

Efficacy of *Trichoderma viride* and *T. harzianum* against foliar diseases of cotton

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ABSTRACT: Seed treatment followed by foliar sprays of Tv97, ThKSD (PDBC), Pf 1 (TNAU), Pf 1 (CICR), Pf (ANGRAU), carbendazim and copper oxychloride at 60, 90 and 120 days after planting were imposed in cotton hybrid, Bunny *Bt* during 2010 and 2011 to evaluate the efficacy of *Trichoderma* isolates against foliar diseases of cotton. All the treatments significantly reduced rust disease. During *kharif* 2010, Tv97 and ThKSD recorded the lowest intensity of rust (18.22% and 18.33%, respectively). *Alternaria* leaf spot was lowest (9.67%) with Pf 1 (CICR) during 2011; Tv97 and ThKSD as well as Pf 1 (TNAU) were statistically *on par* with Pf 1 (CICR). Lowest intensity of bacterial blight (10.08%) was recorded with copper oxychloride followed by Pf 1 (TNAU and CICR). Both Tv97 and ThKSD were statistically *on par* in reducing bacterial blight. Pf (ANGRAU) gave maximum yield of 597.88 kg/ha and *on par* with Tv97 and ThKSD in 2010. Pf-1 (TNAU) gave maximum yield of 1375 kg/ha during 2011, other treatments being *on par*. Benefit cost ratio varied from 1.17 to 1.38 in different treatments as against 0.96 in control. It is concluded that Tv97 and ThKSD could be part of integrated disease management in cotton.

Key words: Cotton, foliar diseases, *Pseudomonas*, *Trichoderma*

The low productivity in Andhra Pradesh is attributed to cultivation of more than 60 per cent of cotton under rainfed conditions by small and marginal farmers. Plant protection costs constitute considerable part of cost of cultivation. Developing low cost technologies will help to reduce the burden of poor tenant farmers. Evaluation of biocontrol agents for management of cotton diseases goes in this direction. During present investigations *Trichoderma viride* and *T. harzianum* isolates (PDBC) were evaluated against foliar diseases of cotton at Regional Agricultural Research Station, Lam, Guntur.

MATERIALS AND METHODS

Cotton hybrid Bunny *Bt* was raised in plots of 31.5 sq m with a spacing of 105 x 60 cm during *kharif* 2010 and 2011. Eight treatments, replicated thrice were imposed in randomized block design, *viz.*, T₁ – Seed treatment (ST) with

Tv 97 (PDBC) @ 6g/kg seed + Foliar spray (FS) @ 10g/l at 60, 90 and 120 days after sowing (DAS); T₂ - ST with ThKSD (PDBC) @ 6g/kg seed + FS @ 10g/l at 60, 90 and 120 DAS; T₃- ST with Pf-1 (TNAU) @ 10g/kg seed + FS @ 10g/l at 60, 90 and 120 DAS; T₄ - ST with Pf-1 (CICR) @ 10g/kg seed + FS @ 10g/l at 60 90 and 120 DAS; T₅ - ST with Pf (ANGRAU) @ 10g/kg seed + FS @ 10g/l at 60 90 and 120 DAS; T₆ - ST with carbendazim @ 2g/kg seed + FS (@ 0.1%) at 60 90 and 120 DAS; T₇- ST with copper oxychloride @ 3g/kg seed + FS @ (0.3%) plus streptomycin (0.01%) 60, 90 and 120 DAS and T₈ - Water spray. Data on foliar diseases including bacterial blight, *Alternaria* leaf spot and rust were recorded using 0 to 4 scale. Depending on the scores collected, per cent disease intensity (PDI) was calculated by using the formula :

$$\text{PDI} = \frac{\text{Sum of numerical ratings}}{\text{Total number of leaves observed} \times \text{Maximum grade}} \times 100$$

Per cent disease control in each treatment was calculated. Treatment wise yield data was recorded. Decrease / increase in the disease/ yield over control were calculated using the formula:

$$\frac{T - C}{C} \times 100$$

Where;

T = PDI or yield (kg/ha) of respective treatment

C = PDI or yield of control

Treatment wise net returns were calculated and benefit cost ratio (BCR) was derived by dividing gross returns by gross expenditure. Incremental benefit cost ratio (IBCR) was calculated by dividing additional benefit with additional cost.

