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Evaluation of Pyraclostrobin 20% WG for the control of fungal diseases in cotton

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Abstract
Efficacy of Pyraclostrobin 20% WG (GSP) was tested at three doses of 375 g/ha, 500 g/ha and 625 g/ha in comparison with market sample (375 g/ha and 500 g/ha) and carbendazim 50% WP @ 250 g/ha at Regional Agricultural Research Station, Lam, Guntur, during *kharif* 2015 - 2016 against fungal diseases of cotton. Pyraclostrobin 20% WG (12.33% to 15.33%) was superior to carbendazim (18%) against Alternaria leaf spot. Different doses of Pyraclostrobin 20% WG were at par with 48.57% to 64.77% reduction in disease intensity. Grey mildew was controlled to the tune of 66.67% to 76.56% and rust disease from 40.74% to 58.04% indicating the efficacy of Pyraclostrobin 20% WG against major fungal diseases in cotton. Different treatments yielded 16.70 to 18.05 q/ha which were significantly *at par*. Highest increase in yield was recorded with carbendazim (21.3%) followed by Pyraclostrobin @ 625g/ha (21.1%). Benefit cost ratio varied from 1.05 to 1.17 in different treatments.

Keywords: Cotton, efficacy, fungal diseases, Pyraclostrobin

Introduction
Cotton is an important commercial crop in India with a production of 377 lakh bales of 170 kg lint in 2017-2018 from an area of 122.35 lakh ha with a productivity of 524 kg/ha, which is far behind the leading countries. Andhra Pradesh stood 7th in area (5.44 lakh ha) but 5th in production (22.0 lakh bales) and 3rd in productivity (688 kg/ha) during 2017-2018 (Anonymous, 2018) [1]. Cotton crop is affected by a number of foliar diseases throughout the season. Among the fungal diseases, *Alternaria* leaf spot/blight is the most common causing defoliation and yield losses to the tune of 38.23% in cotton variety LRA 5166 (Bhattiprolu and Prasada Rao, 2009) [2] and 33.43% in variety Jayadhar (Chattannavar *et al*., 2010) [3]. Spraying Copper fungicides (0.25%) mixed with streptocycline (0.01%) control foliar diseases (Mayee and Mukewar, 2007) [4]. Mancozeb (0.25%) was superior in managing Alternaria leaf spot and increasing cotton yields (Ramagour, 2007) [5]. Grey mildew, once a serious problem for diploid cottons especially in central India has now become a major problem in *Bt* cotton hybrids in central and south zone causing losses to the tune of 38.38 % (Bhattiprolu 2012) [6] and 29.20% (Monga *et al*., 2013) [7]. Cotton leaf rust caused by *Phakopsora gossypii* (Arth.) Hirat. f., though occurs during later part of crop season it may cause losses in late sown as well as prolonged irrigated crop up to 21.7% in Bunny Bt (Monga *et al*., 2013) [7] and 34.05% in RCH 2 BG II (Bhattiprolu, 2015) [8]. In order to explore the possibility of the use of new chemicals against fungal foliar diseases in cotton, Pyraclostrobin was tested against fungal diseases in cotton.

Materials and Methods
A field trial was laid out at Regional Agricultural Research Station, Lam, Guntur during *Kharif* 2015 – 2016. Cotton hybrid Jaadoo BG II was sown on 28.07.2015 in plots of 25 sq. m. adopting a spacing of 105cm x 60cm. Eight treatments were imposed with three replications in randomized block design as detailed below:

Treatment details

Treatment		Dosage/ha(Formulation)
T_1	Pyraclostrobin 20% WG (GSP sample)	375 gm
T_2	Pyraclostrobin 20% WG (GSP sample)	500 gm
T_3	Pyraclostrobin 20% WG (GSP sample)	625 gm
T_4	Pyraclostrobin 20% WG (Market sample)	375 gm
T_5	Pyraclostrobin 20% WG (Market sample)	500 gm
T_6	Carbendazim 50% WP	250 gm
T_7	Untreated control (water only)	--
T_8	Pyraclostrobin 20% WG (GSP sample) (for Phytotoxicity evaluation only)	1000 gm

Three sprays were given at 10 days interval with first spray starting immediately after the appearance of the Alternaria leaf spot on 10.09.2015 and second spray on 20.09.2015. Grey mildew disease symptoms appeared on the crop during third week of November and rust disease symptoms during second week of December; third spray was given on 20.11.2015. Data on Alternaria leaf spot, grey spot and rust was recorded using 0 to 4scale given by Raj (1988) [9]: 0 = No disease; 1 = 0 to 5%; 2 = 5.1 to 20%; 3 = 20.1 to 40% and 4 = >40% leaf area are diseased. Depending on the scores collected, per cent disease index (PDI) was calculated by using the formula of Wheeler (1969) [10]:

$$PDI = \frac{\text{Sum of numerical ratings}}{\text{Total number of leaves scored x maximum rating}} X\ 100$$

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

$$\frac{T - C}{C} X\ 100$$ 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 was derived by dividing gross returns by gross expenditure.

