Impact of Cultural Practices and Nitrogenous Fertilizer on the Development of Brown Spot Disease of Rice

ABSTRACT

Among the diseases the brown spot disease of rice caused by *Bipolarisoryzae* is most dominant fungal disease of rice after blast (*Pyriculariaoryzae*) which is causing losses in the yield which resulted in instability in rice production particularly in north Bihar. This disease was considered to be one of the most important facet of 1943 Bengal Famine. The losses in famine were accounted to 50-90 per cent (Ghose*et al*. 1960; Padmanabhan, 1973). The disease is a serious and has global distribution and it has been found in all rice growing countries in Asia, America and Africa.The studies mainly adhered to see the effect of various doses of nitrogen and different cultural practices on development of brown spot disease of rice.Among the various cultural practices, minimum (17.64%) disease seventy and maximum yield (3.13/ha) were found with application of FYM (5 t/ha) + line sowing of 60 kg seed/ha + 50% N application after 15 DAS 25% Nat maximum tillering + 25% N at panicle initiation + weed control. Doses of nitrogen were positively related with the disease development and negatively related with the grain yield indicating the maximum (38.30% and 39.0%) disease severity and minimum (1.86 and 1.97 t/ha) grain yield with nitrogen dose of 120 kg/ha. In respect of varietal response, the minimum (12.10% and 16.40%) disease severity and the maximum (4.34 t/ha and 4.58 t/ha) yield were recorded in the variety Rajshree receiving 80 kg N/ha.

Key words: Brown spot, Cultural practice, Disease, Fertilizer, Rice

Introduction

"Rice is the most important cereal crop of India and staple food to two third of Indian" (Saikat Sen et al., 2020)."It is estimated that 3.4 billion people eat rice everyday" (irri.org/news-andevent/news/scaling-sustainable-rice-farming-practices-achieve-food-security-asia, 2020). "In terms of global rice production India remained as single second largest country with 118.00 million metric tons and China being world number one with

146.73 million metric tons". (worldagriculturalproduction.com/crop/rice, aspx, Apr.16, 2020). "Although India believed a prominent position in worldwide rice areas and production, the productivity per unit area by world standard is still low with average productivity of about 2.39 t/ha, whereas, in case of China it is 6.71 t/ha. One key factor for low productivity of rice in India is due to pest and disease occurrence. Several biotic and abiotic diseases caused awidespread economic loss to rice crops. Among the pathogens, fungi alone account for nearly 30 diseases of rice in the country" (Rangaswami et al. 2002). The brown spot disease of rice incited by *Bipolarisoryzae* is one most important fungal disease that caused yield loss of upto 45%. On average, the disease causes severely infected seeds cause seedling blight and lead to 10−58% seedling mortality. It also affects the quality and the number of grains per panicle, and reduces the kernel weight.In terms of history, Brown spot was considered to be the major factor contributing to the Great Bengal Famine in 1943.

Materials and Methods

Five cultural practices viz. T_1-farmer's practice of broadcasting (100 kg seed/ha) + RFD, T_2-improved practice of cultivation (sowing of 60 kg seed/ha) + RFD), T_3-line sowing (60 kg seed/ha) +50 % NPK in furrow + 5 tone FYM/ha (before sowing of seed), T_4 -dibbling of two seeds at 20 x 10 cm + RFD, T_5 -FYM (5 t/ha) application 15 days before line sowing of 60 kg seed/ha + 50% N application 15 days after sowing + 25% N at maximum tillering + 25% Nat panicle initiation + weed control. T_6-line sowing (100 kg seed/ha)+125% RFD and two doses of nitrogen *viz*, 80 kg and 120 kg/ha were evaluated against brown spot disease of rice

To evaluate the effect of cultural practices and doses of nitrogen on brown spot of rice, two different field trials were conducted during *Kharif*, 2019 and2020 at Bihar Agricultural University Farm. Sabour, Bhagalpur (Bihar). The first field trial on cultural practices was laid out in randomized block design with 4 replications and variety Pankaj. To see the effect of nitrogen doses, the second field trial was laid out in randomized block design

with 3 replications at 15x15 cm spacing with variety Pankaj, Satyam and Rajshree. Observation on the foliar infection due to brown spot disease were recorded a week after the spraying with fungicides. Ten plants were selected in each plot randomly and the disease severity was recorded at dough stage following 0-9 scale in accordance with standard evaluation system (IRRI 1998 and 1996). The crop yield was recorded after harvest.

Result and Discussion

Effect of various doses of nitrogen on the development of brown spot disease

Effect of two doses (80, 120 kg/ha) of nitrogen in relation to three varieties i.e., Pankaj, Satyam and Rajshree was studied in relation to the development of brown spot disease of rice during *Kharif* 2019 and 2020and the recorded data are presented in Table1.

There was gradual increase in disease severity and decrease in yield as the dose of nitrogen levels were increased to 120 kg/ha. There was a significant differences in disease severity with respect to nitrogen levels, higher (38.30%) disease severity and minimum (1.86 t/ha) yield in 2005 and (39.40%) disease severity and (1.97 t/ha) yield in 2006 with 120 kg/ha nitrogen were recorded in variety Pankaj.The minimum (12.10 % and 16.40%) disease severity and maximum (4.34 and 4.58 t/ha) yield with 80.0 kg/ha nitrogen in variety Rajshree were recorded during both years, respectively. This is in accordance with the work of Maji and Imolehin (2003) concluded that Nitrogen fertilizer at 40 kg N/ha significantly reduced *C. miyabeanus* incidence in the 1997-98, but not in 1998-99 and 1999-2000 cropping season at the same site. Goel *et al*. (2003) reported that the mean incidence of brown spot disease was minimum in the treatment N 120, P 30, K 30, Zn 3 kg/ha.

