Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.6895

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (5):** 1005-1009 (2018)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Sustainable Management of Rice Sheath Blight Disease through Antagonists, Fungicide and Soil Amendments

Rajib Ranjan Chakrabarti[1], Niren Majumdar[2*] and Ranjan Nath[3]

[1]Department of Agriculture, Govt. of Tripura, Agartala

[2]College of Agriculture, Tripura. Lembucherra, Agartala

[3]Department of Plant Protection, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, Birbhum, West Bengal, India

*Corresponding Author E-mail: niren_majumder@yahoo.com

Received: 19.09.2018 | Revised: 15.10.2018 | Accepted: 23.10.2018

ABSTRACT

Rice sheath blight(Rhizoctonia solani) is one of the most important and widespread fungal disease worldwide. Although different management options like fungal and bacterial antagonists, fungicides and soil amendments are reported to be the effective against sheath blight and also increase plant growth as well as grain yield. The present study aimed towards developing a sustainable management of sheath blight disease through sole as well as combined application of these options. Three field trials were conducted during kharif season to assess the per cent disease index (PDI) and grain yield. Out of ten treatments including control the lowest PDI was observed in carbendazim+sawdust treatment (32.89).The highest PDI was found in carbendazim+sawdust treatment (22.30). All treatments showed significant decrease in PDI over control. The grain yield was observed 50.37q/ha in Trichoderma viride + Pseudomonas fluorescens followed by carbendazim + FYM (49.22q/ha). The per cent increase in yield was found highest in Trichoderma viride + Pseudomonas fluorescens treatment (55.22). All treatments found significant in grain yield over control.

Key words: *Rice sheath blight, Rhizoctonia solani, Sustainable management, PDI, Grain yield.*

INTRODUCTION

Rice is the most important food crop of the developing world and the staple food for more than 60% of Indian population[5]. The green revolution has helped the country to meet up the food demand, however, despite the past achievements; rice productivity has been declined due to various reasons. Sheath blight caused by *Rhizoctonia solani* Kuhn is one of the most important and wide spread diseases of rice in the world. The potential losses due to sheath blight alone in India has been up to 51.3 per cent[12]. Many fungicides were reported to successfully combat the disease or pathogen under field and laboratory condition but their inhibitory effect on the sclerotial germination of *Rhizoctonia solani* is very scanty.

Cite this article: Chakrabarti, R.R., Majumdar, N. and Nath, R., Sustainable Management of Rice Sheath Blight Disease through Antagonists, Fungicide and Soil Amendments, *Int. J. Pure App. Biosci.* **6(5):** 1005-1009 (2018). doi: http://dx.doi.org/10.18782/2320-7051.6895

Strobilurins were found very effective both in terms of disease reduction as well as in increasing grain yields[3]. Kazempour observed an increase in the population densities of the strains on rice root system. The isolates of *Pseudomonas fluorescens* were found to be compatible with one another under in vitro conditions. Although the bioagents like *Trichoderma viride*[14,7], *Pseudomonas fluorescens*[9,16], fungicides like carbendazim, edifenphos, validamycin, pencycuron [4,3] and soil amendments like farmyard manure, green manure, saw dust [2,11]. are reported to be the effective management options against sheath blight disease of rice and increase plant growth and yield. The integrated exploitation of biocontrol agents and organic amendments has been suggested as an effective method to control sheath blight disease[2] .The present study aimed towards developing a sustainable management of sheath blight disease through sole as well as combined application of these options.

MATERIAL AND METHODS

Three field trials were conducted during *kharif* , 2010 and 2011 at Agriculture Farm of Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan. The farm is situated at about $23^0 39'$, north latitude and $87^0 42'$, east longitude with an average altitude of 58.9 m above the mean sea level which comes under sub- humid and sub tropical climate. The soil of the experimental field was sandy loam in texture, slightly acidic in reaction (pH 6.4) with low level of organic carbon, available nitrogen and available P_2O_5 but medium level of available K_2O.