RESULTS AND DISCUSSION

All the treatments significantly reduced rust disease during *kharif* 2010; Pf 1 (CICR) recorded lowest intensity of rust (18.03%) followed by Tv97 (18.22%) and ThKSD (18.33%). Both ThKSD and Pf (ANGRAU) gave maximum yield of 597.88 kg/ha while Pf 1 (TNAU), carbendazim and Tv97 were *on par* with them (Table 1). The results indicate efficacy of Tv97 and ThKSD against cotton rust disease.

During 2011, *Alternaria* leaf spot was lowest (9.67%) with Pf (CICR); Pf 1 (TNAU), ThKSD and Tv97 were statistically *on par* with it. Lowest intensity of bacterial blight (10.08%) was recorded with copper oxychloride + streptomycin followed by Pf 1 (TNAU and CICR). Both Tv97 and ThKSD were statistically *on par* in reducing

Table 1. Efficacy of *Trichoderma viride* and *T. harzianum* against cotton rust disease

Treatment	Disease intensity (%)	Disease control (%)	Yield (kg/ha)	Increase in yield (%)
T₁ - Seed treatment (ST) with Tv 97 (PDBC) @ 6g/kg seed + foliar spray (FS) @ 10g/l at 60, 90 and 120 DAS	18.22 (25.25) ^a	49.67	519.58 ^a	58.15
T₂ - ST with Th KSD (PDBC) @ 6g/kg seed + FS @ 10g/l at 60, 90 and 120 DAS	18.33 (25.33) ^a	47.98	597.88 ^a	73.94
T₃ - ST with Pf 1 (TNAU) @ 10g/kg seed + FS @ 10g/l at 60, 90 and 120 DAS	21.03 (27.28) ^a	41.91	566.13 ^a	72.32
T₄ - ST with Pf 1 (CICR H1a) @ 10g/kg seed + FS @ 10g/l at 60 90 and 120 DAS	18.03 (25.10) ^a	50.60	426.98 ^b	29.97
T₅ - ST with Pf (ANGRAU) @ 10g/kg seed + FS @ 10g/l at 60 90 and 120 DAS	19.93 (26.49) ^a	46.33	597.88 ^a	81.97
T₆ - ST with Carbendazim @ 2g/kg seed + FS @ (0.1%) at 60 90 and 120 DAS	21.89 (27.87) ^a	39.53	521.17 ^a	58.64
T₇ - ST with COC @ 3g/kg seed + FS @ (0.3%) plus Streptomycin (0.01%) 60, 90 and 120 DAS	21.33 (27.49) ^a	41.08	489.42 ^b	48.97
T₈ - Water spray	36.20 (36.39) ^b		328.53 ^c	
CD (p=00.5)	6.13		84.47	
CV (%)	16.0		9.6	

*Figures in parentheses were transformed values. Figures marked with same letter do not differ significantly

bacterial blight. Pf 1 (TNAU) gave maximum yield of 1375 kg/ha during 2011, other treatments recorded *on par* yields.

Pooled data on economics of efficacy of *T. viride* and *T. harzianum* revealed that benefit cost ratio (BCR) varied from 1.17 to 1.38 in different treatments as against 0.96 in control (Fig.1). Highest BCR of 1.38 was obtained using Pf 1 (TNAU) followed by Th KSD (1.31) and Pf (ANGRAU) with 1.28 BCR as against 0.96 in the control. Incremental Benefit Cost Ratio of 8.46 to 15.67 was obtained in different treatments. Pf 1 (TNAU) gave maximum incremental cost benefit ratio (ICBR) of 15.67 followed by carbendazim (13.82) and Th KSD (13.17) while Tv 97 recorded 9.72.

Several strains of fluorescent pseudomonads not only enhanced seed germination but also controlled root rot and seedling diseases of cotton (Laha *et al.*, 1992). *Pseudomonas fluorescens* (CHAO) was found effective against Alternaria blight of cotton

(Chattannavar *et al.*, 2001). *T. viride* and *P. fluorescens* isolate Pf -1 significantly reduced Alternaria leaf spot. Gholve *et al.*, (2012) recorded the highest inhibition (63.64%) of *A. macrospora* of cotton with *T. viride*. Seed treatment with *P. fluorescens* @ 10 g/kg followed by foliar spray @ (0.2%) significantly reduced cotton Alternaria leaf spot and increased yield (Bhattiprolu and Prasad Rao, 2009; Bhattiprolu, 2010).

Based on the efficacy and cost effectiveness of ThKSD and Tv97 (PDBC) against rust, bacterial blight and Alternaria leaf spot diseases in cotton, it is concluded that they could be part of integrated disease management in cotton.

