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Assessment of Integrated Disease Management Modules for False Smut Disease in Paddy

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ABSTRACT

Rice (*Oryza sativa* L.) is the most extensively cultivated food crop of the Asia and forms a major part of nourishment for half of the world's population. On Field Trial (OFT) on paddy crop using seed treatment, weed management and application of Propiconazole 25 % EC fungicide, a trail was conducted during *kharif* seasons of the year 2018-19 and 2019-20 respectively in the adopted villages of KVK, P.G College, Ghazipur, to show the higher production potentiality and integrated management of false smut of rice. The demonstrations were carried out in 4 farmers' fields of 0.4 ha area at village Jalalpur of Devkali Block and with same number at village Budhanpur of district Ghazipur (UP) during the year 2018-19 and 2019-20 respectively in irrigated medium land and sandy loam soil situation. The soils were sandy loam in texture having low in pH with 6.5- 6.9, Organic carbon (0.21 - 0.33 %) and available P_2O_5 (15 - 17 kg /ha) and medium in N and K content. Paddy seeds was sown in the month of may in nursery and transplanted in main field during first fore night of june. The technology of Integrated Disease management approach increased the average production by 23.10 %, and 29.14 % and increased the net return by Rs 21,680.00 with an improved B:C ratio of 3.32 instead of 2.62, Rs 24,001.00 with an improved B:C ratio of 2.78 instead of 2.00 than those of farmer's practice during both the years respectively. Thus the technology of integrated disease management in paddy for the management of false smut of paddy may be accepted economically for better livelihood of the farmer's and increased production of rice.

Keywords Assessment, B:C ratio, False smut, IDM module, Net income.

INTRODUCTION

Rice (*Oryza sativa* L.) is the most extensively cultivated food crop of the asia and forms a major part of nourishment for half of the world's population. It is the primary source of energy and protein for 4.5 billion peoples in the most populous nations of Asia. More than 90% of the world's rice is grown and consumed in Asia, where 60 per cent of the world's population lives. It accounts for 35-60% of the caloric intake of three billion Asians (Guyer *et al*. 2000). Worldwide, rice is cultivated in an area of about 161.4 million hectares, production of about 506.3 million tonnes and productivity of 3.14 tonnes per hectare.

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In India area under rice cultivation is 43.39 million hectare and production of about 104.32 million tonnes with 2.40 tonnes per hectare productivity. In Karnataka, it is grown in area of 1.06 million hectares with a production of 2.70 million tonnes and productivity of 2.67 tonnes per hectare (Annon 2016). In India, rice crop is produced in almost all the zones including southern, northern and northeastern zones. The major rice producing states of India are West Bengal, Andhra Pradesh, Tamil Nadu, Karnataka and Punjab. Rice not only a staple food but also a way of living in Asia, with more than 250 million farm households dependent on the crop for their livelihood. The crop growth and production are affected by various biotic and abiotic factors. Biotic stresses include insect pests and diseases caused by fungi, bacteria, viruses, Phyto plasmas and nematodes. Abiotic stresses, drought, cold, heat, chemical injury, salinity and other non-parasitic disorders are also responsible for significant reduction in production and productivity. Fungal diseases like, blast (*Pyricularia oryzae*), sheath blight (*Rhizoctonia solani*), brown spot (*Helminthosporium oryzae*), bakanae disease or foot srot (*Gibberella fujikuroi*), sheath rot (*Sarocladium oryzae*), leaf scald (*Microdochium oryzae*), narrow leaf spot (*Cercospora oryzae*), leaf smut (*Entyloma oryzae*) and udbatta disease (*Balansia oryzae*), bacterial diseases such as bacterial leaf blight (*Xanthomonas oryzae pv. oryzae*) and bacterial leaf streak (*Xanthomonas oryzae pv. oryzicola*) are of economic importance. Viral disease such as rice tungro disease (Rice tungro bacilliform virus and Rice tungro spherical virus) is more prevalent and destructive under Indian condition.

Rice production plays a crucial role in our food security. Rice security is not only an economic issue but also an important parameter to determine social and political stability. Thus, rice research has to be geared up to develop strategies for alleviating losses due to pests and diseases. In the past decades, a number of minor diseases have attained the status of major importance in rice. One such disease is the rice false smut (RFS) disease that is a threat to yield and grain quality. False smut of rice was previously recorded as a minor disease of rice and considered as a symbol of good harvest in old times. In recent years, increasing occurrence of RFS has been reported in most major rice growing regions throughout the world, such as China, India, and USA (Brooks *et al.* 2009, Chen *et al*. 2013, Fan *et al.* 2016). The emergence of this disease is believed to be partially due to wide application of hybrid rice varieties, which are mostly susceptible to the RFS. The causative agent of RFS is an ascomycete fungal pathogen Villosiclava virens (anamorph: *Ustilaginoidea virens* [Cooke] Takahashi) (Guyer *et al.* 2000), which specifically infects rice flowers and transforms the latter into RFS balls (Chen *et al*. 2013). RFS balls are small at first growing slowly and enclosing the floral parts. The early balls were found to be slightly flattened and smooth and were covered by a thin membrane. As the pathogen growth intensifies, the RFS ball bursts with chlamydospores and becomes orange then later yellowish-green or greenish-black

