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SHORT COMMUNICATION

Effect of varietal resistance and nitrogen management on the severity of Bacterial leaf blight of Rice

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Bacterial leaf Blight (BLB) of rice caused by Xanthomonas oryzae pv. oryzae is a major disease of rice in Odisha now a days. The extent of losses caused due to the disease necessitates the development of strategies that are environment friendly and cost effective to reduce crop loss as well as to avoid an epidemic. So a combination of strategies is required to combat this problem. Keeping this in view, a field experiment was carried out with two types of disease management practices other than chemicals i.e., varietal resistance and nitrogen management. The experiment was designed in Split plot with four replications. Four rice varieties were taken as highly susceptible (TN-1), susceptible (Swarna), moderately resistant (Pratikshya) and resistant (Ajay) in the main plots and two nitrogen levels of 80kg/ha and 120kg/ha were maintained in the sub plots. Least disease severity (7.88%) was noticed in the resistant variety Ajay with 80kg N/ha followed by moderately resistant variety Pratikshya (14.75%) with 80kg N/ha and the highly susceptible variety TN-1 showed highest disease severity (47.88%) with 120kg N/ha.

Key words: Rice, BLB, varietal resistance, nitrogen management

Bacterial leaf blight (BLB) caused by *Xanthomonas oryzae* pv. *oryzae* is an important disease of irrigated rice and cause significant yield reduction in case of serious infections. Leaf wilting and rolling symptoms appear in rice seedlings infected by the pathogen and the colour of the leaves turn greyish-green to yellow as the disease progresses. Ultimately the whole seedling dies. In case of mature plants lesion begins as water-soaked stripes on the leaf blades and expands in size becoming yellow to greyish white and finally the entire leaf dries up. The disease is known to occur in epidemic proportions in many parts of the world causing severe crop loss of up to 50%. Since the introduction and widespread cultivation of high yielding but susceptible rice cultivars which are highly responsive to nitrogen fertilizers, BLB has become one of the most serious diseases of rice. An increased application of nitrogen fertilizer is reported to favour disease development and thus causes greater yield loss. Antibiotics, fungicides, and even organics such as cowdung were attempted for the control of this disease but so far, only a partial control of the disease has been possible and BLB remains one of the main biotic constraints to rice production.

In the present investigation, the interaction of two methods of management practice viz. nitrogen management and varietal resistance were tested under field condition for the control of the disease. The current approach tends to develop an integrated control strategy for bacterial leaf blight disease combining genetic resistance and cultural control practices like the judicious use of nitrogenous fertilizers instead of the conventional chemical control.

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The experiment was conducted at All India Coordinated Rice Improvement Project, Regional Research and Technology Transfer Station at Chiplima ($20^0$21'N latitude and $80^0$55'E longitude) Sambalpur, Odisha during *Kharif* season of 2011-12 and 2012-13. The soil was sandy loam and slightly acidic. The experiment was laid out in split plot design with two factors i.e., varietal resistance and nitrogen interaction and the treatments including untreated check were replicated four times. Four rice cultivars namely TN-1 (V_1), Swarna (V_2), Pratikshya (V_3) and Ajay (V4) were taken in main plots as highly susceptible, susceptible, moderately resistant and resistant to bacterial leaf blight disease. In sub plots two nitrogen management levels of 80 kg (N_1) and 120 kg N/ha (N_2) were maintained. Each plot measured 15m^2 with spacing of 15x15 cm with bunds all around the plots. Replications were separated with a gap of 1m for irrigation channels. The seedlings were transplanted by hand into the field at the 5th to 6th leaf stage with recommended package of practices except plant protection. The experimental area was kept free of weeds by hand weeding. The field was flooded from the day of transplanting and the water maintained between 5- 10 cm deep until the grain reached physiological maturity. The field was fertilized with 80:50:50 kg NPK /ha in N_1 plots and 120:50:50 kg NPK/ha in N_2 plots. One half of nitrogen, full dose of phosphorus and half of potash were applied as basal, half of the remaining nitrogen and half of potash at tillering stage and finally the remaining one fourth nitrogen was applied at panicle initiation stage. No artificial inoculation was made as natural inoculum was sufficient to cause the disease. Three sampling units of one m^2 area were fixed in each plot at random for observation of disease severity. Disease severity was recorded at ten days interval starting from the initiation of the disease symptoms and terminal disease severity was recorded at heading stage. The grain yield of each plot was recorded at the time of harvest and converted to q/ha. Both the data on disease severity as well as grain yield were analysed statistically.

Effect of nitrogen management and varietal resistance on BLB severity and ultimately on yield of rice is presented in Table 1.