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Table 2. Efficacy of *Trichoderma viride* and *T. harzianum* against cotton diseases

Treatment	Alternaria leaf spot		Bacterial blight		Yield (kg/ha)	Increase in yield (%)
	Intensity (%)	Control (%)	Intensity (%)	Control (%)		
T₁ - Seed treatment (ST) with Tv 97 (PDBC) @ 6g/kg seed + Foliar Spray (FS) @ 10g/l at 60, 90 and 120 DAS	13.0(21.13) ^a	44.28	18.06(25.14) ^c	35.5	1259 ^b	23.92
T₂ - ST with Th KSD (PDBC) @ 6g/kg seed + FS @ 10g/l at 60, 90 and 120 DAS	12.94(21.05) ^a	44.53	18.22(25.25) ^c	34.93	1175 ^b	15.65
T₃ - ST with Pf 1 (TNAU) @ 10g/kg seed + FS @ 10g/l at 60, 90 and 120 DAS	11.67(19.96) ^a	49.98	14.0(21.97) ^b	50.0	1375 ^a	35.33
T₄ - ST with Pf 1 (CICR) @ 10g/kg seed + FS @ 10g/l at 60 90 and 120 DAS	9.67(18.1) ^a	58.55	14.89(22.67) ^b	46.82	1259 ^b	23.92
T₅ - ST with Pf (ANGRAU) @ 10g/kg seed + FS @ 10g/l at 60 90 and 120 DAS	15.17(22.91) ^b	34.98	21.0(27.28) ^c	25.0	1153 ^b	13.48
T₆ - ST with Carbendazim @ 2g/kg seed + FS @ (0.1%) at 60 90 and 120 DAS	21.11(27.35) ^c	9.52	24.08(29.37) ^d	14.0	1164 ^b	14.57
T₇ - ST with COC @ 3g/kg seed + FS @ (0.3%) plus Streptocycline (0.01%) 60, 90 and 120 DAS	17.42(24.65) ^b	25.33	10.08(18.49) ^a	64.0	1238 ^b	21.85
T₈ - Water spray	23.33(28.86) ^c		28.0(31.95) ^e		1016 ^c	
CD(p=0.05)	4.473		3.681		107.84	
CV (%)	16.5		11.4		5.1	

* Figures in parenthesis are transformed values. Figures with same letter do not differ significantly

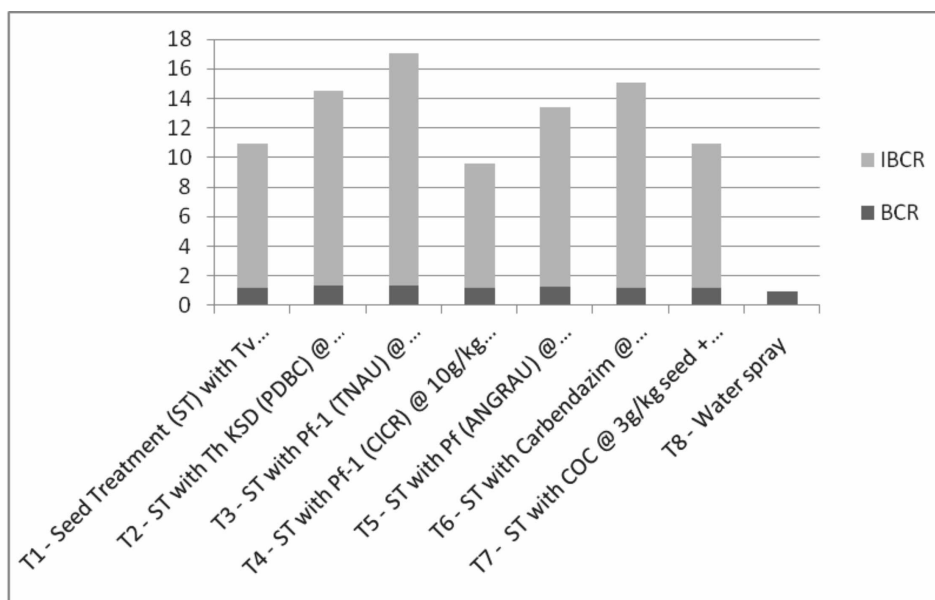


Fig. 1. Economics of efficacy of *Trichoderma viride* and *T. harzianum* against cotton diseases

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