SHORT COMMUNICATION

Fungicidal Management of False Smut Disease in Rice Caused by *Ustilaginoidea virens*

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Abstract

False smut of rice caused by the fungus *Ustilaginoidea virens* has been recorded, in recent years, in the all rice growing areas of State Uttar Pradesh, India. Recommended fungicides are not yet available for chemically controlling the disease. Therefore, uses of unregistered fungicides are common by the farmers, for the management of the disease. The present study, was undertaken to identify effectiveness of fungicides to control false smut of rice. Four systemic fungicides (Propiconazole 25% EC @ 1.0 ml/L, Azoxystrobin 18.2% + Difenconazole 11.4% SC @ 0.5 g + 0.5 ml/L, Azoxystrobin 18.2% @ 1.0 g/L and Tebuconazole 250 EC @ 1.0 ml/L) were evaluated as foliar application in the naturally induced diseased rice, at five different locations in district Siddharthnagar, Uttar Pradesh. Fungicide was applied twice, first at panicle initiation and second at early flowering stage. All the fungicides applied were found effective in controlling the disease. As compared to the untreated (only water application), the fungicide 'Propiconazole 25% EC' reduced the maximum disease severity by 93.57%, followed by 'Azoxystrobin 18.2% + Difenconazole 11.4% SC @ 0.5 g + 0.5 ml/L', Fungicide Tebuconazole 250 EC @ 1.0 ml/L was found least effective in controlling the disease. It is concluded that more multi-location experiments will be required to reach a decisive conclusion on foliar chemical options for controlling rice false smut disease in eastern parts of Uttar Pradesh.

Keywords: False smut, Rice, *Ustilaginoidea virens*.

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Introduction

False smut of rice, also known as pseudo-smut or green smut has been recorded in all rice growing countries worldwide. Earlier, it was regarded as a minor disease, occurring sporadically in certain regions, but now epidemics of the disease are also being reported in different parts of the world including in India (Rush *et al*., 2000; Anonymous, 2016). Recently in India, the disease has been observed in severe form since 2001 in major rice-growing states viz., Andhra Pradesh, Bihar, Gujarat, Haryana, Jammu and Kashmir, Jharkhand, Karnataka, Maharashtra, Pondicherry, Punjab, Tamil Nadu, Uttar Pradesh and Uttaranchal (Dodan and Singh, 1996; Mandhare *et al*., 2008). It is an important devastating disease causing yield losses from 1.01 to 10.91 per cent (Atia, 2004). Disease incidence of 10-20 per cent and 5-85 percent respectively has been reported from Punjab and Tamil Nadu on different rice cultivars (Ladhalakshmi *et al*., 2012). In recent years, its outbreak is anticipated due to high input cultivation, increased use of hybrid varieties and climate change (Lu *et al*., 2009). The efficacy of several fungicides against false smut has also been reported by various workers from different parts of the world. Mohiddin *et al*. (2012) reported that prochloraz + carbendazim was effective against false smut. Pannu *et al*. (2010) obtained reduction in false smut by spraying of fungicide copper oxychloride 50 WP (0.25%) at booting followed by propiconazole 25 EC (0.1%). The present study was conducted to evaluate nine fungicides at two different stages of application against false smut of rice.

Materials and Methods

The field experiment was carried out during *Kharif* season of 2017 and 2018 at five different farmers on different location of Siddharthnagar district. All the agronomical operations were done to stand the healthy plant. Manures and fertilizers were also applied as recommendation of the area. A highly susceptible variety BPT 5204 was transplanted to evaluate the efficacy of fungicides against the disease. Five fungicides namely F_1-Propiconazole 25% EC @ 1.0 ml/L, F_2-Azoxystrobin 18.2% + Difenconazole 11.4% SC @ 0.5 g + 0.5 ml/L, F_3-Azoxystrobin 18.2% @ 1.0 g/L and F_4-Tebuconazole 250 EC @ 1.0 ml/L were evaluated under natural epiphytotic conditions. An untreated control (F_0) plot was also maintain to compare the effectiveness of fungicides. The experiment were laid out in a randomized complete block design. Each Fungicide was sprayed twice, first at panicle initiation stage and second at early flowering stage. In the experiment field, the disease infection occurred naturally.