The phytotoxicity symptoms (leaf injury on tips/surface, necrosis, wilting, vein clearing, hyponasty and epinasty) were recorded in the plots of all the treatments including Pyraclostrobin 20% WG (GSP sample) @ 1000 gm/ha at 1, 3, 5, 7 and 10 days after each application. The leaf injury on tips/surface was recorded based on 1-10 scale (where 1=0-10%, 2=11-20%, 3=21-30%, 4=31-40%, 5=41-50%, 6=51-60%, 7=61-70%, 8=71-80%, 9=81-90%, 10=91-100%).

Results and Discussion

All the treatments were found significantly superior to control. The PDI of Alternaria blight varied from 6.00 to 9.33 seven days after first spray as against 14.00 in the control (Table 1).

Table 1: Bioefficacy evaluation of Pyroclostrobin 20% WG for the control of diseases of cotton

Treatment		Per cent disease index (mean of three replications)					Seed cotton yield (Q/ha)
		Alternaria leaf blight			Grey mildew	Rust	
		7 days after I spray	7 days after II spray	At crop harvest	At crop harvest	At crop harvest	
T_1	Pyraclostrobin 20% WG (GSP sample @ 375 gm /ha)	8.00^a (16.43)	11.67^a (19.96)	14.67^a (22.51)	9.00^a (17.46)	14.67^a (22.51)	16.94^a
T_2	Pyraclostrobin 20% WG (GSP sample @ 500 gm /ha)	6.67^a (14.95)	9.33^a (17.76)	12.67^a (20.84)	7.67^a (16.06)	12.67^a (20.84)	17.86^a
T_3	Pyraclostrobin 20% WG (GSP sample @ 625 gm /ha)	6.00^a (14.18)	9.00^a (17.46)	12.33^a (20.53)	6.33^a (14.54)	11.33^a (19.64)	18.02^a
T_4	Pyraclostrobin 20% WG (Market sample @ 375 gm /ha)	8.33^a (16.74)	12.00^a (20.27)	15.33^a (23.03)	9.00^a (17.46)	13.67^a (21.68)	16.70^a
T_5	Pyraclostrobin 20% WG (Market sample @ 500 gm /ha)	7.00^a (15.34)	10.00^a (18.44)	13.00^a (21.13)	6.33^a (14.54)	11.67^a (19.96)	17.69^a
T_6	Carbendazim 50% WP (250 gm/ha)	9.33^b (17.76)	13.67^b (21.68)	18.00^b (25.10)	9.00^a (17.46)	16.00^b (23.58)	18.05^a
T_7	Untreated control (water only)	14.00^c (21.97)	27.00^c (31.31)	35.00^c (36.27)	27.00^b (31.31)	27.00^c (31.31)	14.88^b
S.E ±		0.800	0.993	1.139	0.933	1.353	58.881
C.D at 5%		16.4	13.1	11.4	15.2	15.3	5.9

Figures in the parentheses are arcsine transformed values
The figures indicated with same alphabet are not significantly different.

After the second spray PDI was in the range of 9.00% to 13.67% while the control recorded 27.00. At harvest control recorded 35.00 PDI whereas the treated plots expressed 12.33 to 18.00 PDI of Alternaria blight. It was thus observed that all the treatments were superior to control treatment and Pyraclostrobin 20% WG was statistically superior to carbendazim in controlling Alternaria leaf blight. Different doses of Pyraclostrobin 20% WG were at par in their efficacy against Alternaria blight. The per cent reduction in Alternaria blight disease over control calculated based on final observation showed disease reduction to an extent of 48.57% to 64.77% (Fig.1). The grey mildew and rust appeared at later

stage of the crop growth. The PDI of grey mildew was in the range of 6.33 to 9.00 in different treatments as against 27.00 in control. Grey mildew was controlled to the tune of 66.67% 76.56% in different treatments. Rust PDI was 11.33 to 16.0 in the treated plots, as against 27.0% in untreated plots. Reduction in rust disease varied from 40.74% to 58.04% in different treatments (Fig.1). Pyraclostrobin 20% WG treatments were found superior than carbendazim 50% WP. Data recorded on alternaria leaf blight, grey mildew and rust diseases indicated that Pyraclostrobin 20% WG is effective against these important diseases. Further it was observed that all the treatments were non phytotoxic to cotton crop as no phytotoxicity symptoms were observed.