The result revealed that, nitrogen management played a significant role in controlling BLB disease severity irrespective of variety. While considering the pooled data it was found that even in the highly susceptible variety TN-1, disease severity reduced drastically from 47.88 % in N_2 plots to 31.75 % in N_1 plots only due to reduction in nitrogen level from 120 kg/ha to 80 kg/ha. Similarly in other varieties also, a sharp reduction of 7-9 % in disease severity was noticed when nitrogen level was reduced to 80 kg/ ha. In the susceptible variety Swarna, disease severity reduced to 20.08% from 29.11% due to reduction in the nitrogen level. The disease severity reduced from 21.68% to 14.75% and from 14.13% to 7.88% in variety Pratikshya and Ajay respectively due to judicious use of nitrogen @ 80 kg/ha. All the N_1 and N_2 plots differed significantly from each other irrespective of varieties. Application of high level of nitrogen was found to increase disease incidence and severity and had been described by many earlier workers High nitrogen level favours pathogen multiplication, lesion enlargement and makes the microclimate more favourable for the pathogen due to increased vegetative growth of the plant. Effect of nitrogen management in reducing BLB severity was also reported. It was found 76 kg N/ ha as the optimum dose to derive a good yield of rice even from a susceptible cultivar which is in conformity with the present finding.

When varietal resistance was considered, BLB disease severity was found to be lowest (7.88 %) in the resistant variety Ajay with reduced nitrogen dose of 80 kg/ha followed by moderately resistant variety Pratikshya with a pooled disease severity of 14.75 % in N_1 plots. The susceptible variety Swarna recorded a disease severity of 20.08 % in N_1 plots and the highly susceptible variety TN-1 recorded the highest disease severity (31.75 %) among N_1 plots. This implies that use of a resistant variety is a better approach to reduce the BLB disease severity. All the varieties differed significantly from each other both in main and sub plots with respect to disease severity. As effective systemic bactericide are not feasible against BLB therefore use of resistant cultivars can be one of the alternatives to mitigate BLB problem .

While considering the combined effect of varietal resistance and nitrogen management, the pooled data revealed that the resistant variety Ajay with nitrogen dose of 80 kg/ha gave the best result recording the lowest BLB disease severity. Reduced disease severity certainly had an effect on the yield of rice crop also. Highest yield of 37.85 q/ha was achieved from the same treatment i.e. from resistant variety Ajay with 80 kg nitrogen/ha.

Table 1: Effect of nitrogen management and varietal resistance on BLB severity and yield of rice

		Bacterial blight severity (%)			Yield (Q/ha)		
Main Plot	Sub Plot	2011	2012	Pooled	2011	2012	Pooled
V_1 (TN-1)	N_1	31.28(33.98)	32.23(34.55)	31.75(34.27)	20.75	31.50	26.15
	N_2	50.73(45.40)	45.03(42.11)	47.88(43.76)	19.66	27.50	23.60
V_2 (Swarna)	N_1	21.43(27.55)	18.73(25.57)	20.08(26.59)	32.71	37.68	35.23
	N_2	28.88(32.47)	29.35(32.73)	29.11(32.63)	27.17	32.68	29.93
V_3 (Pratikshya)	N_1	18.45(25.42)	11.05(19.34)	14.75(22.56)	30.00	39.50	34.78
	N_2	23.38(28.86)	19.98(26.43)	21.68(27.67)	24.33	33.18	28.80
V_4 (Ajay)	N_1	9.85(18.27)	5.90(13.94)	7.88(16.27)	32.15	43.50	37.85
	N_2	16.80(24.15)	11.48(19.73)	14.13(22.04)	29.93	39.18	34.58
CD(0.05)	Main	1.33	1.64	1.15	0.95	1.73	0.97
	Sub	1.23	1.51	1.22	0.89	1.70	0.96
Interaction	M in S	2.49	NS	NS	1.80	NS	NS
	S in M	2.19	NS	NS	1.58	NS	NS

Note: N_1=80kg Nitrogen/ha, N_2=120Kg Nitrogen/ha

Though high nitrogen is known to increase the yield level but at the same time it aggravates the BLB disease severity leading to reduction in yield. I was found that yield response curve (YRC) had a positive slope at low nitrogen levels and a negative slope at high nitrogen levels and reported that increased nitrogen levels were associated with increased BLB and hence reduced yield. Therefore judicial use of nitrogen is a must to get highest yield with lowest disease severity. In the present experiment, 80 kg nitrogen/ha was proved to give superior result as against 120 kg nitrogen/ha in managing BLB disease severity and increasing the yield. With proper nitrogen management, susceptible variety Swarna produced more yield (35.23 q/ha) than the moderately resistant variety Pratikshya (34.78 q/ha) which might be attributed to high yield potential of the former variety though both of the variety were statistically at par with each other with respect to yield. So, determination of optimum nitrogen level for a susceptible cultivar can minimize its disease impact and thereby maximize its genetic yield potential. The highly susceptible variety TN-1 produced lower yield of 26.15q/ha in spite of nitrogen management and thus proved the importance of disease management through resistance breeding.

Therefore combining all the above factors it can be concluded that BLB can be managed in an ecofriendly way by the use of a resistant variety along with proper nitrogen management as judicial use of nitrogenous fertilizer is the most crucial factor in BLB management. In our present study, resistant variety Ajay with nitrogen dose of 80 kg/ ha gave best result recording lowest disease severity and highest yield.