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Chemical and Biological Management of Major Foliar Diseases of Cotton

S. N. Chattannavar ^α, G. N. Hosagoudar ^σ & S. A. Ashtaputre ^ρ

Abstract - A field experiment was conducted during *kharif* 2006-07 and 2007-08 at Agricultural Research Station, Dharwad Farm to evaluation of fungicides, Taqat 500g/ha, Taqat 750g/ha and propiconazole @ 0.1 per cent were effective in controlling the foliar diseases. Maximum yield of 2287.45 kg per hectare was recorded in Taqat 750g/ha. Seed treatment with *P. fluorescens* @ 10 g per kg + foliar spray @ 0.2 per cent on 30, 40, 50, 60, 70, 80 and 90 DAS, seed treatment with *P. fluorescens* @ 10 g per kg + foliar spray @ 0.2 per cent on 30, 50, 70 and 90 DAS, seed treatment with *P. fluorescens* @ 10 g per kg + foliar spray @ 0.2 per cent on 30, 60 and 90 DAS, Copper oxychloride (0.3%) + Streptocycline Sulphate (0.05%) gave better control of the foliar diseases than fungicidal treatments. Maximum yield of 2227.27 kg per hectare was recorded in the seed treatment with *P. fluorescens* @ 10 g per kg + foliar spray @ 0.2 per cent on 30, 40, 50, 60, 70, 80 and 90 DAS and was significantly higher over the control.

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I. INTRODUCTION

Cotton, "The White Gold" or the "King of Fibres" enjoys a pre-eminent status among all cash crops in the country and is the principal raw material for flourishing textile industry. India now produces around 290.00 lakh bales of cotton ranging from short staple to extra long staple from an area of 93.73 lakh hectares with productivity of 526 kg per hectare (Anon., 2009). In Karnataka, the area under cotton cultivation is 3.90 lakh hectares with a production of 9.00 lakh bales and an average productivity of 392 kg per hectare (Anon., 2009).

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*) and Bacterial blight (*Xanthomonas axonopodis* pv. *malvacearum*) are the important ones. The use of fungicides has become inevitable in controlling the foliar diseases in the absence of suitable resistant cultivars. In view of these fungicides need to be evaluated for their efficacy against the foliar diseases in field conditions.

II. MATERIAL AND METHODS

A field experiment was conducted during *kharif* 2006-07 and 2007-08 at Agricultural Research Station, Dharwad Farm under rainfed conditions. A randomized block design (RBD) with four treatments replicated five times with a plot size of 5.4 x 4.5 m was adopted. The Abhadita variety was sown during third week of June with a spacing of 90 x 30 cm. The fungicides Taqat (500 g/ha and 750 g/ha) and Propiconazole (0.1%) were sprayed thrice at an interval of 15 days starting from the initial appearance of the disease. Untreated plot was maintained as control. Disease grading was done using 0-4 scale (Sheo Raj, 1988). Percent disease incidence was calculated using Wheeler's formula (1969) and finally per cent disease control was calculated. Yield was recorded in each treatment.

The experiment on biocontrol of foliar diseases was conducted during *kharif* 2006-07 and 2007-08 at Agricultural Research Station, Dharwad Farm under rainfed conditions in randomized block design (RBD) with five treatments replicated four times with a plot size of 5.4 x 4.5 m. The Abhadita variety was sown during *kharif* 2006-07 and 2007-08 with a spacing of 90 x 30 cm. The different treatments were: Seed treatment with *Pseudomonas fluorescens* @ 10 g/kg seeds + foliar spray @ 0.2 per cent with interval of 10 days i.e 30, 40, 50, 60, 70, 80 and 90 DAS, seed treatment with *P. fluorescens* @ 10 g/kg seeds + foliar spray @ 0.2 per cent with interval of 20 days i.e 30, 50, 70 and 90 DAS, seed treatment with *P. fluorescens* @ 10 g/kg seeds + foliar spray @ 0.2 per cent with interval of 30 days i.e 30, 60 and 90 DAS, and Copper-oxychloride (0.3%) + Streptocycline Sulphate (0.05%). Untreated plot was maintained without spray. Disease grading was done using 0-4 scale (Sheo Raj, 1988). Per cent disease incidence was calculated using Wheeler's formula (1969) and finally per cent disease control was calculated. Yield was recorded in each treatment.

