Screening Of Different Rice Genotype Against Rice Blast (*Pyricularia oryzae*) At Gokuleshwor ,Baitadi

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Abstract- A field experiment to detect the response of different rice genotypes against rice blast disease under DSR condition at Mid hill during rainy season of 2017. Screening of different genotypes was carried out in a field against rice blast disease and checked in one factor RCBD with 3 replication and 9 genotype. The experiment was conducted to impart knowledge about the response of different genotype against rice blast disease. The disease severity, AUDPC was found high in Shankharika genotype while found low in Sabitri genotype. Thus the use of Sabitri genotype provide proper resistance against rice blast disease in rice under the hill region of Baitadi district under Direct Seeded Rice(DSR) condition.

Index Terms- Rice Blast, Screening, AUDPC, Disease Severity, Genotypes

I. INTRODUCTION

Rice (*Oryza sativa* L.) is the staple food for nearly half of the world's population. Worldwide, rice was grown in an area of 165.2 million ha with a total production of 741.0 million tons in the year 2016 (FAOSTAT, 2017). In Nepal, rice ranks the first position in terms of area and production, covering 1.49 million ha with total production of 5.0 million ton in the country with the productivity of 3.4 t ha^{-1} (ABPSD, 2014). There are indications that rice production will be further adversely affected by the biotic and abiotic stresses, caused by changing climate.

Rice blast is a serious disease and causes huge loss in rice production. It was locally known as "Maruwa Rog" in Nepali. Blast disease [*Pyricularia oryzae* (Synonym *P. grisea*)], is one of the most destructive disease in most on leaves, causing leaf blast during the vegetative stage or on nodes and panicle branches during the reproductive stage, causing neck blast (Bonman, 1992). Leaf blast lesions reduced the photosynthetic rate of leaves (Gyano Padhaya, 1992). Neck blast is considered the most destructive phase of the disease and can occur without before infection by leaf blast (Zhu *et al.,* 2005). Plant got highest disease incidence at maximum tillering stage then gradually declined, mainly due to adult plant resistance. More extended dew periods and frequent moisture stress in upland rice contribute to increase disease incidence (Gill and Bonman, 1988) and on tropical lowland rice it is found in seedling blast in nurseries and severe panicle blast (Bonman *et al*., 1989) only.

II. MATERIAL METHODOLOGY

A total of 9 genotypes including local, improved and hybrid originating from the diverse sources were used in the study. All the genotype were collected from National Rice Research Programe, Hardinath, Dhanusha and Shankharika cultivar were used as susceptible check and Sabitri as resistant check. The genotypes details were as follows:

Treatments	Genotype
T_1	Radha 14
T_2	Cehering sub-1
T_3	Sabitri
T_4	TN-1
T_5	IR-87615-4-3-1-3
T_6	IR-09F-434
T_7	IR-87754-42-2-2
T_8	Sankharika
T_9	TOX 322-6-5-2-2-2-2

III. EXPERIMENTAL SITE AND PERIOD

The experiment was conducted in the research field of Gokuleshwor Agriculture And Animal Science College (GAASC) Gokuleshwor, Baitadi during first week of July to mid of October under rain fed conditions. Longitude: $80^{0}50'$ E Latitude: $24^{0}75'$ N, Elevations: 700 masl. A total of 9 rice genotypes including checks (resistant and susceptible) were evaluated in the blast disease screening nursery in a randomized complete block design followed with three replications.

Individual plot size was 1.5m^2. Susceptible checks were planted around each replications to check uniformity of infection.The cultivar Shankharika, were taken as susceptible check in the field to ensure presence of inoculum consisting of diverse races of the blast pathogen. Farm yard manure @10 t/ha, was mixed into soil two weeks before sowing, and chemical fertilizers were applied @60:30:0 kg NPK/ha through urea and di ammonium phosphate respectively. Heavy dose of nitrogen and no potash was used to insure adequate infection. Half dose of nitrogen and full dose of phosphorus was applied as a basal dose at the time of land preparation and remaining half nitrogen was applied at two split doses: one fourth at 15 days after sowing (DAS) and remaining one fourth at 25 DAS.

The observations on disease appearance were recorded from each screened genotypes. The resistance and susceptible check varieties were planted to check the uniformity of the inoculums distribution. Disease observation was started 14 days of seeding and a subsequent five observations were taken at an interval of 6 days by using the disease scale rating 0-9 (IRRI, 2002). Each row was scored for the disease. The details of disease scale are given in Table 1. The data obtained from the experiment were grouped into three categories as a resistant (R), moderately resistant (MR) and susceptible (S) types to determine the nature of genotypes.

