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Effects of nitrogen management and Tricyclazole treatment on leaf blast severity in rice

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ABSTRACT

Field experiment was conducted at Chiplima, Sambalpur, Odisha during wet and dry seasons of 2011-2013 to assess the effect of nitrogen application, fungicidal sprays and varietal resistance on leaf blast disease severity and yield of rice. There was a progressive increase of leaf blast severity with full doses of nitrogen as compared to the application of two-third of the recommended dose in the susceptible variety Swarna. During wet season, the best treatment observed was Swarna with 2-3 sprays of Tricyclazole 75 WP @0.6 g l^{-1} and 2/3rd nitrogen level showing 89.65% disease control, whereas during dry season, treatment having the resistant variety Pratikshya with 100% N was the best giving 96.92% disease control over check and was significantly superior to other treatments. The resistant variety with 100% N showed constantly low disease severity throughout the experiment in both the seasons. Two to three applications of Tricyclazole 75 WP @0.6 g l^{-1} along with two third recommended dose of N showed maximum increase in yield (43.74% in dry season and 59.96% in wet season) in the susceptible variety.

Key words: *rice, leaf blast, nitrogen, fungicide, cultivar*

Rice blast, caused by the fungus *Pyricularia grisea* (Cooke) Sacc. [= *Magnaporthe grisea* (Hebert) Barr], is one of the most devastating diseases of rice (*Oryza sativa* L.) worldwide. Blast can infect most parts of the plant: leaf, collar, node, internode, neck, and other parts of panicle, but rarely infects leaf sheath (IRRI, 2010). Once on a rice plant, the fungus rapidly produces thousands of spores, which are carried readily by wind or rain, onto neighbouring plants. Blast infection can cause yield loss up to 80%, depending on inoculum pressure, crop growth stage at infection, prevailing climatic conditions, varietal susceptibility, and cultural practices (Prabhu *et al*., 2003).

Certain cultural practices encourage blast, like excessive use of nitrogen increases susceptibility of rice to the fungus. Several studies have shown that excessive nitrogen increases N-metabolism in rice plant, leading to enhanced tissue susceptibility to blast disease (Long *et al*., 2000). Fungicides have been used effectively to control blast but the effectiveness of particular fungicides could vary from place to place or season to season. Therefore, information about effective fungicides with different modes of action should be available to farmers. Varier *et al.* (1993) tested eight fungicides for management of rice blast and inferred that seed treatment with Tricyclazole @ 4 g kg^{-1} seed was most effective up to 40 days after sowing. Tirmali *et al.* (2001) also identified Tricyclazole decreasing leaf and neck blast, and increasing the number of tillers there by increasing the yield attributes. Although the disease can be controlled by application of fungicides, the long-term solution would be development of the resistant varieties. However, very few rice cultivars available currently are resistant to the disease.

So, in order to achieve an effective and sustainable control of the blast disease, a management strategy integrating the use of resistant cultivar, appropriate nitrogenous fertilizer and an effective fungicide should be developed. The present study was undertaken to study on the influence of number of sprayings of an effective fungicide with the interaction

of different nitrogen levels and cultivars on the management of rice blast disease.

MATERIALS AND METHODS

Field experiments were conducted during both wet and dry seasons of 2011 to 2013 at Chiplima, Sambalpur, Odisha. Thirty days old seedlings of susceptible variety Swarna and resistant variety Pratikshya were transplanted. Uniform plant population was maintained for each plot (15 m^2) at 15cm. x 15cm. spacing. The experiment was laid out in a randomized block design with seven treatments replicated four times. The treatment consisted of two cultivars, Swarna and Pratikshya. Phosphorus and potash were applied at the same rate in all the plots as per recommendations *i.e* 50:50 kg P_2O_5 and K_2O ha^{-1} but nitrogen was applied at the recommended dose *i.e,* 100 kg ha^{-1} and at $2/3^{rd}$ of recommended dose *i.e,* 67 kg ha^{-1} based on treatments. Nitrogen was applied through split applications – one half nitrogen applied as basal and top dressing the remaining in two equal splits at tillering and panicle initiation stages. Natural occurrence of the disease was permitted. The first spraying of an effective fungicide *i.e,* Tricyclazole 75 WP @0.6 g l^{-1} was made when disease severity reached 5% in control plot. A second spray of the same was given, 15 days after the first spray and third spray was given again depending on the disease severity. Three sampling units of one m^2 area were fixed in each plot at random for observation of disease severity. The third leaf from the top in each tiller was taken and the disease severity was noted. The observations were recorded before spraying of fungicides and ten days afterwards.