Sampling methods:

The field trials in every year were laid out in Randomized Block with ten treatments *viz.* T1 (FYM @ 10 t/ha), T2 (Saw dust @ 4 t/ha), T3 (Saw dust + FYM), T4 (*Trichoderma viride* + *Psudeomonas florescens*) @ 2.5 kg/ha, T5 [FYM +(*Trichoderma viride* + *Psudeomonas florescens*)@2.5 kg/ha], T6 (Sawdust + *Trichoderma viride* + *Psudeomonas florescens*), T7 (Carbendazim @ 1 g/l + FYM), T8 (Carbendazim + Sawdust), T9 (Carbendazim + Sawdust + FYM), T10 (control). All treatments were replicated thrice with a plot size of 4 m x 2 mfor each treatment and replication. *Rhizoctonia solani*, causal organism of sheath blight was artificially inoculated. The soil antagonists like *Trichoderma viride* and *Psudeomonas florescens* were mixed in soil directly and also dip the seedling root just before transplanting. Similarly, Farmyard manures (FYM) and saw dusts were applied in soil while carbendazim was sprayed at 10 days interval after 40 days of transplanting. The crop variety MTU-7029 (Swarna) under study received NPK @ 100:40:40 kg/ha. The plots without any treatments were kept as control. The plot size of 4m × 2m was kept for each treatment and replications, where plants were spaced at 15cm × 15 cm. The data were recorded on per cent disease index (PDI) and grain yield whereas percent decrease in PDI and percent increase in yield were calculated over control.

Randomly 20 tillers of each treatment plot were selected for taking the observations. The observation for percent disease index (PDI) over control and yield (q/ha) were also recorded for each treatment at maturity of the crop.

Calculation of PDI

First spraying was given on 40 days after transplanting and subsequent sprays at 10 days interval for 3 times. Sheath blight incidence was recorded on 10th day after last spraying, using a 0-5 grade scale[17].

0 = No infection 1 = Less than 5 per cent of the area of leaf sheath affected 2 = 6-10 per cent of the area of leaf sheath affected 3 = 11-25 per cent of the area of leaf sheath affected 4 = 26-50 per cent of the area of leaf sheath affected 5 = More than 50 per cent of the area of leaf sheath affected.

The per cent disease index (PDI) was calculated as given by McKinney[10].

$$PDI = \frac{\text{Total sum of numerical ratings}}{\text{Total number of tillers observed}} \times \frac{100}{\text{Maximum disease category}}$$

Statistical analysis:

The data collected from the field were statistically analysed and were presented.

RESULTS AND DISCUSSION

Integrated effects of soil amendments, chemicals and bio-agents for consecutive 3 years were pooled and have been presented in Table.1and Fig.1. All treatments showed significant decrease in percent disease index as increased yield over control. Out of ten treatments including control the lowest PDI was observed in carbendazim+sawdust treatment (32.89) followed by Farm Yard Manure (FYM) +*Trichoderma viride*+ *Pseudomonas fluorescens* (33.06), sawdust + FYM (33.17) and *Trichoderma viride* + *Pseudomonas fluorescens* (33.50). The treatment, saw dust + *Trichoderma viride* + *Pseudomonas fluorescens*, was next in order of efficacy in reducing incidence of sheath blight. Combined effect of carbendazim and saw dusts showed 22.30% highest reduction in PDI over control which was followed by FYM + *Trichoderma viride*+ *Pseudomonas fluorescens*(21.90%), sawdust + FYM (21.64%). Meena and Muthusamy[11] observed that neem cake, farmyard manure and decomposed coir pith effectively reduced disease incidence. They also concluded that the use of organic amendments as one of the successful methods for the control of soil borne pathogens. Significant reduction in sheath infection was observed with *Trichoderma viride* and *Trichoderma harzianum*[6]. The present results are also similar with the findings of Singh and Sinha[16]. Khan and Sinha[8] reported maximum reduction in disease incidence (32.78%) with FYM + *Trichoderma harzianum*. According to Senapoty[15], neem cake was the most effective in reducing disease incidence which followed by farmyard manure, vermicompost and rice husk.

