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EFFICACY OF SILICON SOLUBILIZERS ON BLAST TOLERANCE OF RICE GENOTYPES

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ABSTRACT

An artificial blast screening nursery experiment was conducted in blast screening nursery at Indian Institute of Rice Research (IIRR), Hyderabad during *kharif* 2015 to study the efficacy of silicon solubilizers on blast tolerance of eight rice genotypes. The treatments comprised of control (T_0), silixol @ 0.2% (T_1) and Imidazole @0.05% (T_2) and sprayed before infection (preventive measures) and after infection (curative measures). The scoring for the blast disease was done at 7 DAS (Days after spraying), 14 DAS and 21 DAS. Results revealed that highest incidence of blast disease were observed in control (T_0) followed by silixol @ 0.2% treatment (T_1) and Imidazole treatment @ 0.05% (T_2). Highest PDI (Percentage disease index) was recorded in HR 12(V_8) followed by CO 39 (V_7), BPT5204(V_6), PA6444(V_4) and DRRH3(V_1) showed complete susceptibility to blast. PA6201 (V_3) and PA6129 (V_2) recorded lowest PDI and showed resistance towards the blast disease whereas PHB 71(V_5) showed moderate resistance towards blast disease. More effectiveness of treatments was recorded in pre inoculation spray compared to post inoculational spray.

KEY WORDS: Rice, silicon solubilizer, PDI (Percentage Disease Index)

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important staple food crops and play vital role in the national food grain supply in the world and forms the backbone for more than 50 per cent of the world's population and contributes to 42 per cent of total food grains production, 45 per cent of the total cereal production in the country. Rice is one of the most effective silicon-accumulating plant and accumulate upto 10 per cent of dry weight in the shoots, roots and contributes to enhance resistance to disease and insects (Ishiguru, 2001). Rice blast is caused by Ascomycete fungus *Magnaporthe grisea* anamorph *Pyricularia grisea*), most important destructive fungal disease of rice and causes significant yield losses of 70-80 per cent (Awoderu, 1990) when conditions favours the disease development and it is major constraint to its production worldwide. The disease occurs mainly as leaf blast or neck blast, neck blast is the most destructive in terms of lost yield, leaf blast can cause severe damage before plants reach the reproductive phase of growth (Seebold *et al*., 2004). The application of silicon (Si) to rice fields to control blast is an alternative approach that is gaining importance, especially when rice is grown in soils deemed to be low or limiting in plant available Si. Disease severity or incidence tends to be reduced with increasing tissue content of Si in rice (Datnoff *et al., 19*91).

Although silicon is the second largest element present in the soil it is not available for plants due to presence in the amorphous form. Plants absorb silicon from the soil solution in the form of monosilicic acid and it is highly unstable and readily becomes into non available form. For the prophylactic effect Si needs to be absorbed in the form of silicic acid [$Si(OH)_4$], where along with water, it follows the transpiration stream to finally deposit as silica (Sangster *et al.,* 2001). Silicon nutrition in rice has low soil solubility, so the silicon carrier molecule like Imidazole is known to influence silicon uptake and accumulation in crop plants. Silicon application has been proposed as a viable component of an integrated management programme and environmentally friendly control techniques for insect pests and diseases as it leaves no pesticide residue in food or the environment, and relatively cheap and could easily be integrated with other

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pest management practices (Laing *et al.* 2006). Adequate levels of Si in plant controls rice blast thus minimizing the usage of fungicides, and providing positive environmental benefits (Seebold *et al*., 2000).

MATERIALS AND METHODS

The present study was aimed at evaluating the blast tolerance of eight rice genotypes to the silicon solubilizers treatments. These genotypes were evaluated in an artificial blast screening nursery experiment, laid out in split plot design, with silicon solubilizer treatments ((Silixol (T1) and Imidazole (T2)) as main plots and rice genotypes as sub plots and replicated thrice in *rabi* 2015 at IIRR, Hyderabad. Seeds of eight rice genotypes were sown in nursery and the spraying of treatments was done before the inoculation of the blast spores as pre infectional spray (Preventive measure) and after the inoculation of the blast spores in post infectional spray (curative measure) and scoring for the blast disease was done at 7, 14 and 21 DAS (Days After Spraying). The data were statistically analyzed as described by Panse and Sukhatme (1985).