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Table 1: Effect of fungicides on disease severity, yield and economics during *Kharif* 2017 and 2018 (Pooled data)

Treatments	*Doses (g or ml/L)*	*Per cent infected tillers*	*Per cent infected grains*	*Disease severity*	*% disease reduction over control*	*Yield (q/ha)*	*Yield increased over control*	*% yield increased over control*	*IBCR*
Propiconazole 25% EC	1.0	4.22	0.77	2.35	93.57	67.50	19.10	39.46	8.8
Azoxystrobin 18.2% + Difenconazole 11.4% SC	1.0	4.77	1.02	5.29	85.53	65.25	16.85	34.81	8.6
Azoxystrobin 18.2%	1.0	6.88	1.33	6.49	82.25	60.40	12.00	24.79	4.8
Tebuconazole 250 EC	1.0	5.55	1.55	8.82	75.88	56.55	8.15	16.84	4.4
Untreated control	-	12.22	4.44	36.57	-	48.40	-	-	-
SEm±		0.83	0.42	1.58		3.45			
CD at 5%		2.41	1.01	4.15		8.54			
CV (%)		11.03	9.85	17.52		7.25			

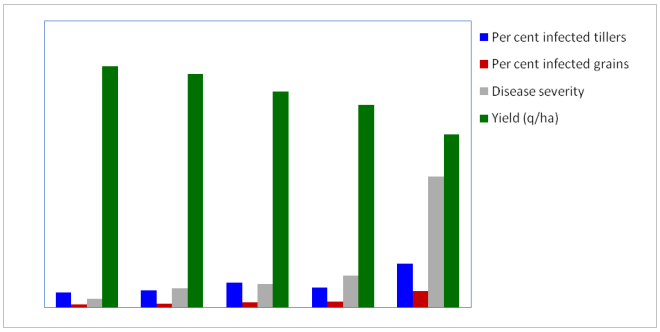

Fig. 1: Effect of fungicides on disease severity, yield and economics during *Kharif* 2017 and 2018 (Pooled data)

Data were recorded on percentage of tillers infection, percentage of grains infected and disease severity. The average values of five locations were then subjected to analysis of variance.

Results and Discussion

Results presented in Table 1 and Fig. 1 are indicated that all the fungicidal spray reduced the disease severity and increased the yield over untreated control. The infection of false smut in the experimental field ranged from 2.35 to 36.57%, where the incidence was the highest in the control (untreated) plots (Table 1). The fungicide Propiconazole 25% EC @ 1.0 ml/L appeared to be the best performer reducing the disease by about 93.57% as compared to the untreated control. It was closely followed by the fungicidal combination Azoxystrobin 18.2% + Difenconazole 11.4% SC @ 0.5 g + 0.5 ml/L which reduce 85.53%. The similar trends were recorded in number of tillers and grains infection.

The indicated in Fig. 1, it has negative correlation between disease severity and yield obtained under all the fungicidal treatments. Yield in all the experiment were increased with reduction of disease severity. Highest yield (67.50 q) was recorded with the application of Propiconazole 25% EC @ 1.0 ml/L. it was significantly superior to all the treatments.

Similar results were also reported by previously for bioefficacy of fungicides under field condition such as carbendazim and propiconazole (Dodan and Singh, 1997), carbendazim (Hegde *et al*., 2000), propiconazole, carbendazim and tebuconazole (Bagga and Kaur, 2006), propiconazole, carbendazim, tebuconazole and carbendazim + mancozeb (Paramjit and Sweety, 2006), trifloxystrobin + tebuconazole, propiconazole (Chen *et al*., 2013; Ladhalakshmi *et al*., 2014; Shivamurthy, 2017).