III. RESULTS AND DISCUSSION

Taqat 750g/ha treatment resulted significantly low Alternaria blight per cent disease index (26.32 PDI) followed by propiconazole (26.49 PDI) while Taqat 500 g/ha (27.36 PDI) was least effective. The three treatments of fungicides tested significantly reduced the maximum per cent disease over control. Taqat 750g/ha

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(23.11 PDC) was followed by propiconazole 0.1 per cent (22.61 PDC) and Taqat 500 g/ha (20.07 PDC). (Table 1).

Taqat 750g/ha recorded significantly low Grey mildew per cent disease index (22.36 PDI) followed by propiconazole 0.1 per cent (22.99 PDI) while Taqat 500 g/ha (24.44 PDI) was least effective. The three treatments of fungicides tested significantly reduced the maximum per cent disease over control in case of Taqat 750g/ha (26.08 PDC) followed by propiconazole 0.1 per cent (24.00 PDC) and Taqat 500 g/ha (19.21 PDC). These results are in conformity with the reports of Chattannavar *et al.* (2000a, 2006).

The kapas yield variation among the treatments was non-significant. However, the maximum yield of 2287.45 kg per ha was recorded in Taqat 750g/ha followed by propiconazole 0.1 per cent (2167.48 kg/ha) and Taqat 500 g/ha (2111.28 kg/ha).

Seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 40, 50, 60, 70, 80 and 90 DAS recorded significantly low Alternaria blight with per cent disease index was 23.89 PDI followed by seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 50, 70 and 90 DAS (24.93 PDI), seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 60 and 90 DAS (26.62 PDI) and Copper-oxychloride 0.3 per cent + Streptocycline Sulphate 0.05 per cent (26.13 PDI) were least effective. Seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 40, 50, 60, 70, 80 and 90 DAS showed maximum per cent disease over control of 19.67 PDC followed by seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 50, 70 and 90 DAS (16.17 PDC), Copper oxy-chloride (0.3%) + Streptocycline Sulphate (0.05%) (12.14 PDC) and seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 60 and 90 DAS (10.49 PDC).

Seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 40, 50, 60, 70, 80 and 90 DAS recorded significantly low Bacterial blight per cent disease index (23.61 PDI) followed by seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 50, 70 and 90 DAS (25.21 PDI), seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 60 and 90 DAS (26.09 PDI) and Copper-oxychloride 0.3 per cent + Streptocycline Sulphate 0.05 per cent (24.02 PDI) were least effective. Seed treatment with foliar spray of *P. fluorescens* on 30, 40, 50, 60, 70, 80 and 90 DAS treatment showed maximum per cent disease over control of 19.77 PDC followed by Copper-oxychloride 0.3 per cent + Streptocycline Sulphate 0.05 per cent (18.38 PDC), seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 50, 70 and 90 DAS (14.33 PDC) and seed treatment with *P. fluorescens* @ 10 g per kg

seeds + foliar spray @ 0.2 per cent on 30, 60 and 90 DAS (11.34 PDC).

Seed treatment with *Pseudomonas fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 40, 50, 60, 70, 80 and 90 DAS treatment recorded significantly low Grey mildew per cent disease index (19.46 PDI) followed by seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 50, 70 and 90 DAS (20.41 PDI), seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 60 and 90 DAS (21.95 PDI) and Copper-oxychloride 0.3 per cent + Streptocycline Sulphate 0.05 per cent (21.72 PDI) were least effective. Seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 40, 50, 60, 70, 80 and 90 DAS showed maximum percent disease over control of 24.19 PDC followed by seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 50, 70 and 90 DAS (20.49 PDC), seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 60 and 90 DAS (14.49 PDC) and Copper-oxychloride 0.3 per cent + Streptocycline Sulphate 0.05 per cent (15.38 PDC).

The kapas yield obtained from different treatments was significant. The maximum yield (2227.27 kg/ha) was recorded in seed treatment with *P. fluorescens* with foliar spray on 30, 40, 50, 60, 70, 80 and 90 DAS treatment followed by seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 50, 70 and 90 DAS (2197.40 kg/ha) treatment followed by Copper-oxychloride 0.3 per cent + Streptocycline Sulphate 0.05 per cent (2031.07 kg/ha) and seed treatment with *P. fluorescens* @ 10 g per kg seeds + foliar spray @ 0.2 per cent on 30, 60 and 90 DAS (1929.30 kg/ha) (Table 2). The treatment of *P. fluorescens* gave 40.36 per cent disease over control of Alternaria blight, 33.82 per cent disease over control of Bacterial blight and Grey mildew by 42.60 per cent disease over control (Chattannavar *et al.* 2000b).