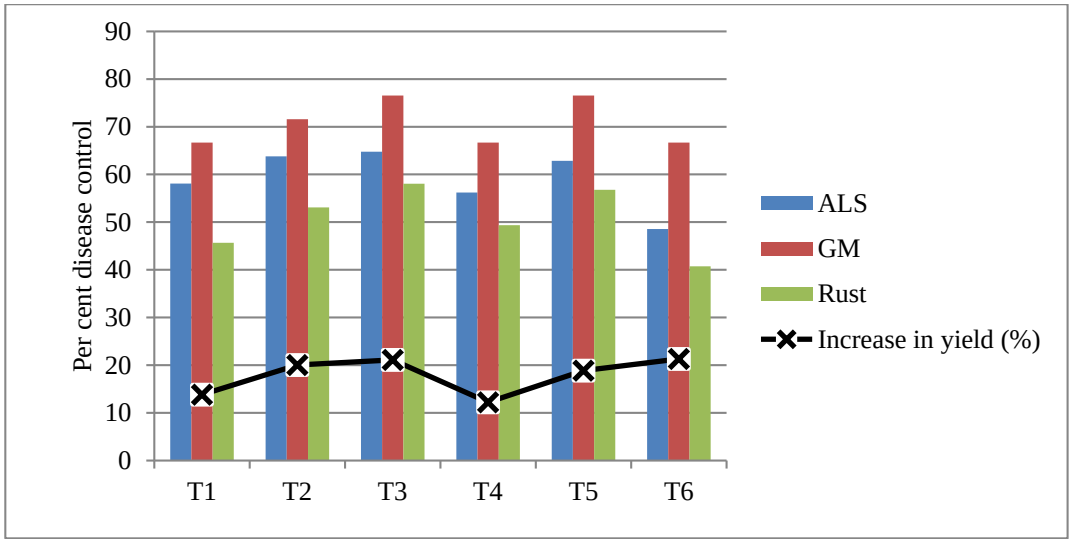

Fig 1: Efficacy of Pyraclostrobin against cotton diseases

Information on the efficacy of topical applications of strobilurins is limited. In cotton, strobilurin fungicides are extensively used to manage Rhizoctonia seedling disease and target leaf spot caused by *Corynespora cassiicola* (Woodward *et al*., 2016) [11]. Resistance breaking by these fungi was already reported by Takeuchi *et al*. (2006) [12] and Olaya *et al*. (2013) [13].

Propineb at a higher concentration of 0.4 per cent checked the development of Cercospora and Alternaria leaf spots at Ludhiana centre (Singh *et al*., 2010) [14]. They also reported that Copper oxychloride @ 0.25 per cent was effective in controlling fungal leaf spots and giving highest yield. Propiconazole at 0.1 per cent was reported effective in preventing losses due to Alternaria leaf spot in cotton (Bhattiprolu and Prasada Rao, 2009 [2]. Carbendazim 0.1% was recommended to avoid losses due to grey mildew (Bhattiprolu, 2012) [6].

Yield data revealed that maximum yield of 18.05 q/ha was recorded with T_6 followed by T_3 (18.02q/ha) while control plots recorded lowest yield of 14.88 q/ha (Table 1). All the treatments resulted in statistically superior yields as compared to control (14.88q/ha). Highest increase in yield was also recorded with carbendazim (21.3%) followed by Pyraclostrobin @ 625g/ha (21.1%) (Fig. 1). Economics of efficacy of Pyroxystrobin 20%WG against foliar diseases of cotton revealed lowest gross expenditure (Rs 78750/-) with highest gross returns (Rs 78750/-) and thus net profit of Rs 13305/- with carbendazim among different treatments. Next best treatment was Pyroxystrobin 20%WG (GSP sample) @ 500g/ha with net profit of Rs 8401/-. Thus benefit cost ratio was highest with carbendazim (1.17) followed by Pyraclostrobin @ 500g/ha (1.1).