Combination fungicides are better compare to the other alone fungicide due to their broad range of action, lower dose and also posses lower risk of fungicide resistance development in target fungal population. In rice, efficacy of such combi products in managing many fungal diseases has been reported (Bhuvaneshwari and Raju, 2012; Kumar and Veerabhadraswamy, 2014; Pramesh *et al*., 2016a,b). In the present study, different combination products such as azoxystrobin (18.2%) SC + difenconazole (11.4%) SC, metiram (55%) WG + pyraclostrobin (5%) WG, tebuconazole 250 EC, flusilazole (25%) SE + carbendazim (12.5%) SE showed their superior bioefficacy in reducing false smut incidence and they can be utilized under epidemic condition. In case of rice, resistance varieties for false smut are still not developed /available to the farmer. Moreover, bio-efficacy of the bio-control agents under the severe epidemic condition are not demonstrated, therefore, chemical control is an inevitable and ultimate means for disease management for farmers. Thus, cultural practices combined with foliar spray of fungicide is the only practice available to manage the disease and even in integrated pest management system need based application of fungicide has been recommended (Bag *et al*., 2016) (Fig. 1). On comparison with the grain yield obtained from each plot it was found that the treatment with azoxystrobin (18.2%) + difenconazole (11.4%) SC gave the highest per plot (68.27 q/ha) which was on par with the metiram (55%) WG+ pyraclostrobin (5%) WG (66.67 q/ha) followed by treatment with propiconazole 25EC (65.67 q/ha), azoxystrobin 25 SC (59.50 q/ha) and pencycuron (22.9%) SC (59.18 q/ha). Grain yield per plot was found to be minimum in untreated control (47.52 q/ha) (Table 1). The highest B: C ratio was recorded in plots treated with combi fungicides metiram (55%) + pyraclostrobin (5%) WG having 1:3.43, followed by propiconazole 25 EC with 1:3.41 and azoxystrobin (18.2%) + difenconazole (11.4%) SC with 1:3.34. In case of rice, many researchers have reported the increased grain yield after application of fungicides due to reduction in biotic stress on plant during critical growth stages (Sood and Kapoor, 1997; Tirmali *et al*., 2001; Prabhu *et al*., 2003; Usman *et al*., 2009; Naik *et al*., 2012; Bhuvaneshwari and Raju, 2012; Bag *et al*., 2016, Pramesh *et al*., 2016a,b). For management of false smut, efficacy of many fungicides has been reported previously (Chen

et al., 2013; Kumar, 2015; Raji *et al*., 2016). In the present study, in addition to the previously reported fungicides, the efficacy of new combination of fungicides such as azoxystrobin (18.2%) SC + difenconazole (11.4%) SC, metiram (5 5%) WG + pyraclostrobin (5%) WG and flusilazole (25%) + carbendizim (12.5%) at 0.1 per cent or the management of false smut under field condition.

Conclusion

Based on the experiment it is concluded that the application of fungicide Propiconazole 25% EC @ 1.0 ml/L appeared to be the best performer reducing the disease incidence as compared to the untreated control. It was closely followed by the fungicidal combination Azoxystrobin 18.2% + Difenconazole 11.4 % SC @ 0.5 g + 0.5 ml/L. The similar trends were recorded in number of tillers and grains infection.

References

Anonymous 2016. Production Oriented Survey. DRR, Hyderabad, India.

Atia, M.M.M. 2004. Rice false smut in Egypt. *Journal of Plant Diseases and Protection* **111**: 71-82.

Bag, M.K., Yadav, M. and Mukherjee, A.K. 2016. Bioefficacy of strobilurin based fungicides against rice sheath blight disease. *Transcriptomics* **4**: 128.

Bagga, P. S. and Kaur, S. 2006. Evaluation of fungicides for controlling false smut (*Ustilaginoidea virens*) of rice. *Indian Phytopathology* **59**(1): 115-117.

Bhuvaneswari, V. and Raju, K.S. 2012. Efficacy of new combination fungicide against rice sheath blight caused by Rhizoctoniasolani (Kuhn). *Journal of Rice Research* **5**(1&2): 57-61.

Chen, Y., Zhang, Y., Yao, J., Li, Y.F., Yang, X., Wang, W.X., Zhang, A.F. and Gao, T.C. 2013. Frequency distribution of sensitivity of *Ustilaginoidea virens* to four EBI fungicides, prochloraz, difenconazole, propiconazole and tebuconazole and their efficacy in controlling false smut in Anhui Province of China. *Phytoparasitica* **14**(3): 277-284.

Dodan, D. S. and Singh, R. 1997. Evaluation of fungi toxicants against false smut of rice. *Journal of Mycology and Plant Pathology* **27**(1): 32-34.

Dodan, D.S. and Singh, R. 1996. False smut of rice present status. *Agricultural Research* **17**(4): 227-240.

Hegde, Y.R., Anahosur, K.H. and Kulkarni, S. 2000. Chemical control of false smut of rice caused by *Claviceps oryzae sativae* Hashioka. *Karnataka Journal of Agricultural Sciences* **13**(3): 623-627.

Kumar, D.M. 2015. Studies on false smut of rice caused by *Claviceps oryzae sativae* Hashioka, M.Sc. Thesis, University of Agricultural Science, Dharwad, Karnataka, India.