RESULTS AND DISCUSSION

In general, disease severity was more in dry season as compared to wet season during both the years of study with varied nitrogen levels there were differences with regard to blast severity. The leaf blast disease in all the fungicidal treatments was uniform after the first spray with significant differences in untreated plots. However, there was a progressive increase of leaf blast severity with full doses of nitrogen application as compared to the application of two-third of the recommended dose (Table 1 and Table 2).

The post-treatment count after spraying in both the seasons revealed that Tricyclazole 75 WP @ 0.6 g l^{-1} was significantly superior in reducing leaf blast severity in the susceptible variety, when compared to untreated plots. The effectiveness of Tricyclazole against blast has been reported earlier (Bhat *et al*., 2012; Gaje and Prasad, 2007). The leaf blast disease severity was significantly higher at 100% nitrogen level (100 kg ha^{-1}) when compared to $2/3^{rd}$ nitrogen level in all the cases. However, the resistant variety showed constantly low disease severity throughout the experiment.

There was significant progressive increase in leaf blast disease severity in the susceptible variety with two-third nitrogen level recording comparatively lower disease severity of 23.19 % in dry season and 10.79 % in wet season and as nitrogen level increased to full dose with 100 kg N ha^{-1} recorded 30.81% leaf blast severity in rabi and 14.01% in wet season (Table 1 and 2). The increase in blast severity with the increase in rate of nitrogen application has been reported by many workers (Kapoor and Sood, 2000; Long *et al*., 2000) and has been attributed to increased plant transpiration by the increase in leaf area index which thereby increases the susceptibility of host tissue.

The combined effects of fungicides and nitrogen showed that a single spray of Tricyclazole 75 WP @0.6 g l^{-1} with two third dose of nitrogen (67 kg ha^{-1}) recorded less disease severity in the susceptible variety in both the seasons. The higher disease severity was observed in plots with RDN. The per cent disease reduction over control for the treatments was higher (69.56%) in dry season compared to wet season (65.52%) under low N dose (Table 1 and 2) .

The data recorded at 10 days after second or third spray indicated that the leaf blast disease was significantly reduced due to the fungicide Tricyclazole 75 WP @0.6 g l^{-1} when compared to untreated check. The leaf blast severity per cent varied from 30.81% to 2.19% in dry season and 14.01% to 1.45% in wet season. Prajapati *et al*. (2004) found Tricyclazole significantly superior in decreasing the leaf and neck blast and increasing the yield. The treatments with 2-3 sprayings of Tricyclazole showed significantly higher disease control when compared to a single spray or no spray in the susceptible variety. On the contrary, highest leaf blast was observed with untreated check at 100% N level with 30.81% leaf blast severity in dry and 14.01% in wet season. The percent disease reduction

Table 1. Effect of management practices against leaf blast severity and yield of rice during dry season 2011-12 and 2012-13

Treatments	Percent disease severity			Disease control (%)	Yield (t ha^{-1})			Yield increase over control (%)
	2011-12	2012-13	Pooled mean		2011-12	2012-13	Pooled mean	
Swarna + 100% RDN	33.6 (35.36)*	28.03 (31.91)	30.81 (33.68)	-	3.96	4.32	4.14	-
2/3rd of RDN	25.93 (30.38)	20.45 (26.82)	23.19 (28.77)	24.73	4.36	4.64	4.50	8.79
100% RDN+a single spray of Tricyclazole 75WP @0.6 g l^{-1}	12.63 (20.79)	12.80 (20.88)	12.71 (20.84)	58.75	4.54	4.89	4.72	13.95
2/3rd of RDN+a single spray of Tricyclazole 75WP @0.6 g l^{-1}	8.95 (17.29)	9.80 (18.15)	9.38 (17.83)	69.56	5.19	5.32	5.26	26.96
100% RDN+need based sprays of Tricyclazole 75WP @0.6 g l^{-1}	2.75 (9.52)	4.05 (11.54)	3.40 (10.62)	88.96	5.23	5.37	5.30	28.07
2/3rd of RDN + need based sprays of Tricyclazole 75WP@0.6 g l^{-1}	1.83 (7.71)	2.55 (9.12)	2.19 (8.49)	92.89	5.85	6.05	5.95	43.74
Pratikshya + 100% RDN	1.10 (5.97)	0.80 (5.03)	0.95 (5.56)	96.92	5.72	5.39	5.55	34.18
CD (P<0.05)	4.30	3.47	2.27		4.09	5.18	2.52	

