The Pharma Innovation Journal 2022; SP-11(9): 940-942

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(9): 940-942

www.thepharmajournal.com
Received: 22-06-2022
Accepted: 05-08-2022

Snehdeep Kamboj
Agricultural Consultant, Global Agronomics, Abohar, Punjab, India

Ajay Kumar
Head, Global Agronomics, Abohar, Punjab, India

Damanpreet Singh Sandhu
Agricultural Consultant, Global Agronomics, Abohar, Punjab, India

Rajdeep Singh
Agricultural Consultant, Global Agronomics, Abohar, Punjab, India

Corresponding Author:
Snehdeep Kamboj
Agricultural Consultant, Global Agronomics, Abohar, Punjab, India

Rice sheath blight: Symptoms, causes, management and control

Snehdeep Kamboj, Ajay Kumar, Damanpreet Singh Sandhu and Rajdeep Singh

Abstract
Rice is the chief food grain and is a staple food for maximum of the world's population. Taking into consideration the substantial rise in projected population, increased crop yield is required to meet the requirements of the rising global food demand. But, biotic stresses such as diseases have hindered cultivation of rice. Out of them, rice sheath blight is a major soil borne disease leading to economic losses of rice cultivation. This article recapitulates Rice sheath blight (SB), disease symptoms, management and control. Specifically, it elaborates the effects of widespread chemical methods, various cultural methods and biological control methods that influence SB incidence.

Keywords: Rice, sheath blight, fungicides, biocontrol

1. Introduction
The population of world is anticipated to increase from 6.1 billion in 2000 to 9.2 billion in the year 2050 (Yellareddygari *et al*., 2014) [23]. Taking into account the substantial rise in projected human population, it requires enhanced crop yields to satisfy the supplies of the increasimg global demand for food. Countries including, Bangladesh, China, India, Pakistan, Indonesia, and Nigeria contribute to majority of the population growth annually. Among these six, Bangladesh, China, India, and Pakistan are foremost consumers of rice. Irrespective of chief advancements in agriculture sector over the past 5 decades, a substantial proportion of the world's population suffer from undernourishment and hunger. Malnutrition and hunger are responsible for the imbalance between demographic food demand and production of crops (Skamnioti and Gurr, 2009) [19]. Corresponding to the population rise, Food security issue is expected to arise with the probability of losing agricultural land to urbanization and industrialization that may possibly limit further expansion of area to less or non-fertile land (Young, 1999; Fernando, 2006) [24, 4]. Additionally, identification of novel plant diseases complexes the challenges scientists and growers meet worldwide to satisfy the nutritional supplies of the rising population.
It is a monocotyledonous annual grass that belongs to *Gramineae* family and *Oryza* genus. *Oryza* encompasses twenty wild and 2 cultivated species: *Oryza sativa* (cultivated worldwide) and *Oryza glaberrima* (cultivated merely in Africa) (Pareja *et al*., 2011) [13]. At present, China and India are ranked first and second in rice production as per the Foreign Service Association of United States Department of Agriculture statistics (Lee and Rush, 1983) [9]. Rice crop occupied 31.49 lakh hectares in Punjab with total paddy production of 208.83 lakh tonnes (139.92 lakh tonnes of rice) during 2020-21. The average yield of paddy was 66.31 quintals per hectare (26.84 quintals per acre). Despite of effective adaptation of scientific advances, industrial research and rice crop establishment, pathogens and pests are unescapable and defensive methods should be available to minimize the crop loss (Tilman *et al*., 2002) [21].

2. Rice Sheath Blight
The world's largest rice agro-ecosystem is considered to nurse the ever rising human population and it also acts as a home to great number of pathogens and pests. Rice diseases can result in substantial yield losses and quality degradation and can be a threat to the export industry. Sheath Blight of Rice (SB), caused by *Rhizoctonia solani* is one of the most devastating disease of rice throughout the world and it can cause about 50% loss of yield under optimal conditions (Yellareddygari *et al*., 2014) [23]. It is also a frequently occurring soil borne disease in rice. The catastrophe is that, 'there is no naturally occurring varieties of rice that are completely resistant to Sheath Blight".

Therefore, farmers have to merely rely on fungicides to overcome it.

3. Symptoms and modes of infection

The fungus produces long cells of septate mycelium that are of three types: runner hyphae, lobate hyphae and monolid hyphae. Sclerotia consists compact masses of mycelia which are white when young and turns brown to dark brown when older (Yellareddygari *et al*., 2014) [23]. Individual sclerotia are 1-6 mm in diameter which may unite to form large masses that are more virulent than smaller ones. Favorable conditions for the pathogen to attack is when temperature ranges between 28-32 °C and relative humidity is 95-100%. High levels of nitrogen fertilizers, high seeding rate, close plant spaces and frequent rains are also major reasons for the attack of sheath blight in paddy. The pathogen can also survive as sclerotia or mycelium in dry soil for 20 month whereas for 4-8 months in moist soil. It spreads through irrigation water (Prasad *et al*., 2010) [15].