Scoring was done by using the following 0-9 scale as described by IRRI (2002) and Ghazanfar *et al.* (2009). The score 0 was considered as highly resistant reaction whereas 1 as resistant, 2-5 moderately resistant, 6-7 as susceptible and 8-9 were considered highly susceptible.

Table 1 Scale for blast disease assessment (IRRI, 2002)

Scale	Infection	Host response
0	No lesions observed	Highly resistant (HR)
1	Minute brownish non-sporulating spots of pin point size under lower leaves.	Resistant (R)
2	Round, slightly prolonged necroticgray spots, of 1-2 mm in diameter, with a well defined brownish margin, little sporulating lesions mostly found on the lower leaves.	Moderately resistant (MR)
3	Spot same as in 2, but with a notable number of spots on the upper leaves.	Moderately resistant (MR)
4	Typically, heavy sporulating blast spots with 3 mm or more in length causing less than 2%infection on leaf.	Moderately susceptible (MS)
5	Typical blast lesions of 3 mm or longer infecting 2-10% of the leaf area	Moderately susceptible (MS)
6	Typical blast lesions of 3 mm or longer infecting 11-25% of the leaf area	Susceptible (S)
7	Typical blast lesions of 3 mm or longer infecting 26-50% of the leaf area	Susceptible (S)
8	Typical blast lesions of 3 mm or longer infecting 51-75% of the leaf area	Highly susceptible (HS)
9	Typical blast lesions of 3 mm or more in longer infecting more than 75% leaf area	Highly susceptible (HS)

Based on the scored value from estimation of the leaf area infestation the severity % was calculated per plot by using the following formula:

$$\text{Disease severity (\%)} = \frac{\text{Sum of all numerical rating}}{\text{Total number of samples observed} \times \text{Maximum rating}} \times 100$$

Estimation of area under disease progress curve (AUDPC)

The effect of disease severity on rice variety was integrated into area under disease progress curve (AUDPC) for the quantitative measure of epidemic development, disease severity and rate of progress which has no unit. AUDPC were computed, from the disease severities values from the formula given by Shaner and Finney (1977), Das, Rajaram, Mundt, and Kronstad (1992).

$$\text{AUDPC} = \sum_{i=1}^{n-1} \left[\frac{X_{(i+1)} + X_i}{2}\right] (T_{i+1} - T_i)$$

Where,

Xi = disease severity on first date
Ti= date on which the disease was scored
n= number of dates on which disease was scored

IV. RESULT AND DISCUSSION

Disease severity at different dates of scoring

Mean disease severity on the 15 DAS was 4.39. Lowest severity was observed in IR-87754 (0.74), while highest disease severity was observed in Shankharika (27.73) followed by Radha-14(22.22).Mean value of disease severity on the 22 DAS was 5.75. Least disease severity was seen in the Sabitri(1.11) and highest disease severity was seen in the Shankharika (32.21). It is followed by Radha-14(3.70).Mean value of disease severity on the 29 DAS was 8.06. The lowest disease severity was seen in treatment Sabitri (2.22). Highest disease severity was seen on the Shankharika (41.11), followed by Radha-14 (5.92). Mean value of disease severity on the 35 DAS was 11.07. The lowest disease severity was seen on Sabitri (4.07). Highest disease severity was seen on Shankharika (50.00), followed by Radha-14 (8.89) and TOX (8.88) respectively.

Mean value of disease severity on the 42 DAS was 20.07. Lowest disease severity was seen in the Sabitri (14.07). Highest disease severity was seen in Shankharika (56.29), followed by TOX (17.77) and Radha-14 (17.40) respectively. Sabitri was reported to be most resistant experiment by Manandhar *et al.* (1985) presented Shankharika to be most susceptible variety and established that it is adversely affected by blast pathogen. Shankharika was categorized as the most susceptible variety

which coincides with the result presented by (Manandhar *et al.*, 1985).

