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Response of integrated disease management practices against sheath blight of rice

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Abstract
Sheath blight of rice caused by *Rhizoctonia solani* Kuhn is most widely distributed and cause substantial yield loss. It is major production constraint in high yielding varieties under intensive rice production system. The pathogen has very wide host range and exhibits considerable pathogenic and molecular variability. Due to non-availability of resistant cultivars, the management of sheath blight primarily dependence on chemicals control only. The present study focused on better management practices with minimum use fungicides for the management of this disease. In view of above Integrated Disease Management practices were adapted from nursery to main field with six treatment combinations ie. T_1- Seed treatment with Bio-control agent (*Trichoderma viride*) @ 10 g/kg seed, T_2 - T_1 + bio-control agent at 15-20 DAT, T_3 - T_1 + one spray of propiconazole at booting stage, T_4 - T_2 + one spray of propiconazole at booting stage, T_5 - Seed Treatment with carbendazim (2 g/kg) + spray of (trifloxystrobin 25% + tebuconazole 50%) @ 0.4 g/l at booting stage and T6 - control. The experiment was laid out in RBD with four replications in 5X2 m plot size with 15X15 cm spacing. Among the treatment combination T-$_4$ (Seed treatment with bio agent+ bio agent at 20 DAT+ Propiconazole @1 g/l) was found most effective in checking the sheath blight severity (21.4%), incidence (22.3%) and increase the grain yield (3800 kg/ha) in comparison to non IPM adopted plot disease severity (64.4%), incidence (42.5%) and grain yield (2475 kg/ha).

Keywords: Rice, sheath blight, integrated disease management

Introduction
Sheath blight of rice caused by *Rhizoctonia solani* Kuhn is one of the most devastating fungal diseases in all temperate and tropical rice growing areas of the world. The disease was first reported from Japan in 1910 by Miyake. In India, sheath blight was first reported from Gurdaspur (Punjab) by Paracer and Chahal (1963) [8] and later Kohli (1966) [5] reported it from Uttar Pradesh. The average Yield loss ranging from 20 to 50% have been reported depending on the intensity of infection and climatic conditions in different countries. However, under high disease severity, the yield loss may reach up to 70% (Baby 1992; Singh *et al.* 2016) [1, 11].

The symptoms of the disease first appeared in the form of lesions on the leaf sheath. The lesions were first ellipsoid or ovoid somewhat irregular, greenish grey, varying from and size 1-3 cm in length. The center of the lesion became greenish white with a brown margin. Under favorable conditions, infection spread rapidly to upper leaf sheath and leaf blades. Sclerotia were formed on or near these lesions which could be easily detached. The size and colour of lesion and formation of sclerotia depends upon the environmental condition. In the field, the lesion usually first appear near the water line. Sheath blightlesions produced on the leaf blades become larger and somewhat irregular in shape which were first greenish grey and gradually enlarged and become grayish- white with brown margin. In severe infection numerous sclerotial bodies also appeared on the lesion.

White mycelial growth of *Rhizoctoni solani* initially covered the panicle several stage brownish to black small sclerotial bodies interwoven with mycelium also appeared on ear head also infected grains become chaffy, partially filled, particularly in the lower parts of the panicles. Effects of sheath blight on grains from severely infected panicles were shriveled lighter in weight and exhibited grey to dark brown discoloration. Severely infected grains became chaffy.

The disease is caused by *Rhizoctonia solani* Kuhn (AG 1 IA) [Teleomorph: *Thanatephorus cucumeris* (Frank) Donk], Out of 14 anastomosis groups of *R. solani*, sheath blight fungus has been placed in AG-1 IA (Gonzalez-Vera *et al.* 2010) [3]. In India, Korea, Philippines and USA, *R. solani* isolates infecting rice belonged to AG-1 IA group while in Japan and Taiwan to AG-1 IA and AG-2-2. However, in Indonesia and China, they belonged to AG-1 IA, AG2-2, AG-4, and AG-1 IA, AG-1 IB, AG-1 IC, AG-4 and AG-Bb (binucleate isolates), respectively. Lore *et al*. (2015) [6] observed that sheath blight can be caused by *R. solani* and *R. oryzae sativae* occurring singly or in combination in different parts of India, though *R. solani* are the dominant species. They also found that mixed inoculation of *Rhizoctonia* species has been found to aggravate the disease complex.