Kumar, P.M.K. and Veerabhadraswamy, A.L. 2014. Appraisea combination of fungicides against blast and sheath blight diseases of paddy (*Oryza sativa* L.). *Journal of Experimental Biology and Agriculture Sciences* **2**(1): 49-57.

Ladhalakshmi, D., Laha, G., Singh, R., Karthikeyan, A., Mangrauthia, S., Sundaram, R., Thukkaiyannan, P. and Viraktamath, B. 2012. Isolation and characterization of *Ustilaginoidea virens* and survey of false smut disease of rice in India. *Phytoparasitica* **40**(2): 171.

Ladhalakshmi, D., Laha, G.S., Krishnaveni, D., Prakasam, V. and Prasad, M.S. 2014. Evaluation of selected fungicides against rice false smut disease. 3rd Int. Conference on Agric. & Horti., Hyderabad International Convention Centre, India.

Lu, D., Yang, X.Q., Mao, J.H., Ye, H.L., Wang, P., Chen, Y.P., He, Z.Q. and Chen, F. 2009. Characterising the pathogenicity diversity of *Ustilaginoidea virens* to hybrid rice in China. *Journal of Plant Pathology* **91**(2): 443-451.

Mandhare, V.K., Gawade, S.B., Game, B.C. and Padule, D.N. 2008. Prevalence and incidence of bunt and false smut in paddy (*Oryza sativa* L.) seeds in Maharashtra. *Agricultural Science Digest* **28**(4): 292-294.

Mohiddin, F.A., Bhat, F.A., Gupta, V., Gupta, D. and Kalha, C.S. 2012. Integrated disease management of false smut of rice caused by *Ustilaginoidea virens*. *BioScience Trends* **5**(4): 301-302.

Naik, G.R., Naik, G.B., Naik, B.T. and Naik, K.R. 2012. Fungicidal management of leaf blast disease in rice. *Global Journal of Bio-science and Biotechnology* **1**: 18-21.

Pannu, P.P.S., Thind, T.S. and Sanjay, G. 2010. Standardization of technique for artificial creation of false smut of rice and its management. *Indian Phytopathology* **63**(2): 234-235.

Paramjith, S.B. and Sweety, K. 2006. Evaluation of fungicides for controlling false smut (*Ustilaginoidea virens*) of rice. *Indian Phytopathology* **59**(1): 115-117.

Prabhu, A.S., Filippi, M.C. and Zimmermann, F.J.P. 2003. Cultivar response to fungicide application in relation to rice blast control, productivity and sustainability. *Pesquisa Agropecuária Brasileira* **38**: 11-17.

Pramesh, D., Maruti, Saddamhusen, A., Muniraju, K.M. and Guruprasad, G.S. 2016b. A new combination fungicide active ingredients for management of sheath blight disease of paddy. *Advances in Research* **8**(5): 1-7.

Pramesh, D., Maruti., Muniraju, K.M., Mallikarjun, K., Guruprasad, G.S., Mahantashivayogayya, K., Mastanareddy, B.G., Gowdar, S.B. and Chethana, B.S. 2016a. Bio-efficacy of a combination fungicide against of blast and sheath blight disease of paddy. *Journal of Experimental Agriculture International* **14**(4): 1-8.

Raji, P., Sumiya, K.V., Renjisha, K., Dhanya, S. and Narayanankutty, M.C. 2016. Evaluation of fungicides against false smut of rice caused by *Ustilaginoidea virens*. *International Journal of Applied and Natural Sciences* **5**: 77-82.

Rush, M.C., Shahjahan, A.K.M. and Jones, J.P. 2000. Outbreak of false smut of rice in *Louisiana*. *Plant Disease* **84**(1): 100.

Shivamurthy, P. 2017. Studies on false smut of rice caused *Ustilaginoidea virens* (Cke.) Tkh. M.Sc. Thesis. Univ. Agric. Sci. Raichur, Karnataka (India).

Sood, G.K. and Kapoor, A.S. 1997. Efficacy of new fungicides in the management of rice blast. *Research in Plant Disease* **12**: 140-142.

Tirmali, A.M., Latake, S.B. and Bendra, N.J. 2001. Evaluation of new fungicides for control of blast disease of rice. *Journal of Maharashtra Agricultural University* **26**:197-198.

Usman, G.M., Waqas, W., Sahi, S.T. and Yasin, S. 2009. Influence of various fungicides on the management of rice blast disease. *Mycopathology* **7**: 29-34.