MATERIALS AND METHODS

On Field Trial (OFT) on paddy crop using seed treatment, weed management and application of Propiconazole 25 % EC fungicide, a trail was conducted during kharif seasons of the year 2018-19 and 2019-20 respectively in the adopted villages of KVK, PG College, Ghazipur, to show the higher production potentiality and integrated management of false smut of rice. The demonstrations were carried out in 4 farmers' fields of 0.4 ha area at village Jalalpur of Devkali Block and with same number at village Budhanpur of district Ghazipur (UP) during the year 2018-19 and 2019-20 respectively in irrigated medium land and sandy loam soil situation. The soils were sandy loam in texture having low in pH with 6.5- 6.9, Organic carbon (0.21 - 0.33 %) and available P_2O_5 (15 - 17 kg /ha) and medium in N and K content. Paddy seeds was sown in the month of may in nursery and transplanted in main field during first fore night of june. The problem of low productivity of paddy was analyzed through using Participatory Rural Appraisal (PRA) techniques like Focus Group Discussion and Group Discussion. From these analyses, it was found out that among the bio-physical constraints, the lack of knowledge to cope up with false smut disease were ranked first. In this context, the On Campus farmers' training were conducted to aware and impart knowledge about the problem of low yield of paddy due to infestation of false smut and 4 farmer's were selected for demonstration in

Table 1. Implementation of OFT program on paddy.

Year	Variety	Technology demonstrated	Area (ha.)	No. of farmers / Demonstration
2018-19	Damini	Integrated disease management	0.4	04
2019-20	Damini	Integrated disease management	0.4	04

the partner farmers' plots. The different features and potentiality of the demonstrated occurrence of disease were discussed comparing it to the general farmer's practice. All the agronomic practices like seed rate, sowing method, seed treatment, weed management were discussed thoroughly to get the maximum benefit. The herbicides (Bispyribac sodium) and fungicide (Propiconazole 25 % EC) were distributed. The sowing in all the demonstration plots was completed by 12th June in both the years. All other agronomic practices were same as it was practiced in the check plots. The crops were totally managed by farmers. They shared all the inputs except the herbicides and fungicides which was shared by KVK. At the time of maturity, field visit program were conducted in the demonstration plots in the every village. After harvesting and threshing, the yield data were obtained from individual partner farmers plots.

RESULTS AND DISCUSSION

From the (Table 1) it was noted that 4 numbers of On Field Trial Demonstrations (OFT's) on integrated disease management of false smut of paddy was implemented in 0.4 ha area during the year 2018-19 and the same number in the year 2019-20. In the year 2018- 19, seeing the success of the program, the area of the OFT was repeated in the year 2019-20. The perusal of the data (Table- 2) on the performance of the OFT's clearly indicated that average yield of the paddy crop was increased by 23.10% and 29.14% per cent in both years respectively with the application of bispyribac sodium10% SC at post emergence stage and propiconazole 25% EC at panicle initiation stage in which seeds were treated with trichoderma and with one hand weeding. In the year 2018-19, the average yield of the demonstration of the paddy variety Damini was found 54.50q/ha which was satisfactorily higher than those of the local check plots. Thus it increased the yield by 23.10 per cent with reference to the check plots. Similarly, in the year 2019-20, the average demonstration yield of the variety Damini was found 54.46 q/ha which was remarkably higher than those of the check yield i.e., 42.12 q/ha. The yield gap with reference to check yield was increased by 29.14% using the technology of integrated disease management approach. Similar results were reported 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,

Table 2. Assessment of IDM modules for False Smut disease in Paddy.

Sl .No.	Observed parameters	Treatments					
		T_1 (Farmer's practice)			T_2 (seed treatment with Trichoderma + application of bispyribac sodium 10 % SC at post emergence (weed management) + Propiconazole 25 % EC at panicle initiation stage		
1.	Total No. of panicle/m^2	220.5	205.3	212.9	240.1	252.0	246.05
2.	No. of infested panicle/m^2	80.1	91.4	85.75	2.8	4.6	3.7
3.	Disease incidence (%)	36.3	44.5	40.4	1.1	1.8	1.45
4.	No. of smut bolls/ infected panicle	7.3	8.7	8.0	2.0	1.5	1.75
5.	Yield (q ha^{-1})	44.32	42.17	43.24	54.56	54.46	54.51
6.	% increase in yield	-	-	-	23.10	29.14	26.12
7.	Net income Rs/ha	37980	26450	32215.00	59660	50451	55055.5
8	B:C ratio**	2.62 : 1	2.00 : 1	2.31 : 1	3.32 : 1	2.78 : 1	3.05 : 1

tebuconazole and carbendazim + mancozeb (Paramjit and Sweety 2006), rifloxystrobin + tebuconazole, propiconazole (Chen *et al*. 2013, Ladhalakshmi *et al*. 2014, Shivamurthy, 2017). Therefore, the results of present study it was concluded that Propiconalzole should be adopted in IDM modules, which would increase the yield by reducing the disease with acceptable B: C ratio. Considering the economics of the program, it might be depicted that demonstration of IDM approach have higher B:C ratio of 3.32 and 2.78 in comparison to 2.62 and 2.00 as reported in the check during 2018-19 and 2019-20 respectively

CONCLUSION

After completion of the OFT program, it might safely be stated that Integrated Disease Management approach in paddy for false smut were found successful to minimize the yield gap and to increase the production and productivity of paddy in the Ghazipur District of Uttar Pradesh and it can also be concluded that Propiconalzole with bispyribac sodium herbicide should be adopted in IDM modules, which would increase the yield by reducing the disease with acceptable B: C ratio.

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