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INTEGRATED MANAGEMENT OF SHEATH BLIGHT DISEASE OF RICE

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ABSTRACT

Sheath blight disease caused by *Rhizoctonia solani* has now been considered one of the most economically significant diseases of rice in India. To manage the disease in an integrated way, biocontrol treatment of *Trichoderma* sp. and chemical treatment are combined to reduce the number of chemical sprays to the minimum. Among the combination treatments, seed treatment with *Trichoderma* sp. @ 10 g/kg of seed, application of *Trichoderma* sp. @ 10 g/l of water at 15-20 DAT followed by a single spray of propiconazole @ 1ml/l at the booting stage was highly effective to manage the disease with 54.4 % disease control compared to check plot. The treatment also produced a significantly higher yield (43.2 q/ha) compared to control plots. Therefore, this treatment can be recommended for the management of the disease in an integrated way, targeting to keep the hazardous effect of chemicals to a minimum.
Keywords **:** Rice, Sheath blight disease, IDM

Introduction

Sheath blight, a fungal disease of rice, caused by *Rhizoctonia solani* [Teleomormh- *Thanatephorus cucumeris* (Frank) Donk] is one of the major biotic constraints in India and can reduce rice yields from 4 to 50% depending on the disease severity and stage of infection (Singh *et al*., 2016). The severity of the disease is increasing day by day due to the intensive cultivation of high-yielding varieties and excessive use of nitrogenous fertilizers. To date, no rice variety with complete resistance to the disease is available. Moreover, regular use of particular chemical over a period of time increases the chance of developing resistance in the pathogen (Brent and Holomon, 1998) and they often have a significant negative impact on the environment and human beings through environmental pollution. As none of the disease control methods alone can ensure efficient and sustainable protection against the disease, a systemic approach integrating all possible methods of disease management may be a better option. Many researchers have recommended a balanced application of manures and fertilizers followed by a minimum application of plant protection chemicals for better disease management and obtaining the maximum yield (Pal *et al*., 2013; Yellareddygari *et al*., 2014; Pal *et al*., 2024). Considering all the above factors, eco-friendly disease management is the only option in the present scenario. With a view to this, the present experiment was conducted incorporating a biocontrol agent with an effective fungicide to reduce the frequency of chemical fungicide use for effective management of the disease in an integrated way.

Materials and Methods

Field experiments were conducted during kharif seasons of 2019, 2020 and 2021 at the experimental site of All India Coordinated Research Project on Rice, Regional Research and Technology Transfer Station, Chiplima, Sambalpur, Odisha. Rice variety Swarna, susceptible to sheath blight was selected for the study. Seed treatment was done as per the treatments and thirty days old seedlings were transplanted. The experiment was laid out on RBD with six treatments and four replications. The six treatments include T_1 = Seed treatment with bio-control agent *Trichoderma* sp. @ 10 g/kg seed, T_2 = T_1 + spraying of *Trichoderma* sp. @ 10g/l at 15-20 DAT, T_3 = T_1+ one spray of

propiconazole 25 EC @ 1ml/l at booting stage, $T_4 = T_2$ + one spray of propiconazole 25 EC @ 1ml/l at booting stage, T_5 = Seed treatment with carbendazim 50 WP @ 2 g/kg seed + spraying of (trifloxystrobin 25% + tebuconazole 50%) 75 WG @ 0.4 g/l at booting stage, T_6- Control (No Spraying). The biocontrol agent *Trichoderma* sp. was supplied from ICAR-NRRI, Cuttack, Odisha in talc formulation. Artificial inoculation was done three to four weeks after transplanting by putting rice stem bits containing mycelial mass and sclerotia of *Rhizoctonia solani* in between the leaf sheath just above the water line. The spraying of biocontrol agent and chemical was made as per the treatment details. Sheath blight severity was recorded by taking the percent disease severity and disease score using the Standard Evaluation System (Anonymous, 2016). Three sampling units of one m^2 area were fixed in each plot at random for observation of disease severity. The final disease severity was recorded 15 days after the last spraying.