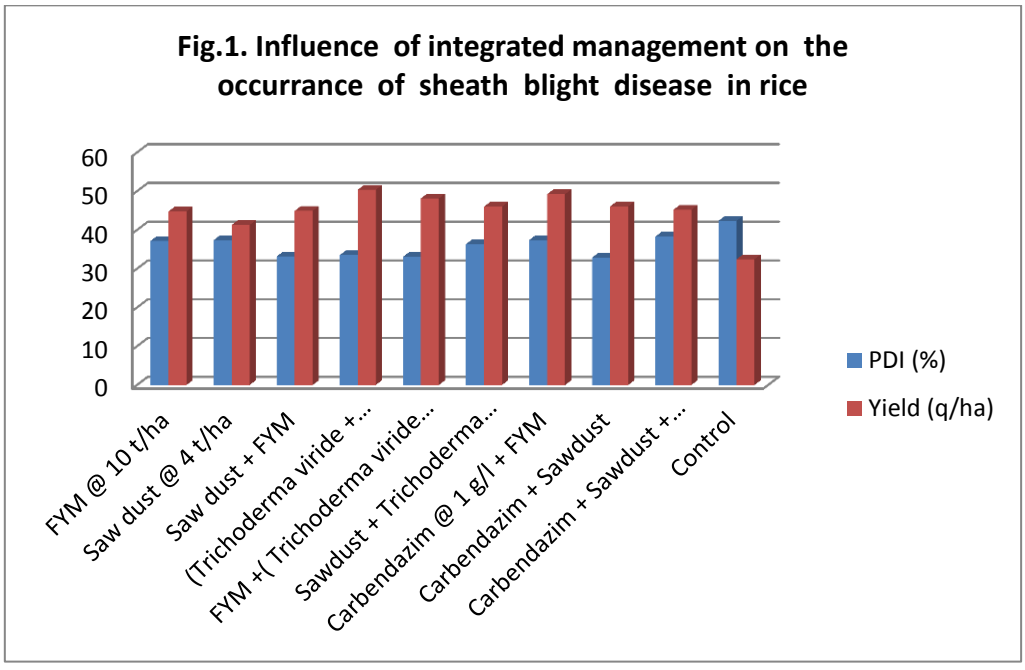
The grain yield (Table 1 and Fig.1.) was observed in *Trichoderma viride* + *Pseudomonas fluorescens* (50.37q/ha) followed by carbendazim + FYM (49.22q/ha), FYM + *Trichoderma viride* + *Pseudomonas fluorescens* (48.14q/ha), and carbendazim + sawdust (46.09q/ha). Grain yield increase of 55.22% over control was found to be significant in *Trichoderma viride* + *Pseudomonas fluorescens* followed by Carbendazim+ FYM (51.68%), FYM + *Trichoderma viride*+ *Pseudomonas fluorescens*(48.36%). Significant differences were in grain yield over control. All the treatments except soil application of saw dust were at par with each other in increasing yield but significantly different from where no treatment was applied *i.e.* control. A lowest increase of 27.23% was observed in the plots in which only saw dusts applied. Das and Hazarika[6]. reported that *Trichoderma harzianum* found to be effective in increasing yield. Grain yield (6.07 t/ha) was highest under the integrated use of FYM and chemical fertilizers[13]. Ashrafuzzaman *et al.*[1]. reported an average of 17.22 to 27.96% increase in grain yield when plants treated with single or combined doses of ash, bleaching powder, poultry manure and Bavistin. According to Surulirajan and Kandhari[18], soil amendment (FYM + Saw dust) along with spray(*Trichoderma viride*+ carbendazim) showed higher grain yield over control. Integrated effects of organic amendments with *Trichoderma harzianum* were at par with each other in increasing grain yield/plant[8].

The results of the present study showed that there is a scope for effective management of sheath blight disease with use of available soil amendments, fungal and bacterial antagonists.

Table 1. Effect of integrated management on yield and percent disease index (PDI) of rice

Treatment	PDI (%)	% decrease in PDI	Yield (q/ha)	% increase in yield
FYM @ 10 t/ha	37.19[b] (37.58)	12.15	44.80[a]	38.07
Saw dust @ 4 t/ha	37.37[b] (37.68)	11.73	41.28[b]	27.23
Saw dust + FYM	33.17[a] (35.17)	21.64	44.93[a]	38.47
(*Trichoderma viride* + *Psudeomonas fluorescens*) @ 2.5 kg/ha	33.50[a] (35.37)	20.86	50.37[a]	55.22
FYM +(*Trichoderma viride* + *Psudeomonas fluorescens*)@2.5 kg/ha	33.06[a] (35.10)	21.90	48.14[a]	48.36
Sawdust + *Trichoderma viride* + *Psudeomonas fluorescens*	36.33[b] (37.07)	14.18	46.01[a]	41.80
Carbendazim @ 1 g/l + FYM	37.37[b] (37.68)	11.73	49.22[a]	51.68
Carbendazim + Sawdust	32.89[a] (34.99)	22.30	46.09[a]	42.04
Carbendazim + Sawdust + FYM	38.28[b] (38.22)	9.58	45.19[a]	39.27
Control	42.34[c] (40.60)	0.00	32.44[c]	0.00
SEM(±)	0.65	-	2.29	-
CD at 5%	1.79	-	6.35	-