*Figures in parentheses indicate angular transformed values, RDN= Recomended dose of nitrogen

over control for the treatments 10 days after second/ third spraying recorded higher disease reduction in Tricyclazole treated plots at both the nitrogen levels. The combination effect highlighted that under low nitrogen levels fungicides proved better with 88.96 % and 75.73% leaf blast control in RDN plots.

The best result was observed in the treatment having susceptible variety with 2-3 sprays of Tricyclazole 75 WP @0.6 g l^{-1} at 2/3rd nitrogen level in wet season of both the years. Whereas during dry season of both the years, treatment having the resistant variety with 100% N was the best and significantly superior to other treatments including untreated check. Though there were significant differences in leaf blast severity at varied nitrogen levels irrespective of fungicidal treatments in the susceptible variety, the resistant variety with recommended dose of N showed constantly low disease severity throughout the experiment in both the seasons.

During both the years, two to three applications of Tricyclazole 75 WP @0.6 g l^{-1} along with two third of RDN showed maximum increase in yield in the susceptible variety that was 43.74% in dry season and 59.96% in wet season. The results are in conformity with those of Tirmali *et al.* (2001) and Prabhu *et al*. (2003) who also reported that fungicides application increases the yield of rice. Resistant variety with RDN also closely followed it with 34.18 % and 40.46% increase in yield during dry and wet season, respectively. Higher nitrogen dose and low disease severity could not increase grain yield in the resistant variety. The susceptible variety Swarna is highly responsive to all the management practices which might in turn resulted in higher yield. In almost all the cases, treatments with 2/3rd of recommended dose of N gave more yield than the treatments with RDN. These findings are in conformity with those of Mubarak (2008) and Bhat *et al*. (2013).

From the present study it can be concluded that, in areas where susceptible variety is highly popular among the farmers and can not be substituted by a resistant variety, balanced use of nitrogenous fertilizers along with need based sprays of Tricyclazole 75 WP @ 0.6 g l^{-1} can be recommended for the management of leaf blast with increased grain yield. Use of blast resistant variety with recommended dose of nitrogen is always a better approach to overcome the yield loss

Table 2. Effect of management practices against leaf blast severity and yield of rice during wet season 2011-12 and 2012-13

Treatments	Percent disease severity			Disease control (%)	Yield (t ha^{-1})			Yield increase over control (%)
	2011-12	2012-13	Pooled mean		2011-12	2012-13	Pooled mean	
Swarna + + 100% RDN	7.93 (2.90)*	20.10 (4.52)	14.01 (3.80)	-	2.00	2.82	2.41	-
2/3rd of RDN	7.30 (2.79)	14.28 (3.84)	10.79 (3.36)	22.98	2.30	3.15	2.72	13.07
100% RDN+ A single spray of Tricyclazole 75 WP @0.6 g l^{-1}	4.50 (2.23)	9.15 (3.10)	6.83 (2.71)	51.25	2.45	3.37	2.91	20.75
2/3rd of RDN+ A single spray of Tricyclazole 75WP @0.6 g l^{-1}	4.25 (2.17)	5.40 (2.42)	4.83 (2.31)	6.5.52	2.70	3.69	3.19	32.57
100% RDN + Need based sprays of Tricyclazole 75WP@0.6g l^{-1}	3.45 (1.98)	3.35 (1.94)	3.40 (1.97)	7.5.73	3.05	3.85	3.45	43.15
2/3rd of RDN + Need based sprays of Tricyclazole 75WP@0.6g l^{-1}	1.40 (1.37)	1.50 (1.40)	1.45 (1.40)	8.9.65	3.55	4.16	3.85	59.96
Pratikshya + 100% RDN	2.20 (1.62)	1.78 (1.49)	1.99 (1.58)	8.5.80	3.00	3.77	3.38	40.46
CD (P<0.05)	0.27	0.47	0.23		4.41	3.48	3.12	

*Figures in parentheses indicate square root transformed values, RDN= Recomended dose of nitrogen fertilizers

due to less disease severity and ultimately reducing the cost of cultivation.

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