Sclerotia produced by the fungus and the fungal mycelium surviving in the plant debris serve as a major source of primary infection. Sclerotia can also survive for a long period under unfavorable conditions. Rainwater runoff and flood irrigation permit good dispersal of floating sclerotia and consequently provide the primary inoculums. Several weed plants, *viz*. *Cynodon dactylon*, *Echinochloa colona and Echinochloa crusgalli*, etc. growing in and around rice fields infected by the pathogen and can be an important source of primary infection (Singh *et al.* 2012) [10]. In addition, the pathogen can also be seed-borne, and various workers have reported seed infection ranging from 10 to 39% (Dasgupta 1992) [2]. Sheath blight is basically a disease of warm and humid area (28-30 °C temperature and 96–97% RH). Cultivation of high-yielding, semi-dwarf, nitrogen-responsive varieties with broad leaves and thick canopy, close planting and heavy application of nitrogenous fertilizers leading to increased plant-to-plant contact and increase in humidity in the microclimate during maximum tillering stage are known to further aggravate the disease. The present stuty focused on better management practices with minimum use of fungicides for the management of this disease.

Materials and Methods

The field experiment was conducted to see the performance of integrated management practices against sheath blight of rice at Crop Research Station, Masodha, Ayodhya WS 2020 & 2021. The bio-agent (*Trichoderma viride*) and its time of application alongwith need based fungicides against sheath blight, were evaluated under natural infection *on rice variety Pusa Basmati 1*. The six treatment combinations were used *viz:* (T_1-Seed treatment with bio-control agent (*Trichoderma viride*) @ 10 g/kg seed, T_2- T_1 + bio-control agent at 15-20 DAT, T_3- T_1 + one spray of propiconazole at booting stage, T_4- T_2 + one spray of propiconazole at booting stage, T_5 - Seed Treatment with carbendazim (2 g/kg) + spray of (trifloxystrobin 25% + tebuconazole 50%) @ 0.4 g/l at booting stage and T6 - control) against *R. solani* under field conditions. Control plot were sprayed with ordinary water. The chemical fertilizers were used as per recommendation for crop cultivation. Disease observations were recorded after 20 days of final treatment. The disease severity and incidence was recorded as PDI (%) and increase in grain yield (kg/h) was calculated by using following formula.

$$\text{Per cent increase in yield} = \frac{\text{Yield in treated pot} - \text{Yield in check plot}}{\text{Yield in check plot}} \times 100$$

Results

The plot transplanted with (T_4) seeds treated with *Trichoderma* + spray of *Trichoderma* at 20 days of planting along with one spray of fungicide Propiconazole @ 1.0 ml/l at boot stage, found best yield in checking the disease severity (22.0% & 20.8%) incidence 23.1 and 21.5% along with grain yield 3750&3850 kg/ha in both the year respectively. Table 1&2, followed by T_5-seed treatment with Carbendazim + one spray of (Trifloxystrobin 25% + Tebuconazole 50%) @ 0.4g/l disease severity 28.2% and 27.0%, incidence 26.1 & 24.8% with 3563 & 3650 kg/ha grain yield both the year respectively. In case of T_3-seed treatment with bio-agent with one spray of Propiconazole at boot stage also reduced the disease severity 32.6 and 30% incidence 28.9 & 26.5% with grain yield 3513 & 3375 kg/ha, respectively. However, T_2- treated plot the severity and incidence was comparatively more than T_1 i.e. 42.5% and 40.6%, incidence 32.1 & 30.1% with grain yield 3075 & 3125 kg/ha. The plot planted with treated seed with bio-agent only (T_1) found more infection of sheath blight.