The process of sheath blight infection in rice crop are described as follows:

- The crop is affected by the fungus at heading and tillering stage, and primary symptoms are witnessed over leaf sheaths adjoining water levels where oval, elliptical or irregular greenish grey spots are formed.
- In infected plants, spherical/oval/ellipsoid shaped lesions that are of 0.5-3 cm, with green grey to straw colored center can be witnessed.
- As the spots enlarge, a wide reddish brown margin starting from the sheath of leaves at the water line and gradually progressing from leaf sheath towards the leaf blades, panicles and tillers.
- The center becomes grayish white with blackish brown or purple brown borders.
- The presence of several large lesions on sheath generally results in death of complete leaf or the leaves of plants may die in severe cases. Eventually, leading to lodging and hampering in the grain filling (Singh *et al*., 2019) [17].
- Older leaves of five to six week of age are highly susceptible. A yield loss of nearly 25% is noticed if the flag leaves are infected.

4. Management and Control

There are many management strategies we can adopt to tackle the sheath blight that are explained below.

4.1 Chemical Control

Chemical method is one of the most widespread, easy-to-handle and widely adopted methods used for controlling rice sheath blight disease due to its higher efficacy rates (Fernando, 2006) [4]. However, despite of their effectiveness, chemical fungicides, do come with their health demerits and over dosages may possibly harm the plant itself (Cassman, 1999) [3]. Moreover, its constant usage comes with the risk of resistance development in the pathogen. Currently, cultural practices along with the fungicidal foliar spray is the commonly used method to manage disease (Skamnioti and Gurr, 2009) [19].

The chemical control of disease is done by the use of foliar fungicides. Carbendazim (1g/lit) and Propiconazole (1ml/lit) is highly effective. Spraying fungicides such as Benomyl and Iprodione and antibiotics, such as Validamycin is effective. Chlorothalonil 1 kg or Edifenphos 1 lit/ha can be used to treat infected crop.

Commonly used fungicides to overcome rice SB are Azoxystrobin, Propiconazole, Flusilazole, Validamycin, Carbendazim, Trifloxystrobin and Hexaconazole, either single or in combination (Bag, 2011; Prasad *et al*., 2010; Shamim *et al*., 2017; Singh and Singh, 2011) [2, 15, 16, 18]. However, Azoxystrobin which inhibits pathogen electron transport system showed best results against SB with 70-71% effectiveness in disease reduction (Uppala and Zhou, 2018) [22]. A few commonly used fungicides that can be used to manage Sheath Blight are listed in Table 1.

4.2 Biocontrol Agents

Biological control is documented as a promising substitute to chemical methods. There are various organisms that have an antagonistic effect when grown together with another organism. This is a natural phenomenon and is far better alternative to fungicides (Iftikhar *et al*., 2020) [7]. A few microbes that are used to control rice SB diseases are represented in Table 2.

4.3 Cultural Methods

Cultural methods to overcome the attack of sheath blight are applying green manure 6.25 t/ha or FYM 12.5 t/ha to encourage antagonistic micro flora. Avoid excess usage of fertilizers and grow crop at optimum spacing for healthy crop stand. Avoid the flow of irrigation water from infected fields to healthy ones. Practice deep ploughing of field in summer to kill pathogens and burning of stubbles to overcome the issue of sheath blight (Bag, 2011) [2].

Table 1: Fungicides and their recommended dosages.

S. No.	Fungicide	Recommended Dose	Disease Severity	References
1.	Azoxystrobin 25 SC	1.0 ml/L	16.40%	[1]
2.	Amistar 25SC [Azoxystrobin 25% SC]	1.0 mL/L	30.60%	[10]
3.	Trifloxystrobin 25%+tebuconazole 50% 75 WG	0.4 g/L	52.60%	[1]
4.	Validamycin	2.5 mL/L	21.47%	[10, 12]
5.	Metominostrobin 20 SC	2.0 mL/L	30.10%	[2]

Table 2: Microorganisms, their recommended doses and strains.

Microorganism	Species	Doses	Reduction of Disease Severity	References
Bacteria	*Bacillus subtilis*	MBI 600	22.9%	[10]
	Pseudomonas Fluorescens	Strain 7-14	85%	[5]
	Pseudomonas putida	V 14-i	68%	[20]
	Marine associated *pseudomonas*	AMET1102, AMET1104, AMET1133, AMET1133, AMET1140	31.9%	[8]
	Streptomyces	PM5	82.3%	[14]

Fungi	*Trichoderma harzianum*	4-8 gm	70%	[6]
	Trichoderma viride		45.70-47.30%	[11]

5. Conclusion

Rice Sheath Blight disease is among the top diseases of rice worldwide and rice lacks any naturally occurring variety that's 100% resistant. Therefore, the only way to treat rice SB disease lies in the hands of various chemical agents, biological agents, cultural methods or integrated use of all these.