In the artificial blast screening nursery a local susceptible variety HR 12 was sown as border rows on all sides of the bed. The susceptible check was sown after every twenty test entries, for spreading of the inoculum. The rice genotypes were sown in the rows perpendicular to the boarder rows. Relative humidity was maintained with water sprinklers. The beds were covered with polythene sheets during night to maintain high humidity and to increase the disease pressure on the rice genotypes. Spore suspension was prepared from seven day old culture grown on oat meal agar. The mycelium was scraped in 10 ml distilled water and the solution was filtered through two fold cheese cloth to remove the fungal debris. The spore concentration was adjusted to 1 × 10 spores per ml using haemocytometer. Using hand held value (300 ml) capacity automizer, the spore suspension containing Tween -20 (0.2%) was sprayed uniformly over the 15 day old seedlings. The inoculum was sprayed in the evening till the entire plant surface become wet with spore suspension and left overnight. Water was sprayed three to four times during day time to maintain high humidity. Care was taken not to pray water immediately after spraying inoculum. The minimum gap between spraying the inoculums and spraying water was kept for at least twelve hours. Disease scoring was done using 0- 9 SES scale (SES, 2002). Percentage Disease index was be calculated by using the following formula.

$$PDI = \frac{\text{Sum of scores}}{\text{Number of observations} \times \text{highest number in rating scale}} \times 100$$

RESULTS AND DISCUSSION

Post infectional spray (Curative measures)

Highest PDI was observed in control (T_0) (61.1%, 65.15% and 79.70 %) followed by silixol @ 0.2%treatment (T_1)(59.02%, 64.41% and 78.59 %) and Imidazole treatment @ 0.05% (T_2) (58.27 %, 64.24 % and 78.30%)recorded least PDI at 7 DAS, 14 DAS and 21DAS (Days after spraying of silicon solubilizer treatments) respectively (Table 1).

Among the genotypes tested highest percentage disease index (PDI) was recorded in HR 12(V_8) (77.77 % and 100 %) followed by CO 39 (V_7), BPT 5204(V_6), PA 6444(V_4) and DRR H3(V_1) all these genotypes showed complete susceptibility to blast disease and recorded 100 % PDI at 21 DAS (Days after spraying of silicon solubilizer treatments) (Table 2). Whereas PA 6201(V_3) recorded lowest PDI (37.34 %) and showed resistance towards the blast disease and was followed by PA6129 (V_2) (38.15 % PDI). PHB 71(V_5) showed moderate resistance towards blast disease and recorded 56.94 % PDI at 21 DAS (Days after spraying of silicon solubilizer treatments) (Table 2).

Interpretation of data revealed that the silicon solubilizer treatments at the initial stage of disease development showed reduced percentage disease index (PDI) and as reached to final stages of disease development silicon solubilizers were less effective. But there is considerable improvement in the effectiveness of treatments compared to post inoculational spray.

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Interpretation of data revealed that the silicon solubilizer treatments at the initial stage of disease development showed reduced percentage disease index (PDI) and as reached to final stages of disease development silicon solubilizers were not effective.

In addition, amending partially blast-resistant rice cultivars with silicon, resistance increased to the same level as completely resistant cultivars (Seebold *et al.* (2001)). Rice seedling blast is significantly suppressed by the application of Si fertilizers in the nursery (Maekawa*et al.,* 2001).In rice, Si has been as effective as a fungicide in controlling rice blast *(Magnaporthae grisea, Pyricularia grisea)* and has even reduced the rate or number of necessary fungicide applications (Datnoff *et al.,* 2001).

CONCLUSION

The silicon solubilizer treatment did not showed significant reduction of PDI. However, imidazole treatment (T_2) showed better performance compared to silixol treatment (T_1) and among the genotypes PA6129 (V_2) and PA6201 (V_3) was superior in terms of growth and yield under both control and treatments.