Table 1: Response of Integrated Management Practices on Disease severity and Grain Yield of rice *Kharif* 2020

Treatment	Disease Incidence (%)	Disease severity (%)	(%) decreased disease severity over control	Grain Yield (kg/ha	(%) Increased grain yield
T_1 - ST with Bio-agent (*Trichoderma viride*) @ (10 g/kg)	42.6 (40.16)	51.9 (46.07)	21.72	2763	13.92
T_2 - T_1 + bio-agent at 15-20 DAT	32.1 (34.48)	42.5 (40.68)	35.86	3075	26.80
T_3 - T_1 + one spray of Propiconazole @ 1.0 ml/l at booting stage	28.9 (32.32)	32.6 (34.58)	50.82	3513	44.85
T_4 - T_2 + one spray of propiconazole @ 1.0 ml/l at booting stage	23.1 (28.72)	22.0 (27.92)	66.86	3750	54.64
T_5 - ST with carbendazim (2 g/kg) + spray of (trifloxystrobin 25% + tebuconazole 50%) @ 0.4 g/l at booting stage	26.1 (30.69)	28.2 (32.20)	57.47	3563	44.35
T6 - control	43.3 (41.13)	66.3 (54.51)	-	2425	46.71
CD@5%	2.99	3.36	-	281.56	-
CV (%)	5.82	5.01	-	6.32	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

Table 2: Response of Integrated Management Practices on Disease severity and Grain Yield of rice *Kharif* 2021

Treatment	Disease Incidence (%)	Disease severity (%)	(%) decreased disease severity over control	Grain Yield (kg/ha	(%) Increased grain yield
T_1 - ST with Bio-agent (*Trichoderma viride*) @ (10 g/kg)	40.8 (39.68)	50.9 (45.49)	18.89	2887	14.36
T_2 - T_1 + bio-control agent at 15-20 DAT	30.1 (33.27)	40.6 (39.58)	35.23	3125	23.76
T_3 - T_1 + one spray of Propiconazole @ 1.0 ml/l at booting stage	26.5 (30.93)	30.0 (33.18)	52.21	3375	33.66
T_4 - T_2 + one spray of propiconazole @ 1.0 ml/l at booting stage	21.5 (27.56)	20.8 (27.08)	66.88	3850	52.48
T_5 - ST with carbendazim (2 g/kg) + spray of (trifloxystrobin 25% + tebuconazole 50%) @ 0.4 g/l at booting stage	24.8 (29.84)	27.0 (31.26)	56.98	3650	44.35
T6 - control	41.6 (40.22)	62.4 (52.37)	-	2525	-
CD@5%	3.12	3.50	-	290.75	-
CV (%)	6.18	5.35	-	5.96	-

(Figures in the parenthesis indicate transformed means; AT- Arc sine transformation)

Table 3: Response of Integrated Management Practices on Disease severity and Grain Yield of rice *Kharif* 2020 and 2021 (Pooled)

Treatment	Disease Incidence (%)			Disease severity (%)			Grain Yield (kg/ha		
	2020	2021	Mean	2020	2021	Mean	2020	2021	Mean
T_1 - ST with Bio-agent (*Trichoderma viride*) @ (10 g/kg)	42.6	40.8	41.7	51.9	50.9	51.4	2763	2887	2825
T_2 - T_1 + bio-agent at 15-20 DAT	32.1	30.1	31.1	42.5	40.6	41.6	3075	3125	3100
T_3 - T_1 + one spray of Propiconazole @ 1.0 ml/l at booting stage	28.9	26.5	27.7	30.6	30.0	31.3	3513	3375	3444
T_4 - T_2 + one spray of propiconazole @ 1.0 ml/l at booting stage	23.1	21.5	22.3	22.0	20.8	21.4	3750	3850	3800
T_5 - ST with carbendazim (2 g/kg) + spray of (trifloxystrobin 25% + tebuconazole 50%) @ 0.4 g/l at booting stage	26.1	24.8	25.5	27.2	27.0	27.6	3563	3650	3606
T6 - control	43.3	41.6	42.5	66.3	62.4	64.4	2425	2525	2475
CD@5%	2.99	3.12		3.36	3.50		281.56	290.75	
CV (%)	5.82	6.18		5.01	5.35		6.32	5.96	

