Mycopath (2003), **1**(2): 115-117

Economic evaluation of bakanae disease of rice

Saleem Il Yasin, Tasleem-uz-Zaman Khan, Khalid Majeed Akhtar, Muhammad Anwer and Mushtaq Ahmad

Rice Research Institute, Kala Shah Kaku, Lahore

Abstract

Bakanae disease infestation levels of 5, 10, 25, 50, 75 and 100% seedlings were compared with non-infested control in a field trial. According to the results treatments with 5, 10, 25, 50, 75 and 100% infestation had significantly lower paddy yields of 4.15, 3.95, 3.75, 2.97, 2.45 and 1.87 t/ha respectively against 4.45 t/ha paddy yield in the control. Losses of 57.97% were recorded in 100% infested treatment producing 68.40% seedling infection. The study indicated the potential of the disease to cause heavy economic losses.

Key words: *Fusarium moniliforme*, Bakanae disease, incidence: loss ratio.

Introduction

Rice (*Oryza sativa* L.) is an important crop of Pakistan cultivated over 2225 hectares with an average production of 3350 kg/ha (Anonymous, 2003). Among the diseases that affect rice crop, Bakanae disease is a major disease of rice caused by *Fusarium moniliforme* Sheld., causing great damage to the crop (Wahid *et al*., 1991). Yield losses are as high as 20 to 50% in Japan, 15% in India and 3.7 to 14.7% in Thailand have been reported (Ou, 1985). During a survey of the traditional Basmati rice growing area of the Punjab, a high disease incidence was recorded in Sheikhupura, Gujranwala and Sialkot districts. Disease incidence up to 30% was recorded in district Gujranwala, in Sadhoke area; no field was free from the disease in the whole area surveyed (Khan *et al*., 2000). Disease control studies have found fungicidal seed treatment effective in controlling the disease (Khan *et al*., 1995; Aurangzeb *et al*., 1998). Information on relationship of the disease incidence with paddy losses is lacking. The current studies were planned with the objective to investigate the effect of different infestation levels on disease development, paddy yield and their relationship.

Materials and Methods

Field trial

Fusarium moniliforme was grown on autoclaved wheat grains for two weeks at 20°C. Aqueous suspension was prepared by blending 1 kg culture, grown on grains, in 4 litres of sterilized distilled water. Roots of a 30-days old seedlings of Basmati 385 were washed under running tap water and infested by dipping roots in the inoculum. Infestation levels of 5, 10, 25, 50, 75 and 100% were established by transplanting appropriate percentage of the infested and non-infested seedlings. Non-infested seedlings were used as control. The studies were conducted in randomised complete block design (RCBD) having plot size 2 x 5 m with 4 replications at Rice Research Institute, Kala Shah Kaku. No Potash was added to the field while a high nitrogen dose of 150 kg/ha was applied in order to increase the succulence and susceptibility of plants. Bakanae disease incidence data were recorded 3 weeks after transplanting and paddy yield data were recorded at maturity. Statistical analyses of the data were conducted and significance was tested using least significance difference (LSD) test.

Economic evaluation of the disease

Percent decrease in the yield against the control was calculated for all the treatments. To study the relationship of the disease incidence with yield losses, corrected disease incidence and incidence: losses ratio for each treatment was calculated as below:

$$\text{Corrected disease incidence} = \text{Incidence recorded} - \text{Incidence in control}$$

$$\text{Incidence: Losses ratio} = \frac{\text{Percent yield losses against control}}{\text{Corrected disease incidence}}$$

Relationship of the disease incidence with losses was studied by the curve obtained by plotting incidence: loss ratios against the corrected disease incidence.

Results and Discussion

Field trial

Significant seedling infection of 6.58, 10.20, 33.52, 49.17 and 68.40 percent was recorded in the treatments of 10, 25, 50, 75 and 100 percent seedling infestation respectively against 0.46%

disease in the control (Table 1). The same treatments also caused significant reduction in paddy yields by 11.23, 15.73, 33.25, 44.94 and 57.97% in the same order against 4.45 t/ha paddy yield in the control. The disease increased with increasing infestation levels and caused a progressive reduction in the yield. Disease levels recorded in different treatments reflected proportionately, but remained lower than the initial infestation levels. This effect might be due to some antagonistic or other biotic factors that would require a separate study on this aspect or due to weather fluctuations especially lower soil temperature due to which a lower number of seedlings expressed the disease. A lower infection level at lower soil temperatures has been reported and the effect is on the seedlings rather than infection as fungus has been isolated from outwardly healthy-looking seedlings (Ou, 1985). A low level of disease incidence in the control may be due to the natural infection/presence of the pathogen in the seedlings.