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1. Effect of pre infectional (Preventive measure) spray of silicon solubilizers on blast disease and Percent Disease Index (PDI) in rice genotypes during *rabi* 2015-2016

	7 DAS				14 DAS				21 DAS			
Genotypes	Control (T0)	Silixol (T1)	Imidazole (T2)	Mean	Control (T0)	Silixol (T1)	Imidazole (T2)	Mean	Control (T0)	Silixol (T1)	Imidazole (T2)	Mean
DRRH3 (V_1)	65.74	64.82	63.89	64.82	66.60	64.40	64.03	65.01	77.31	76.38	76.84	76.84
PA6129 (V_2)	35.65	34.26	33.30	34.40	37.03	34.40	34.03	35.16	38.43	36.11	35.18	36.57
PA 6201 (V_3)	34.77	33.30	33.30	33.79	36.11	34.40	33.67	34.73	37.04	35.87	35.18	36.03
PA6444 (V_4)	66.67	64.03	62.93	64.54	66.60	64.81	63.88	65.10	77.77	77.77	77.77	77.77
PHB71 (V_5)	43.05	40.27	42.20	41.84	44.40	41.07	42.59	42.69	55.09	53.7	48.61	52.47
BPT 5204 (V_6)	65.74	64.77	63.30	64.60	66.60	64.82	64.35	65.26	77.77	77.77	77.77	77.77
CO 39(V_7)	66.21	64.77	64.82	65.27	77.70	64.82	65.13	69.22	77.77	77.77	77.77	77.77
HR 12(V_8)	65.74	65.28	65.28	65.43	77.77	77.77	77.77	77.77	100	80.7	79.93	86.88
Mean	55.45	53.94	53.63		59.10	55.81	55.68		67.65	64.51	63.63	
	T	G	T × G	G× T	T	G	T × G	G× T	T	G	T × G	G× T
SE(m)	0.178	0.380	0.640	0.502	0.138	0.264	0.449	0.389	0.099	0.538	0.878	0.281
C.D.	0.716	1.088	NS	NS	0.554	0.756	1.336	1.360	0.401	1.542	2.528	2.685

DAS – Days After Spraying of silicon solubilizer treatments

2. Effect of Post infectional (curative measure) spray of silicon solubilizers on blast disease and Percent Disease Index (PDI) in rice genotypes during Rabi 2015-2016

	7 DAS				14 DAS				21 DAS			
Genotypes	Control (T0)	Silixol (T1)	Imidazole (T2)	Mean	Control (T0)	Silixol (T1)	Imidazole (T2)	Mean	Control (T0)	Silixol (T1)	Imidazole (T2)	Mean
DRRH3 (V_1)	48.61	44.44	45.83	46.29	77.31	76.38	76.84	76.84	100.00	100.00	100.00	100.00
PA6129 (V_2)	37.04	35.18	33.79	35.34	40.27	35.87	36.11	37.42	40.37	37.50	36.57	38.15
PA6201 (V_3)	36.97	34.26	33.79	35.01	37.03	36.11	34.72	35.95	38.88	36.57	36.57	37.34
PA6444 (V_4)	77.77	76.38	75.00	76.38	77.77	77.77	77.77	77.77	100.00	100.00	100.00	100.00
PHB71 (V_5)	55.09	54.16	48.61	52.62	55.50	55.87	55.17	55.51	58.33	56.94	55.55	56.94
BPT 5204 (V_6)	77.77	76.38	75.00	76.38	77.77	77.77	77.77	77.77	100.00	100.00	100.00	100.00
CO 39(V_7)	77.77	73.61	76.38	75.92	77.77	77.77	77.77	77.77	100.00	97.70	97.70	98.47
HR 12(V_8)	77.77	77.77	77.77	77.77	77.77	77.77	77.77	77.77	100.00	100.00	100.00	100.00
Mean	61.10	59.02	58.27		65.15	64.41	64.24		79.70	78.59	78.30	
	T	G	T × G	G× T	T	G	T × G	G× T	T	G	T × G	G× T
SE(m)	0.034	0.224	0.365	0.095	0.115	0.198	0.341	0.326	0.077	0.094	0.171	0.218
C.D.	0.135	0.642	1.048	1.116	0.465	0.567	1.022	1.028	0.311	0.269	0.529	0.505

DAS – Days After Spraying of silicon solubilizer treatments