Discussions

Under field condition, Integrated disease management (IDM) practices such as T_1- Seed treatment with Bio-control agent (*Trichoderma viride*) @ 10 g/kg seed, T_2 - T_1 + bio-control agent at 15-20 DAT, T_3 - T_1 + one spray of propiconazole at booting stage, T_4 - T_2 + one spray of propiconazole at booting stage, T_5 - Seed Treatment with carbendazim (2 g/kg) + spray of (trifloxystrobin 25% + tebuconazole 50%) @ 0.4 g/l at booting stage (Table 3) were used against sheath blight of rice. All these management practices were found moderate to highly effective in checking the disease severity and disease incidence as compared to control. The efficacy of among following treatments T_4 – ST with *Trichoderma viride* @ 10g/kg seed+ one spray of bio-agent at 20 DAT + one spray of propiconazole at booting stage were found best in compared to other treated plot. These practices suppressed the mycelial growth, sclerotia formation and their germination that might be cause of their excellent performance. Bio-agent protect seedling infection from sheath blight resulted enhancement of grain yield. These findings are comparable with the work of Kabdwal *et al.*, (2023) [4] they used combination of *Trichoderma harzianum* + *Pseudomonas fluorescens* + Herbal Kunapajala (Seed treatment + Soil fungicides @ 0.15 per cent was found effective. Prasad *et al.*, (2019) [9] also reported that integration of resistant cultivar with varying doses of N found effective response against sheath blight of rice.

References

1. Baby UI. Studies on the control of rice sheath blight disease with organic soil amendments. Ph.D. thesis, University of Madras, Madras; c1992. p. 128.
2. Dasgupta MK. Rice Sheath Blight: The challenge continues. In: Singh US, Mukhopadhayay AN, Kumar J, Chaube HS, editors. Plant diseases of international importance: diseases of cereals and pulses. Prentice Hall, Englewood Cliffs. 1992;1:130-157.
3. Gonzalez-Vera AD, Bernardes-de-Assis J, Zala M, McDonald BA, Correa-Victoria F, Graterol-Matute EJ, *et al*. Divergence between sympatric rice-and maize-infecting populations of Rhizoctonia solani AG-1 IA from Latin America. Phytopathology. 2010;100(2):172-182.
4. Kabdwal BC, Sharma R, Kumar A, Kumar S, Singh KP, Srivastava RM, *et al*. Efficacy of different combinations of microbial biocontrol agents against sheath blight of rice caused by Rhizoctonia solani. Egypt J Biol Pest Control. 2023;33:29. https://doi.org/10.1186/s41938-023-00671-6.
5. Kohli CK. Pathogenicity and host range studies on paddy sheath blight pathogen Rhizoctonia solani Kuhn. J Res P.A.U. 1966;3:7-40.
6. Lore JS, Jain J, Hunjan MS, Gargos G, Mangat GS, Sandhu JS, *et al*. Virulence spectrum & Genetic structure of Rhizoctonia isolates associated with rice sheath blight in the North region of India. Eur J Pl Pathol. 2015;143:847-860.
7. Miyake I. Studienuber die pilze der reisplanze in Japan. J. College Agric Imperial Univ., Tokyo. 2020;2:237-276.
8. Paracer CS, Chahal DS. Sheath blight of rice caused by Rhizoctonia solani Kühn: A new record in India. Curr. Sci. 1963;32:328-329.
9. Prasad V, Dixit S, Giri SP, Singh DP, Khan AW. Effect of integrated management practice on Sheath blight of rice. Journal of Pharmacognosy and Phytochemistry. 2019;8(3):3860-3862.
10. Singh A, Singh VK, Singh SP, Pandian RTP, Ellur RK, Singh D, *et al*. Molecular breeding for the development of multiple disease resistance in Basmati rice. AoB PLANTS; c2012. p. 29. https://doi.org/10.1093/aobpla/pls029.
11. Singh R, Sunder S, Kumar P. Sheath blight of rice: Current status and perspectives. Indian Phytopathol. 2016;69:340-351.