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Evaluation of efficacy of different fungicides against false smut disease in rice

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ABSTRACT

An attempt was made to evaluate the efficacy of fungicides against the false smut disease of ricecaused by *Ustilaginoidea virens* at farmer's field in different locations of Bhagalpur district (Bihar) during the two consecutive *kharif* seasons of 2013 and 2014. The results revealed that all the tested fungicides showed significantly better performance over control (Farmers practice). Technology option (TO_3) seed treatment with Carbendazim @ 2g/kg seed and two sprays of Propiconazole @ 1 ml/lhas shown the minimum disease severity (20.3%) over the all technology option and farmers practice (control). Significantly maximum grain yields (36.5 q/ha) was also obtained from technology options (TO_3), which was statistically superior over TO_2seed treatment with Carbendazim @ 2g/kg seed and one foliar spray of Propiconazole @1ml/l and technology option (TO_1) seed treatment with Carbendazim @ 2g/kg seed and one foliar spray of Carbendazim @2g/l, whereas minimum yield (18.3 q/ha) was obtained from control.

Keywords: Fungicides, False smut, Rice, Grain yield

INTRODUCTION

Rice is staple food crop for India, plays a very significant role in National food security system. Though India is the major producer of rice its productivity is low as compared to world average (Singh *et al.*, 2017). Among all rice-growing states in India, Bihar is at 6th rank in area and production of rice and at 13th rank in productivity and occupied ~3.27 m ha, 6.38 mt production and 1.95t/ha respectively, which contributes ~7.45% in total area and 6.1% production of India.

One of the major reasons for low production and productivity in rice are various biotic factors affecting the crop, which renders estimated annual yield and quality losses of 8 to 10 percent (Subash *et al.*, 2016 and Kumar *et al.*, 2016). Among them, some diseases occur wherever rice is grown and they are of national as well as of regional importance (Singh *et al.*, 2012).

Few of these diseases reach to epidemic proportion and cause serious crop losses while others cause only negligible losses. Among major rice diseases, false smut caused by *Ustilaginoidea virens* (Cooke) Takahashi is globally and economically important disease of rice (Elazegui *et al.*, 2009). False smut is also known as green smut and present in most of the major rice growing areas of tropical Asia and in Italy, Australia, South America, and the United States. The epidemic of false smut disease of rice was reported in Tamil Nadu and later in many countries (Elazegui *et al.*, 2009).In India the disease has been observed in severe form since 2001 in major rice-growing states, *viz*., Haryana, Punjab, UP, Uttaranchal, Tamil Nadu, Karnataka, Andhra Pradesh and Bihar (Ladhalakshmi *et al.*, 2012). False smut contributes a major role in crop loss (2-75%) of rice in north India and disease incidence of 10-20% and 5-85%, respectively has been reported from Punjab and Tamil Nadu on different rice cultivars. In recent years, its outbreak might be possibly due to high input cultivation, increased use of hybrid varieties, and climate change (Lu *et al.*, 2009). False smut is nowadays considered an emerging disease in many rice-growing countries.

MATERIALS AND METHODS

An On-Farm Trial (OFT) was carried out for comparative evaluation of technology options (fungicides) *viz.* carbendazim, propiconazole and combination of carbendazim and propiconazoleto control false smut disease of rice by KrishiVigyan Kendra, Bhagalpur (Bihar) during *kharif* 2013 and *kharif* 2014 (two consecutive years) at farmer's field of Bhagalpur district. The study region falls under sub-humid, sub-tropical monsoon type of climate (Agro climatic Zone III B). The mean annual rainfall of the region is 1200 mm, most of which is contributed by south-west monsoon from July to September.

During these two years of study, total 10on-farm trials was carried out at different locations. Rice var. Shahbhagi (21days old) seedlings were planted with20x15cm spacing in randomized block design with three replications. Seed treatment was carried out with fungicide carbendazim 50% @ 2 g/kg before sowing in the nursery. The recommended dose of different fungicides was applied by hand sprayer at booting and milking stage. Average data of disease severity (2013 and 2014) were recorded using 0-9 disease rating scale (Table 1) as described by Anonymous (2002). All trials were conducted under the supervision of a team of experts. In trial plots, all agronomic practices were emphasized as per zonal package of practices (Zone III B). The farmer's practices were followed in case of local checks. Fertilizer application and intercultural operation were performed as and when needed. The data on output were collected from trial plots and finally, the yield,

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cost of cultivation, gross returns; net returns with the benefit-cost ratio were worked out.