Economic evaluation of the disease

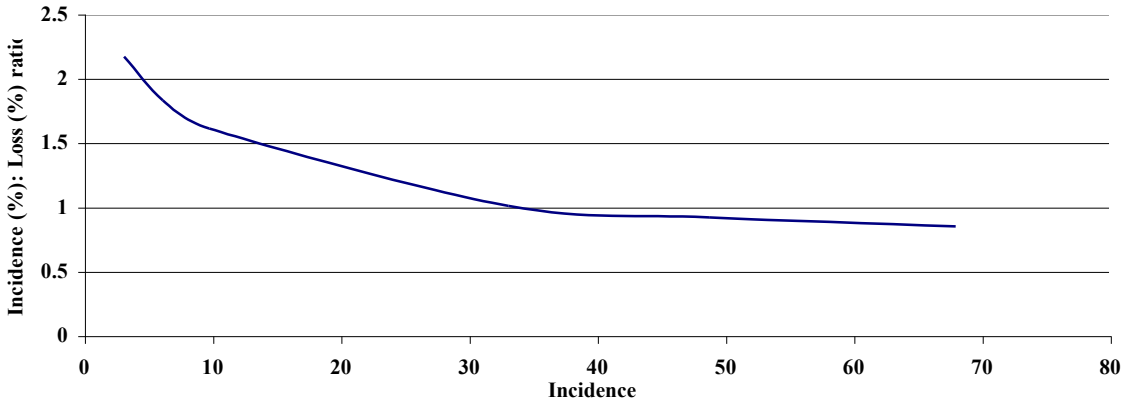
From the results on economic losses it is drawn that the economic losses increase as the disease increases (Table 1). The disease can claim up to 57.97% reduction in yield or losses by 68.40% disease incidence. It is deduced from the current study that the disease has a potential of causing heavy economic losses. Considering the potential economic losses due to the disease, on the basis of this study in conjunction with the previous studies (Khan *et al*., 1995; Aurangzeb *et al*., 1998) seed treatment with suitable fungicides is emphasised. The relationship between Bakanae disease incidence and losses are presented in Figure 1. The curve or the trend obtained provides useful information. The relationship observed in the study can serve as a tool for the estimation of economic losses due to the disease in standing rice crop.

Table 1: Effect of different infestation levels on Bakanae disease development and paddy yield

Treatments	Seedling infection (%)**	Paddy yield (t/ha)**	Percent reduction in paddy yield	Incidence : Loss ratio
T1: (0% infestation)	0.46 *f*	4.45 *a*	-	-
T2: (5% infestation)	3.56 *ef*	4.15 *ab*	6.74	1 : 2.17
T3: (10% infestation)	6.58 *de*	3.95 *bc*	11.23	1 : 1.83
T4: (25% infestation)	10.20 *d*	3.75 *c*	15.73	1 : 1.61
T5: (50% infestation)	33.52 *c*	2.97 *d*	33.25	1 : 1.01
T6: (75% infestation)	49.17 *b*	2.45 *e*	44.94	1 : 0.92
T7: (100% infestation)	68.40 *a*	1.87 *f*	57.97	1 : 0.85

** Means within a column sharing a common letter are not significantly different according to the LSD test at *P= 0.01.*

Figure 1. Relationship of disease incidence with paddy yield losses



References

Anonymous, 2003. Agriculture Statistics of Pakistan. *Ministry of Food, Agriculture and Cooperatives,* Islamabad.

Aurangzeb M, Ahmad J, Ilyas MB, 1998. Chemical control of bakanae disease of rice caused by *F. moniliforme*. *Pak. J. Phytopath*., **10**: 14-17.

Khan TZ, Gill MA, Yasin SI, Khan MG, 1995. Effect of seed treatment on bakanae disease incidence and paddy yield. *Pak. J. Phytopath.*, **7**: 124-127.

Khan JA, Jamil FF, Gill MA, 2000. Screening of rice varieties/lines against bakanae and bacterial leaf blight diseases. *Pak. J. Phytopath.*, **12**: 6-11.

Ou SH, 1985. Rice Diseases, *Commonwealth Mycological Institute,* Kew, Surrey, England.

Wahid A, Saleem M, Khan MU, Tariq AR, Saleem A, 1991. Seed mycoflora of rice. *Pak. J. Agri. Res.*, **31**: 95-100.