%) significantly lowered rust per cent disease index (28.50 PDI) followed by Hexaconazole (0.1%) (30.30 PDI) and Difenconazole (0.1%) (30.40 PDI) while Tridemifon (0.1%) (33.00 PDI) was the least effective. The 6 treatments of fungicides tested significantly reduced the least per cent disease index of rust disease over control. The *kapas* yield variation among the treatments was significant. However, the maximum yield of 2396.25 kg/ha was recorded in Propiconazole (0.1%) followed by

Table 1. Chemical control of cotton rust (2006-2007, 2007-2008 and 2008-2009)

Treatments and Concentration	Per cent disease index at 120 DAS**				PDC (%)	Yield (kg/ha)				Increase yield over control (%)
	2006-2007	2007-2008	2008-2009	Pooled		2006-2007	2007-2008	2008-2009	Pooled	
T₁ Hexaconazole (0.1%)	30.30(32.37)*	25.30(30.20)	27.60(31.71)	27.90(31.87)	35.42	2327.35	2275.38	2328.16	2310.30	29.03
T₂ Propiconazole (0.1%)	28.50(32.28)	25.20(30.13)	27.30(31.52)	27.70(31.76)	35.88	2396.25	2321.86	2338.44	2352.18	30.29
T₃ Chlorathalonil (0.1%)	32.20(34.58)	32.30(34.64)	32.80(34.92)	32.40(34.72)	25.00	1892.24	2081.40	2032.02	2001.89	18.10
T₄ Tridemifon (0.1%)	33.00(36.07)	35.00(36.25)	33.00(35.08)	34.60(36.02)	19.91	1802.64	2077.54	1999.38	1959.86	16.34
T₅ Difenconazole (0.1%)	30.40(33.46)	28.20(32.07)	30.80(33.72)	29.80(33.08)	31.02	2244.93	2164.78	2214.58	2208.10	25.75
T₆ Mancozeb (0.1%)	31.10(33.85)	30.20(33.35)	31.80(34.33)	31.00(33.84)	28.24	1862.89	2116.52	2193.48	2057.63	20.32
T₇ Control	42.30(40.55)	46.10(42.74)	42.90(40.93)	43.20(41.07)	-	1592.33	1664.73	1661.74	1639.60	-
SEm±	0.613	0.837	0.722	0.564		33.344	57.522	54.976	20.312	
P=0.05	1.887	2.580	2.224	1.739		102.742	177.242	169.398	62.588	

**Days after sowing; PDC: Per cent disease over control ; * Figures in parentheses indicate angular transformed values

Table 2. Economic analysis of experiment on chemical control of cotton rust (2006-2007, 2007-2008 and 2008-2009 pooled data)

Treatment	Cost of chemical (Rs/kg)	Quantity required/ha* in sprays	Total cost of chemical/ha (Rs)	Cost of cultivation (Rs)	Total cost of cultivation (Rs)	Additional cost over control (Rs)	Yield (q/ha)	Total returns (Rs)**	Net returns (Rs)	Additional returns over control (Rs)	Incremental B:C
1 2	3	4	5	6	7(5+6)	8	9	10	11(10-7)	12	13(12/8)
T₁ Hexaconazole (0.1%)	549	1500ppm	824	36552	37376	4178	2310	92412	55037	22651	5.42
T₂ Propiconazole (0.1%)	1256	1500ppm	1884	36761	38645	5447	2352	94087	55442	23056	4.23
T₃ Chlorathalonil (0.1%)	1096	1500ppm	1644	35009	36653	3455	2002	80076	43422	11036	3.19
T₄ Tridemifon (0.1%)	2582	1500ppm	3873	34799	38672	5474	1960	78394	39722	7336	1.34
T₅ Difenconazole (0.1%)	2964	1500ppm	4446	36041	40487	7289	2208	88324	47838	15452	2.12
T₆ Mancozeb (0.1%)	340	3000g	1020	35288	36308	3110	2058	82305	45997	13611	4.38
T₇ Control	-	-	-	33198	33198	-	1640	65584	32386	-	-

Hexaconazole (0.1%) (2327.35 kg/ha) and Difenconazole 0.1% (2244.93 kg/ha). (Table 1)

During 2007-2008 the results indicated that the again the Propiconazole (0.1%) significantly better in lowering rust per cent disease index (25.20 PDI) followed by Hexaconazole (0.1%) (25.30 PDI) and Difenconazole (0.1%) (28.20 PDI) while Tridemifon (0.1%) (35.00 PDI) was least effective. The 6 treatments of fungicides tested significantly reduced the least per cent disease index of rust disease over control. The *kapas* yield variation among the treatments was significant. However, the maximum yield of 2321.86 kg /ha was recorded in Propiconazole (0.1%) followed by Hexaconazole (0.1%) (2275.38 kg/ha) and Difenconazole (0.1%) (2164.78 kg/ha). (Table 1)

Similar results were observed during 2008-2009 resulted in significantly low rust per cent disease index (27.30 PDI) followed by Hexaconazole (0.1%) (27.60 PDI) and Difenconazole (0.1%) (30.80 PDI) while Tridemifon (0.1%) (33.00 PDI) was least effective. The six treatments of fungicides tested significantly reduced the least per cent disease index of rust disease over control. The *kapas* yield variation among the treatments was significant. However, the maximum yield of 2338.44 kg / ha was recorded in Propiconazole (0.1%) followed by Hexaconazole (0.1%) (2328.16 kg/ha) and Difenconazole(0.1%)(2214.58kg/ha).(Table 1)

The pooled analysis of three years revealed that Propiconazole (0.1%) was significantly lowered rust per cent disease index (27.70 PDI) followed by *on par* of Hexaconazole (0.1%) (27.90 PDI) and the next best was Difenconazole (0.1%) (29.80 PDI) while Tridemifon (0.1%) (34.60 PDI) was the least effective. The six treatments of fungicides tested significantly reduced the least per cent disease index of rust disease over control. The maximum per cent disease over control (PDC) were observed in Propiconazole (0.1%) (35.88 PDC) followed by Hexaconazole (0.1%) (35.42 PDC) and Difenconazole (0.1%) (31.02 PDC). The *kapas* yield variation among the treatments was significant. However, the maximum yield of 2352.18 kg per ha was recorded in Propiconazole(0.1%) followed

by Hexaconazole(0.1%) (2310.30 kg/ha) and Difenconazole (0.1%) (2208.10 kg/ha) and they were *on par*. The maximum per cent increased in yield over control was observed in Propiconazole (0.1%) (30.29%) followed by Hexaconazole (0.1%) (29.03%) and Difenconazole (0.1%) (25.75%) (Table 1).

Among the treatments maximum total return was obtained in Propiconazole (1%) *i.e.* 94087/-. Maximum yield of 2352 kg/ha was obtained in Propiconazole (1%) and net returns of Rs 55442 /- was recorded. Unprotected plots resulted in net returns of Rs 32386/-. Highest incremental benefit cost ratio of 5.42 was obtained with Hexaconazole (0.1%) followed by Mancozeb (0.2%) (4.38) (Table 2). The results are in accordance with Jadeja *et al.*, (1999) who studied the efficacy of triazoles and reported that best control was achieved with three sprays of hexaconazole and difenconazole and these treatments also gave more pod and fodder yield. Benagi (1991) reported that, groundnut rust can be controlled effectively by spraying with Propiconazole with higher pod and haulm yield.

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