Table 1: Disease rating scale (Anonymous, 2002)

Scale	Infected florets
0	No incidence
1	Less than 1%
3	1-5%
5	6-25%
7	26-50%
9	51-100%

RESULTS AND DISCUSSION

Influence of Technology Option on Disease Dynamics

The result presented in Table 2 indicated that a maximum number of infected tillers was recorded in farmers practice (53.33tillers/m^2) while minimum (18.56 tillers/m^2) in TO_3 followed by TO_1 (29.75 tillers/m^2) and TO_2 (27.12 tillers/ m^2). Similarly, the maximum number of smutted balls/panicle was recorded in farmers practice (4.87 smutted balls/panicle) while minimum (1.97 smutted balls/panicle) in TO_3 followed by TO_2 (3.23 smutted balls/panicle) and TO_1 (3.57 smutted balls/panicle). Disease severity grade was least (5) in TO_3 which was followed by TO_2 and TO_1 with disease severity grade of 7. However, the maximum disease severity grade (9) was observed in control (farmers practice).Considering percentage of disease incidence, technology option (TO_3) seed treatment with Carbendazim @ 2g/kg seed and two foliar Spray of Propiconazole @1ml/l gave minimum disease severity (20.3%) followed by technology option (TO_2) seed treatment with Carbendazim @ 2g/kg seed and one foliar spray of Propiconazole @1ml/l (32.0%) and technology option (TO_1) seed treatment with Carbendazim @ 2g/kg seed and one foliar Spray of Carbendazim @2g/l (36%). Disease severity per cent of TO_1 (36) and TO_2 (32) was statistically at par with each other. Maximum disease severity (56.8%) was found with farmers practice.

Table 2: Infected tillers, smutted ball/panicle and disease severity scale

Technology Option	Infected tillers/ m^2 (no.)	Smutted ball / panicle (no.)	Disease severity scale	Disease severity* (%)
TO_1: Seed treatment with carbendazim @ 2g/kg seed+ One spray of carbendazim @ 2g/l. water at milking stage	29.75	3.57	7	36.0
TO_2: Seed treatment with carbendazim @2g/kg seed+One spray of Propiconazole @ 1ml/l. water at milking stage	27.12	3.23	7	32.0
TO_3: Seed treatment with carbendazim @2g/kg seed+ Two sprays of Propiconazole @ 1ml/l. water at 'booting' and 'milking' stage	18.56	1.97	5	20.3
Farmer's Practice: No application of fungicides	53.33	4.87	9	56.8
CD (P=0.05)	3.22	0.29		4.00

Influence of Technology Option on Yield and Economics

All the technology options tested were significantly reduced disease severity and increased yield over control (Table 3). Significantly highergrain yield (36.5q/ha) was obtained from TO_3 followed by TO_2 (28.2 q/ha) and TO_1 (25.0q/ha). The minimum grain yield (18.3q/ha) was obtained from control (farmers practice) treatment. Economics depicted in the Table 3 clearly indicated that farmers practices require minimum investment in rice production but the benefit in

Table 3: Effect of fungicides on disease severity, yield and economics to control false smut disease of rice caused by *Ustilaginoidea virens*

Technology Option	Yield (q/ha)	Gross Return (Rs. /ha)	Cost of Cultiv-ation (Rs./ha	Net Return (Rs./ha)	B:C ratio
TO_1: Seed treatment with carbendazim @ 2g/kg seed+ One spray of carbendazim@ 2g/l. water at milking stage	28.0	36,680	22,249	14,431	1.65
TO_2: Seed treatment with carbendazim @2g/kg seed+ One spray of Propiconazole@ 1ml/l. water at milking stage	28.2	41,396	22,684	18,712	1.82
TO_3: Seed treatment with carbendazim @2g/kg seed+ Two spray of Propiconazole@ 1ml/l. water at 'booting' and 'milking' stage	36.5	47,815	23,834	23,98	2.00
Farmer's Practice: No application of fungicides	18.3	23,973	19,000	14,973	1.26
CD (P=0.05)	1.88				

terms of gross return, net returns and B:C ratio did not support minimum investment for the rice crop production. Results shows that benefit-cost ratio (B:C) was maximum 2.00 in TO_3 followed by TO_2(1.82) and TO_1(1.65). The results are accordance with the findings of Hedge *et al.*(2000) evaluated two systemic (carbendazim and tricyclazole), five non-systemic fungicides (captan, chlorothalonil, COC, mancozeb and combination of carbendazim + mancozeb).

Among all fungicides evaluated *in vitro* against false smut of rice, carbendazim@ 0.025% was most effective in inhibiting the mycelial growth. Among the six fungicides evaluated in vitro condition trifloxistrobin 25%+ tebuconazole 50%, propiconazole and metiram 55% + pyraclostrobin 5% completely inhibited the mycelial growth of pathogen at all the concentrations (0.2%, 0.1%, 0.05%, 0.04%, 0.03%, 0.02%, 0.01%) tested, except metiram 55% + pyraclostrobin 5% recorded mycelia growth of 0.3 cm at 0.01% and showed 89.4% inhibition over control. The fungicide kresoxim methyl at 0.2% and 0.1% concentrations showed 100% inhibition, whereas carbendazim (12%) + mancozeb (63%) and carbendazim showed 100% inhibition at 0.2% only. Same views observed by other workers (Kumar *et al*., 2013 and Kumar *et al*., 2015) with brown spot and sheath rot disease of rice. Among systemic fungicides, propiconazole showed maximum inhibition in colony diameter (88.6%) at 20 ppm and tebuconazole is the next in order inhibiting colony diameter of 88%. In non-systemic fungicides, maximum inhibition of colony diameter (88.6%) was recorded with chlorothalonil.

CONCLUSION

This study concludes that seed treatment with Carbendazim along with two foliar sprays of Propiconazole at booting and milking stage has enhanced disease control and reduces yield losses effectively.

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