Sunder *et al*. (2005) revealed a significant reduction in brown leaf spot with increase in Nitrogenous fertilizer levels from 0- 180 kg ha^{-1}, irrespective of cultivars. The maximum brown leaf spot severity (29.2%) was recorded in HKR 95-192 and HKR 46, respectively,

while it was minimumin HKRH 1059 and IR 64.Manzoor et al. (2017) reported that Rice blast responded significantly to N fertilization. Both deficiency and excessive use of N promoted disease severity.

Effect of various cultural practices on the development of brown spot disease and yield of rice

Impact of various cultural practices on development of brown spot disease was studied in *Kharif*2019 and 2020 and the recorded data are presented in Table 2. In *Kharif* 2019It is obvious from the data that treatment T_5(FYM 5 t/ha application 15 days before line sowing of 60 kg seed/ha + 50% N application 15 days after sowing + 25% N at maximum tillering + 25% Nat panicle initiation + weed control) recorded the minimum disease severity (18.10%) and maximum yield (3.02 t/ha) which was statistically at par with treatment T_4(dibbling of two seeds at 20 x 10 cm + RFD)20.70% and T_3(line sowing with 60 kg seed/ha +50 % NPK in furrow + 5 tone FYM/ha before sowing of seed)21.10%. However, the maximum disease severity (43.80%) and minimum yield (1.63 t/ha) were observed in treatment T_6 (line sowing with 100 kg seed/ha +125% RFD).

Similar trend was found in *Kharif* 2020. The minimum disease severity (17.17%) and maximum yield (3.24 t/ha) were observed in treatment T_5(FYM 5 t/ha application 15 days before line sowing of 60 kg seed/ha + 50% N application 15 days after sowing + 25% N at maximum tillering + 25% Nat panicle initiation + weed control) which was at par with treatment T_4(dibbling of two seeds at 20 x 10 cm + RFD) 19.60% and T_3(line sowing with 60 kg seed/ha +50 % NPK in furrow + 5 tone FYM/ha before sowing of seed)20.30%. However, the maximum disease severity (42.43%) and minimum yield (1.75 t/ha) were recorded in treatment T_6(line sowing with 100 kg seed/ha +125% RFD).

Pooled analysis of two year data revealed that the minimum disease severity (17.64%) and maximum yield (3.13 t/ha) were observed in treatment T_5 followed by treatment T_4 (20.15%) and T_3 (20.70%). Treatment T_6 recorded the maximum (43.11%) disease severity and minimum yield (1.68 t/ha).This result is in accordance with Annual report of Directorate of Rice Research, 2006, Sanjeev et al. (2009) and Jacob and Elizabeth. 2005.

Conclusion

Doses of nitrogen were positively related with the disease development and negatively related with the grain yields indicating the maximum disease development and minimum grain yield with nitrogen dose of 120 kg/ha. Varietal responses were also clear, showing the minimum disease severity and the maximum yield with the variety Rajshree. Among the various cultural practices minimum (17.64%) disease severity and maximum (3.13 t/ha) yield were found in application of FYM (5 t/ha) + line sowing of 60 kg seed/ha + 50 % N application after 15 DAS + 25% at maximum tillering + 25% at Panicle initiation + weed control.

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Table 1: Effect of various doses of nitrogen on the development of brown spot disease of rice.

Treatments	2019				2020			
	Disease severity (%)*		Yield (t/ha)*		Disease severity (%)*		Yield (t/ha)*	
	80 Kg N	120 Kg N	80 Kg N	120 Kg N	80 Kg N	120 Kg N	80 Kg N	120 Kg N
Pankaj	26.6	38.3	2.90	1.86	30.1	39.4	2.93	1.97
Satyam	22.2	27.6	3.15	2.72	22.1	29.9	3.35	2.60
Rajshree	12.1	16.0	4.34	3.47	16.4	21.0	4.58	3.56
CD at 5%								
For N level	3.2		0.8		4.3		0.7	
For varieties	2.8		0.3		4.1		0.4	

* Average of 3 replications.

Table 2: Effect of various cultural practices on the development of brown spot disease and yield of rice

Treatments	2019		2020		Pooled	
	Disease severity (%)*	Yield (t/ha)*	Disease severity (%)*	Yield (t/ha)*	Disease severity (%)*	Yield (t/ha)*
Farmers practice of broadcasting (100 kg seed/ha) + RFD	33.40	1.84	32.15	1.97	32.78	1.41
Improved practice of cultivation (60 kg seed/ha) + RFD	30.20	2.42	28.08	2.52	29.18	2.47
Line sowing (60 kg/ha) + 50% NPK in furrows + 5t FYM /ha (before sowing of seed)	21.10	2.68	20.30	2.70	20.70	2.69
Dibbling of two seeds at 20x10 cm + RFD	20.70	2.87	19.60	3.01	20.15	2.94
FYM (5 t/ha) application 15 days before (60 kg seed) and 50% N application after 15 DAS + 25% at Maximum tillering + 25 % at PI + weed control	18.10	3.02	17.17	3.24	17.64	3.13
Line sowing (100 kg seed/ha) + 125 % RFD	43.80	1.63	42.43	1.75	43.11	1.68
C.D. (0.05)	3.42	0.38	4.41	0.41	2.06	0.27
C.V. (%)	8.16	10.56	11.01	10.40	5.03	7.40
S. Em. $\pm$	1.13	0.12	1.46	0.13	0.68	0.09

* Average of 4 replications.