6. References

1. Bag MK, Yadav M, Mukherjee AK. Bioefficacy of strobilurin based fungicides against rice sheath blight disease. Transcriptomics. 2016;4(128):2.
2. Bag MK. Performance of a new generation fungicide Metominostrobin 20SC against Sheath Blight disease of rice in West Bengal. Journal of Mycopathological Research. 2011;49(1):167-169.
3. Cassman KG. Ecological intensification of cereal production systems: Yield potential, soil quality, and precision agriculture. Proceedings of the National Academy of Sciences of the United States of America. 1999;96:5952-5959.
4. Fernando PC. Agriculture, pesticides, food security and food safety. Environmental Science & Policy. 2006;9:685-692.
5. Gnanamanickam SS, Valasubramanian R, Chatterjee A, Chatterjee AK, Mew TW. Antibiotic production mediates the biological control of rice blast by Pseudomonas fluorescens. Food and Agriculture Organization of the United States, 1994.
6. Gnanamanickam SS. Biological Control of Sheath Blight (ShB) of Rice. In Biological Control of Rice Diseases. Springer, Dordrecht, 2009, 79-89.
7. Iftikhar Y, Sajid A, Shakeel Q, Ahmad Z, Haq ZU. Biological antagonism: A safe and sustainable way to manage plant diseases. Springer, 2020, 83-109.
8. Jayaprakashvel M, Sharmika N, Vinothini S, Venkatramani M, Muthezhilan R, Hussain AJ. Biological control of sheath blight of rice using marine associated fluorescent pseudomonads. Biosciences Biotechnology Resesrch Asia. 2014;11:115-121.
9. Lee FN, Rush MC. Rice sheath blight: a major rice disease. Plant Disease. 1983;67:829-832.
10. Lu MM, Li S, Yang H, Morrisey EE. Foxp4: A novel member of the Foxp subfamily of winged-helix genes co-expressed with Foxp1 and Foxp2 in pulmonary and gut tissues. Mechanisms of Development. 2002;119:197-202.
11. Mathivanan N, Prabavathy VR, Vijayanandraj VR. Application of talc formulations of *Pseudomonas fluorescens*, Migula and *Trichoderma viride* Pers. ex SF Gray decrease the sheath blight disease and enhance the plant growth and yield in rice. Journal of Phytopathology. 2005;153(11-12):697-701.
12. Panda BB, Gaur K, Kori ML, Tyagi LK, Nema RK, Sharma CS, *et al*. Anti-Inflammatory and analgesic activity of *Jatropha gossypifolia* in experimental animal models. Global Journal of Pharmacology. 2009;3(1):1-5.
13. Pareja L, Fernández-Alba AR, Cesio V, Heinzen H. Analytical methods for pesticide residues in rice. Trends in Analytical Chemistry. 2011;30:270-291.
14. Prabavathy VR, Mathivanan N, Murugesan K. Control of blast and sheath blight diseases of rice using antifungal metabolites produced by *Streptomyces* sp. PM5. Biological Control. 2006;39(3):313-319.
15. Prasad D, Singh R, Singh A. Management of sheath blight of rice with integrated nutrients. Indian Phytopathology. 2010;63(1):11.
16. Shamim MD, Sharma D, Bisht D, Hussain R, Khan NA, Pandey P, *et al*. Molecular tools for controlling of sheath blight disease of rice and its management in biotic stress management in rice. Apple Academic Press. 2017;109:148.
17. Singh P, Mazumdar P, Harikrishna JA, Babu S. Sheath blight of rice: A review and identification of priorities for future research. Planta. 2019;250(5):1387-1407.
18. Singh R, Singh BP. Efficacy of Validamycin at different crop stages against sheath blight of rice. Indian Phytopathology, 2011.
19. Skamnioti P, Gurr SJ. Against the grain: safeguarding rice from rice blast disease. Trends in Biotechnology. 2009;27:141-150.
20. Thara KV, Gnanamanickam SS. Biological control of rice sheath blight in India: Lack of correlation between chitinase production by bacterial antagonists and sheath blight suppression. Plant and Soil. 1994;160(2):277-280.
21. Tilman D, Cassman KG, Matson PA, Naylor R, Polasky S. Agricultural sustainability and intensive production practices. Nature. 2002;418:671-677.
22. Uppala S, Zhou XG. Field efficacy of fungicides for management of sheath blight and narrow brown leaf spot of rice. Crop Protection. 2018;104:72-77.
23. Yellareddygari SKR, Reddy MS, Kloepper JW, Lawrence KS, Fadamiro H. Rice sheath blight: A review of disease and pathogen management approaches. Journal of Plant Pathology and Microbiology, 2014, 5(4).
24. Young A. Is there really spare land? A critique of estimates of available cultivable land in developing countries. Environmental Development and Sustainability. 1999;1:3-18.