The Percent Disease Index (PDI) was calculated by using the following formulae by McKinny H.H. (1923):

$$PDI = \frac{\text{Sum of al the numerical rating}}{\text{Number of observation x Max rating}} \text{ x100}$$

Data on different plant growth parameters like plant height, average number of tillers per hill, number of panicles per hill, panicle length, number of grains per panicle and 1000 grain weight were also recorded treatment wise. The grain yield of each plot was recorded at the time of harvest and converted to q/ha. Percent increase in grain yield was calculated using the following formula:

$$AYL = [(Yp - Yu)/Yu] \times 100$$

where, Yp = Yield under protected conditions and Yu = Yield under unprotected conditions (Nagaraja *et al*., 2012). The benefit: cost (B: C) ratio was also worked out for each treatment. All these collected data were analysed statistically following Gomez and Gomez (1984).

Results and Discussion

Effect of treatments on sheath blight disease severity

Sheath blight severity decreased notably in treated plots compared to control plots where no spraying was done (Table 1). According to first year data, the lowest disease severity was noticed in T_5 plots where only chemicals were used for seed treatment and spraying. The next best treatment was T_4 i.e., a combination of biocontrol and chemical treatment which reduced the disease severity to 25.56 from 46.94 in control plots in terms of PDI. In the second year of experiment, T_4 was at par with T_5 in reducing the disease severity and performed best among the bio control and integrated treatments. The result of the third year experiment was similar to that of first year and in all the cases T_4 gave the best result among all the integrated disease management practices.

Table 1: Effect of IDM practices on sheath blight disease severity of rice (*Kharif* 2019, 2020 and 2021)

Treatment No.	Treatment Details	Dose	Sheath blight Severity% (PDI)			Pooled PDI	Disease Control (%)
			2019	2020	2021		
T_1	Seed treatment (ST) with *Trichoderma* sp.	10g/kg seed	39.72 * (39.00)	41.11 (39.84)	39.72 (39.01)	40.19 (39.31)	19.9
T_2	T_1 + one spray of *Trichoderma* sp. at 15-20 DAT	10g/l	35.28 (36.31)	38.61 (38.37)	34.72 (36.01)	36.20 (36.93)	27.9
T_3	T_1+ one spray of propiconazole at booting stage	1ml/l	27.78 (31.62)	27.50 (31.52)	23.34 (28.79)	26.21 (30.77)	47.8
T_4	T_2 + one spray of propiconazole at booting stage	1ml/l	25.56 (30.23)	23.33 (28.77)	19.72 (26.22)	22.87 (28.52)	54.4
T_5	ST with carbendazim @2 g/kg +one spray of (trifloxystrobin+ tebuconazole) at booting stage	0.4 g/l	14.72 (22.47)	16.39 (23.72)	14.17 (22.02)	15.09 (22.81)	69.9
T_6	Control (No spraying)	-	46.94 (43.22)	52.22 (46.26)	51.39 (45.78)	50.19 (45.09)	-
CD (0.05)			6.65	5.51	3.94	3.28	

*Figures in the parenthesis are transformed values

The three years pooled data revealed that though chemical management practices (T_5) gave the best result but among the bio control and IDM practices, T_4 i.e., seed treatment with *Trichoderma* sp. + one spray of *Trichoderma* sp. at 15-20 DAT+ one spray of propiconazole at booting stage produced the lowest PDI of 22.87 with 54.4 % disease control over the control treatment. The treatments with integrated disease management practices i.e. T_4 and T_3 did not differ significantly from each other in reducing the sheath blight disease severity across the three years of experimentation but numerically better values were obtained from T_4 treatment. The present finding is in accordance with the findings of Singh *et al.* (2007) and Pal *et al*. (2015) who also found that integrating bio control treatment with chemicals can manage the disease more effectively and can minimize the number of chemical sprays as well.