Table 2: Economics of efficacy of Pyroxystrobin 20%WG against foliar diseases of cotton

Treatment		Cost of spraying Rs	Gross expenditure Rs	Additional yield kg/ha	Gross returns Rs.	Net profit Rs.	Benefit Cost Ratio
T_1	Pyraclostrobin 20% WG (GSP sample @ 375 gm /ha)	4800	80865	206	86394	5529	1.07
T_2	Pyraclostrobin 20% WG (GSP sample @ 500 gm /ha)	5700	82685	298	91086	8401	1.1
T_3	Pyraclostrobin 20% WG (GSP sample @ 625 gm /ha)	8400	85545	314	91902	6357	1.07
T_4	Pyraclostrobin 20% WG (Market sample @ 375 gm /ha)	5400	81225	182	85170	3945	1.05
T_5	Pyraclostrobin 20% WG (Market sample @ 500 gm /ha)	6900	83715	281	90219	6504	1.08
T_6	Carbendazim 50% WP (250 gm/ha) @900/kg	1575	78750	317	92055	13305	1.17
T_7	Untreated control (water only)	900	74905	0	75888	983	1.01

Conclusion

The study revealed broadspectrum activity of Pyraclostrobin 20% WG against Alternaria leaf blight, grey mildew and rust diseases in cotton with statistically on par yields with carbendazim and with no phytotoxicity. In view of high cost, judious use of Pyraclostrobin 20% WG @ 500g/ha is suggested for the control of these diseases in cotton.

References

1. Anonymous. Annual Report, All India Coordinated Cotton Improvement Project, Coimbatore, 2018.
2. Bhattiprolu SL, Prasada Rao MP. Estimation of crop losses due to Alternaria leaf spot in cotton. J Indian Soc. Cotton Impr. 2009; 34(3):151-154.
3. Chattannavar SN, Hosagoudar GN and Ashtaputre SA. Crop loss estimation due to foliar diseases in cotton. Karnataka J Agric. Sci. 2010; 23:559-601.
4. Mayee CD, Mukewar PA. Loss inducing diseases of cotton and their management with special reference to Andhra Pradesh. In: Cotton in Andhra Pradesh. Rao N G P, Appa Rao A and Siddiq E A. (Eds), Farm and Rural Science Foundation and ANGRAU, Hyderabad, 2007, 197-199.
5. Ramagour G. Disease scenario in Bt cotton with special reference to Alternaria leaf spot. Karnataka J Agric. Sci. 2007; 20:928-29.
6. Bhattiprolu SL. Estimation of crop losses due to grey mildew (*Ramularia areola* Atk.) disease in Bt cotton hybrid. J Cotton Res. Dev. 2012; 26(1):109-112.
7. Monga D, Sree Lakshmi B, Prakash AH. Crop losses due to important cotton diseases. Central Institute for Cotton Research, Regional Station, Sirsa-125055, India. 2013; 1:23.
8. Bhattiprolu SL. Estimation of crop losses due to rust *Phakopsora gossypii* (Arth.) Hirat.f disease in Bt cotton hybrid. J Cotton Res. Dev. 2015; 29(2):301-304.
9. Raj S. Grading system for cotton diseases. Nagpur. CICR. Tech. Bull., 1988, 1-7.
10. Wheeler BEJ. An Introduction to Plant Diseases. John Wiley and Sons Limited, London. 1969, 301.
11. Woodward JE, Dodds DM, Main CL, Barber LT, Boman RK, Whitaker JR *et al*. Evaluation of Foliar Applications of Strobilurin Fungicides in Cotton across the Southern United States. Journal of Cotton Science. 2016; 20(2):116-124.
12. Takeuchi T, Kubo C, Ishii H. Sensitivity of Chiba Prefecture isolates of *Corynespora cassiicola*, the cause of Corynespora leaf spot on cucumber, to several fungicides. Annu. Rep. Kanto-Tosan Plant Protection Society. 2006; 53:55-60.
13. Olaya G, Satmiento L, Edlebeck K, Buitrago C, Sierotzki H, Zaunbrecher J *et al*. Azoxystrobin (QoI) resistance monitoring of *Rhizoctonia solani* isolates causing rice sheath blight in Louisiana. Phytopathology. 2013; 103(2):S2.106.
14. Singh D, Mohan C, Rewal HS, Brar JS. Management of foliar diseases in Bt cotton with agrochemicals. J Mycol. Pl. Path. 2010; 40(4):560-563.