Treatments with similar alphabetical letters are statistically at par; Figures in parenthesis are angular transformed values



CONCLUSION

Sheath blight is important disease to reduce the grain yield and the present study can conclude that the per cent increase in yield was found highest in *Trichoderma viride* + *Pseudomonas fluorescens* treatment.

REFERENCES

1. Ashrafuzzaman, M., Jalaluddin, M., Khalil, M. I. and Hossain, I., Integrated management of sheath blight of aman rice. *Bangladesh J. of Plant Pathology*, **21(1/2):** 53-58 (2005).
2. Baby, U. I. and Manibhushanrao, K., Influence of organic amendments on arbuscular mycorrhizal fungi in relation to rice sheath blight disease. *Mycorrhiza*, **6(3):** 201-206 (1996).
3. Biswas, A., Bioefficacy of the new molecule Monceren 250 SC (pencycuron)

against sheath blight disease of rice. *Environment and Ecology*, **22(Spl-3):** 579-581 (2004).

4. Bora, K., Das, B. C. and Roy, A., KIntegrated management of sheath blight disease of rice with *T. harzianum* and chemicals. *Oryza*, **36:** 238-240 (1999).
5. C.R.R.I., Vision 2030. Central Rice Research Institute (ICAR), Cuttack, Odisha, India. (2011).
6. Das, B. C. and Hazarika, D. K.,Biological management of sheath blight of rice. *Indian Phytopath*, **53(4):** 433-435 (2000).
7. Kandhari, J., Majumdar. S. and Sen. B., Impact of *Aspergillus niger* AN 27 on growth promotion and sheath blight disease reduction in rice. *Int. Rice Res. Notes*, **25:** 21-22 (2000).
8. Khan, A. A. and Sinha, A. P, Integration of fungal antagonist and organic amendments for control of rice sheath blight. *Indian Phytopath.*, **59(30):** 363-365 (2006).
9. Mathivanan, N., Prabavathy, V. R. and Vijayanandraj, V. R., Application of talc formulations of *Pseudomonas fluorescens* Migula and *Trichoderma viride* Pres. ex S.F. Gray decrease the sheath disease and enhance the plant growth and yield in rice. *Journal of Phytopath*, **153(11/12):** 697-701 (2005).
10. McKinney, H.H., A new system of grading plant diseases. *J. of Agril. Res*., 26: 195-218 (1923).
11. Meena, B. and Muthusamy, M., Effect of organic soil amendments against rice sheath blight. *Indian Phytopath*, **52(1):** 92-93 (1999).
12. Ranjan, C. P. D, Estimation of yield losses due to sheath blight of rice. *Indian Phytopath*., **40:** 174-177 (1987).
13. Rekhi, R. S., Singh, R., Goel, R. K. and Singh, J, Crop yield, disease incidence, and insect pest attack in relation to N dynamics in rice. *Int. Rice Res. Notes*, **29(2):** 65-67 (2004).
14. Roy, A.K., Parasitic activity of *Trichoderma viride* on the sheath blight fungus of rice (*Corticium sasakii*). *Z. PflKrankh. Pfli. Schultz*, **84:** 675-683 (1977).
15. Senapoty D., Efficacy of soil amendments for the management of rice sheath blight. *Indian Phytopathology*, **63(1):** 94-95 (2010).
16. Singh R. and Sinha, A. P., Influence of time of application of *Pseudomonas fluorescens* in suppressing sheath blight of rice. *Indian Phytopath*, **58(1):** 30-34 (2005).
17. Sriram S, Raguchander T, Babu S, Nandakumar R, Shanmugam V, Vidhyasekaran P, Balasubramanian P, Samiyappan R, Inactivation of phytotoxin produced by the rice sheath blight pathogen, Rhizoctonia solani. *Can. J. Micro*., **46:** 520-524 (2000).
18. Surulirajan, M. and Kandhari, J., Integrated management of rice sheath blight under field condition. *Indian Phytopath*, **58(4):** 431-436 (2005).