Effect of treatments on growth parameters of rice

The effects of treatments on different growth parameters of rice proved to be significant except for no. of panicles per hill as per the results of three years pooled data analysis (Table 2). The parameters like plant height, average number of tillers per hill and 1000 grain weight were highest in T_4 treatment where integrated disease management practices were followed. This might be due to the effect of bio control agent *Trichoderma* sp integrated in the treatment. This result is in conformity with the findings of several previous workers who also found that talc formulation of *Trichoderma* sp not only control the sheath blight disease but also increase the growth parameters in paddy (Soe and De Costa, 2012; Mathivanan *et al*. 2005; Khan and Sinha, 2007).

Table 2 : Effect of IDM practices on growth parameters of rice crop (pooled of *kharif* 2019, 2020 and 2021)

Treatments	Plant height (cm)	Av no. of tillers/hill	No. of panicle/hill	Panicle length (cm)	Grain /panicle	1000 grain weight (g)
T_1	103.8	9	7.41	23.10	180.03	19.36
T_2	107.1	10	7.80	24.12	184.05	19.68
T_3	106.5	11	7.92	24.81	187.20	19.50
T_4	108.0	12	8.55	24.90	190.41	21.36
T_5	106.8	11	8.61	25.20	192.30	20.70
T_6	100.2	8	6.48	22.11	177.33	18.44
CD (0.05)	1.85	1.62	NS	1.67	3.63	1.83
SEm (±)	0.61	0.53	0.48	0.55	1.19	0.60

Effect of treatments on yield components of rice

The yield components of rice crop were recorded and presented in Table 3. The three years pooled data revealed that maximum yield was observed in T_5 or chemical management. Among the integrated management practices, T_4 (combination of bio control and chemical treatment) gave the best result across the three years of experiment recording 43.2 q/ha of grain yield and 23.4 % yield increase over the control plot. Though T_4 and T_3 are statistically at par with each other, the percent yield increase over control and BC ratio in T_4 are more than that of T_3 which may be due to the fact that spraying of biocontrol agent *Trichoderma* sp was integrated in T_4. Many previous research findings also suggested that application of bio control agent not only reduce the disease severity but also promote plant growth and ultimately increase the grain yield in rice (Dennis and Webster, 1971; Pal *et al*., 2015).

Table 3: Effect of IDM practices on yield components of rice (kharif 2019, 2020, and 2021)

Treatment No.	Treatment Details	Dose	Grain Yield (q/ha)			Pooled Yield	Yield increases over control (%)	BC Ratio
			2019	2020	2021			
T_1	Seed treatment (ST) with *Trichoderma* sp.	10g/kg seed	36.5	39.2	37.3	37.7	7.7	1.28
T_2	T_1 + one spray of *Trichoderma* sp. at 15-20 DAT	10g/l	38.8	39.5	39.0	39.1	11.7	1.29
T_3	T_1+ one spray of propiconazole at booting stage	1ml/l	41.7	41.5	40.6	41.3	18.0	1.38
T_4	T_2 + one spray of propiconazole at booting stage	1ml/l	43.3	42.5	43.8	43.2	23.4	1.40
T_5	ST with carbendazim @2 g/kg +one spray of (trifloxystrobin+ tebuconazole) at booting stage	0.4 g/l	49.4	45.1	47.5	47.3	35.1	1.45
T_6	Control (No spraying)	-	33.8	36.6	34.7	35.0	-	-
CD (0.05)			5.1	3.24	4.04	2.68		

Conclusion

So, from the experimental results it can be concluded that seed treatment with *Trichoderma* sp. @ 10 g/kg of seed, application of *Trichoderma* sp. @ 10 g/l of water at 15-20 DAT followed by a single spray of propiconazole @ 1ml/l at the booting stage can be used effectively to manage sheath blight disease of rice in an integrated way with less environmental pollution. It can also help to improve the plant growth characteristics and ultimately achieve a good yield of the crop.

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