Table 2 Disease severity at different DAS

Genotypes	Disease severity on				
	15DAS	22DAS	29DAS	35DAS	42DAS
Cehering sub	1.85 [b]	3.33[b]	4.44[b]	5.55[b]	15.18[b]
IR-09F	1.48 [b]	2.22[b]	2.96[b]	4.44[b]	14.07[b]
IR-87615	1.48 [b]	2.59[b]	4.44[b]	7.04[b]	15.92[b]
IR-87754	0.74[b]	1.48[b]	3.70[b]	6.29[b]	15.55[b]
Radha-14	2.22[b]	3.70[b]	5.92[b]	8.89[b]	17.40[b]
Sabitri	1.11[b]	1.11[b]	2.22[b]	4.07[b]	14.07[b]
Shankharika	27.73[a]	32.21[a]	41.11[a]	50.00[a]	56.29[a]
TN-1	1.48[b]	1.85[b]	2.59[b]	4.44[b]	14.44[b]
TOX	1.48[b]	3.33[b]	5.18[b]	8.88[b]	17.77[b]
Mean	4.39	5.75	8.06	11.07	20.07
CV	30.81	38.22	33.16	25.29	20.58
LSD	2.34	3.8	4.63	4.84	7.15
Sem(±)	1.11	1.79	2.18	2.28	3.38

Treatment means are separated by Duncan's Multiple Range Test (DMRT) and the columns represented by the same letter (s) are not significantly different among each other at 5%

Effect of different treatments on Area Under Disease Progressive Curve(AUDPC)

Mean 1st AUDPC was found to be 35.54. Lowest 1st AUDPC was observed in Sabitri and IR-87754(7.77) whereas highest AUDPC was observed in Shankharika (209.82). Lowest 2nd AUDPC was observed in Sabitri (11.65) followed by TN-1(15.54). Highest 2nd AUDPC was observed in Shankharika (256.64). Mean 2nd AUDPC found was 48.38. Lowest 3rd AUDPC was found in Sabitri(29.99) and highest 3rd AUDPC was found in Shankharika (273.33). Mean 3rd AUDPC was found to be 57.4. Lowest 4th AUDPC was found in Sabitri(63.49). Highest 4th AUDPC was observed in Shankharika(372.02). Mean 4th AUDPC was found to be 109.01. Highest total AUDPC was observed in Shankharika (1111.82) whereas lowest Total AUDPC was observed in Sabitri (101.78). Mean total AUDPC was found to be 250.34.

Table 3 1st AUDPC, 2nd AUDPC, 3rd AUDPC, 4th AUDPC of different treatment.

Genotypes	AUDPC1	AUDPC2	AUDPC3	AUDPC4	Total AUDPC	Mean AUDPC
Cehering sub	18.13[b]	27.20[b]	22.21[b]	72.57[b]	147.91	36.97[b]
IR-09F	12.95[b]	18.13[b]	44.45[b]	64.79[b]	118.08	29.52[b]
IR-87615	14.24[b]	24.61[b]	42.22[b]	80.36[b]	153.67[b]	38.41[b]
IR-87754	7.77[b]	18.13[b]	34.45[b]	76.47[b]	132.36[b]	33.09[b]
Radha 14	20.72[b]	33.69[b]	30[b]	92.02[b]	190.89[b]	47.72[b]
Sabitri	7.77[b]	11.65[b]	29.99[b]	63.49[b]	101.78	25.44
Shankharika	209.82[a]	256.64[a]	273.33[a]	372.02[a]	1111.82	277.95[a]
TN-1	11.65[b]	15.54[b]	21.11[b]	66.10[b]	114.40	28.60
TOX	16.83[b]	29.80[b]	18.87[b]	93.31[b]	182.17	45.54
Mean	35.54	48.38	57.4	109.01	250.34	62.58
CV	32.72	34.56	28.05	21.82	26.68	26.68
LSD	20.13	28.94	27.87	41.17	115.62	28.9
Sem(±)	9.49	13.65	13.15	19.42	5	

Treatment means are separated by Duncan's Multiple Range Test (DMRT) and the columns represented by the same letter (s) are not significantly different among each other at 5%

V. CONCLUSION

Rice blast is the major fungal disease caused by *Pyriculaira oryzae* a field experiment to determine the response of different rice genotype under DRS condition at vegetative stage during rainy season at Baitadi. Nine rice genotype were shown in randomized complete block design. The experiment was limited to vegetative stage and its purpose was to identify the resistant and susceptible genotype among the different rice genotype collected from the NRRP, Hardinath, Dhanusha.

Shankharika was found most susceptible and Sabitri, IR-09F and TN-1 were found to be resistant and other were found to be moderately resistant. As Shankharika was found to be most susceptible to the blast on the field and lab condition as NARC has describe in both Midhills and Terai, Sabitri was found to be most resistant among all genotype, further research is recommended on other genotypes above for further certainty in addition further research work such as comparison of plant yield with disease can be done and also molecular study of plant genotype is further recommended.

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