Under field evaluation of fungicides and bioagents. Among the fungicides Taqat 750g/ha was effective in controlling the foliar diseases and the maximum yield of 2287.45 kg per hectare. Among the bioagents the seed treatment with *P. fluorescens* @ 10 g per kg + foliar spray @ 0.2 per cent on 30, 40, 50, 60, 70, 80 and 90 DAS gave better control of the foliar diseases than fungicidal treatments and the maximum yield of 2227.27 kg per hectare.

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Table 1 : Management of foliar diseases through chemicals during 2006-07 and 07-08

Sl. No	Treatments	AB PDI		Mean	PDC	GM PDI		Mean	PDC	Pooled Yield (kg/ha)
		90 DAS**	120 DAS**			90 DAS**	120 DAS**			
T ₁	Taqat 500 g/ha	25.18 (30.13)*	29.54 (32.90)	27.36	20.07	22.12 (28.04)	26.77 (31.18)	24.44	19.21	2111.28
T ₂	Taqat 750 g/ha	24.60 (29.73)	28.04 (31.95)	26.32	23.11	20.34 (26.78)	24.38 (29.60)	22.36	26.08	2287.45
T ₃	Propiconazole (0.1%)	24.66 (29.80)	28.32 (32.14)	26.49	22.61	20.66 (27.06)	25.32 (30.20)	22.99	24.00	2167.48
T ₄	Control	34.19 (35.79)	34.28 (35.85)	34.23	-	27.73 (31.76)	32.77 (34.94)	30.25	-	2093.39
	SE m±	1.451	0.496			0.817	0.692			100.222
	CD at 5%	4.472	1.529			2.516	2.134			NS

**Days after sowing

PDI: Per cent disease index

GM: Grey mildew

PDC: Per cent disease over control

AB: Alternaria blight

* Figures in parentheses indicate angular transformed values.

Table 2 : Evaluation of *Pseudomonas. Fluorescens* against major foliar diseases of cotton - (pooled data of 2006-07 and 07-08)

Sl. No	Treatments	AB PDI		Mean	PDC	BB PDI		Mean	PDC	GM PDI		Mean	PDC	Pooled Yield (kg/ha)
		90 DAS**	120 DAS**			90 DAS**	120 DAS**			90 DAS**	120 DAS**			
T ₁	Seed treatment with <i>P. fluorescens</i> @ 10 g/kg seed + foliar spray @ 0.2% on 30,40,50,60,70,80 and 90 DAS **	20.73 (27.06)	27.06 (31.37)	23.89	19.67	18.3 (25.33)	28.93 (32.52)	23.61	19.77	16.04 (23.58)	22.88 (28.59)	19.46	24.19	2227.27
T ₂	Seed treatment with <i>P. fluorescens</i> @ 10 g/kg seed + foliar spray @ 0.2% on 30,50,70 and 90 DAS **	21.62 (27.69)	28.25 (32.08)	24.93	16.17	20.45 (26.85)	29.98 (33.21)	25.21	14.33	17.60 (24.80)	23.22 (28.79)	20.41	20.49	2197.40
T ₃	Seed treatment with <i>P. fluorescens</i> @ 10 g/kg seed + foliar spray @ 0.2% on 30,60 and 90 DAS**	24.91 (29.93)	28.33 (32.14)	26.62	10.49	22.34 (28.18)	29.84 (33.09)	26.09	11.34	18.7 (25.62)	25.21 (30.13)	21.95	14.49	1929.30
T ₄	Copperoxychloride 0.3% + Streptocyclin Sulphate 0.05%	23.68 (29.13)	28.58 (32.33)	26.13	12.14	18.98 (25.85)	29.06 (32.65)	24.02	18.38	20.06 (26.64)	23.39 (28.93)	21.72	15.38	2031.07

T ₅	Control	29.84 (33.09)	29.65 (32.96)	29.74	-	27.40 (31.56)	31.46 (34.14)	29.43	-	23.4 (28.93)	27.95 (31.88)	25.67	-	1718.06
	SE m±	0.273	0.366			0.366	0.555			0.423	0.448			48.349
	CD at 5%	0.841	1.129			1.128	1.711			1.303	1.381			148.979

**Days after sowing

PDI: Per cent disease index

PDC: Per cent disease over control

GM: Grey mildew

AB: Alternaria blight

BB: Bacterial blight

* Figures in parentheses indicate angular transformed values.