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Management of leaf blast and neck blast of rice caused by *Pyricularia oryzae* under field condition

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Abstract
Rice (*Oryza sativa* L.) is the most essential cereal crop consumed by 50% of world's population. An experiment was conducted during *kharif* 2016 to know the impact of ten treatments including fungicides, botanicals and bio-agents on management of blast of rice at AHRS, Ponnampet. Among ten treatments, Nativo was found effective in reducing both leaf blast (27.79 PDI) and neck blast (21.68%) disease. Tricyclazole + Tebuconazole 36% SC and ICF-110 were onpar with each other with respect to both leaf blast and neck blast incidence followed by Tricyclazole. *Bacillus subtilis* was found less effective in reducing both leaf and neck blast disease when compared to other treatments. The highest per cent disease reduction over control was found in Nativo with leaf blast (60.18%) and neck blast (59.00%). The least per cent disease reduction over control was recorded in *Bacillus subtilis.* Further, the highest yield was recorded in Nativo with 4204 kg/ ha. Followed by ICF-110 (3967 kg/ ha), Tricyclazole + Tebuconazole 36% SC (3806 kg/ ha), and Tricyclazole (3633 kg/ ha). The least grain yield was observed in *Bacillus subtilis* (2311 kg/ ha) when compared to other treatments.

Keywords: management, leaf blast, neck blast, fungicides

Introduction
Rice (*Oryza sativa* L.) is the most important cereal crop of the world. Asia known as rice bowl of the world as 90 per cent or more of the world's rice is grown and consumed in Asia. Among the Asian countries, India is one of the leading producers of rice [1]. The world's estimated rice production is 496.0 million metric tons during 2016 (Anon, 2016) [2]. India is the largest rice growing country accounting for about one third of the world acreage under the crop. In India's annual rice production is 103.6 million tons during 2016 (Anon, 2016) [2]. The productivity of rice is highly affected by several biotic and abiotic factors. Rice crop is susceptible to many fungal, bacterial, viral and nematode diseases [3]. The most significant disease in rice is blast disease incited by *Pyricularia oryzae* as it is reported in more than 85 countries wherever rice is grown [4]. Heavy yield losses have been reported in many rice growing countries *viz.*, 75, 50 and 40 percent grain loss was occur in India [5], Philippines [6] and Nigeria [7]. The pathogen can cause damage up to 90% and sometime total crop loss under favorable conditions [8]. The rice blast fungus can causes symptoms like leaf blast, nodal blast and neck or panicle blast. The most severe stage is neck blast [9]. The usual practices followed for management of blast disease of rice includes use of resistant varieties, use of fungicides, application of fertilizers and irrigations [10, 11]. Thus, the study was conducted for the management of blast disease of rice under field condition by using fungicides, botanicals and bio-agents.

Material and Methods
An experiment was conducted during *Kharif*, 2016 at AHRS, Ponnampet. The susceptible variety Jyothi was sown on 09-07-2016 and transplanted on 10-08-2016 in RCBD with 3 replications and 10 treatments. The spacing followed was 15 X 15 cm and total plot size was 4.50m^2 (Table 1 and Plate 1). Totally three sprays were given, first at appearance of the disease as prophalytic spray, second at 15 days after first spray and third one at 15% emergence of the panicles. Five hills were randomly selected from each plot and were tagged. The observations for leaf blast was recorded as PDI at first and second spray by using 0-9 scale given by IRRI (1996) and for the neck blast as percent neck blast incidence at third spray and at harvest, The leaf blast incidence was calculated by using formula given by [12].

$$PDI = \frac{\text{Sum of individual rating}}{\text{Number of leaves assessed x Maximum disease grade value}} \times 100$$

From the selected five hills randomly from each plot, the neck blast incident was calculated by using the formula given below.

$$\text{Per cent neck blast incidence} = \frac{\text{Infected panicles}}{\text{Total number of panicles}} \times 100$$

Statistical analysis was carried out as per the procedure given by [13]. The original means were converted into arc sine transformed values. The yield and average plant height was recorded at harvest in all the treatments.

Table 1: List of fungicides, bio-agents and botanicals evaluated under field condition against *Pyricularia oryzae*

Sl. No.	Treatement	Concentration
1	Tricyclazole 75% WP	0.6gm/l
2	Carbendazim 50% WP	1gm/l
3	Hexaconazole 5% EC	1 ml/l
4	Tebuconazole 50% + Trifloxystrobin 25% WG (Nativo)	1 gm/l
5	Tricyclazole + Tebuconazole 36% SC	2 ml/l
6	Tricyclazole 45% + Hexaconazole 10% WG (ICF-110)	1gm/l
7	*Pseudomonas flourosense*	10 gm/l
8	*Bacillus subtilis*	10 gm/l
9	Nimbicidine	3 ml/l
10	Control	-----

Table 2: Evaluation of fungicides, bio-agents and botanicals against blast of rice under field condition

Sl. No.	Treatments	Concentration	Leaf blast (PDI)	Neck blast (%)	Yield (Kg/ha)	Average plant height (cm)	No. of tillers	Percent disease reduction over control	
								Leaf blast (%)	Neck blast (%)
1	Tricyclazole 75% WP	0.6gm/l	34.28(35.19)	26.46(30.97)	3633	66.05	16	50.88	49.66
2	Carbendazim 50% WP	1gm/l	36.83(37.38)	27.28(31.50)	3425	65.83	15	47.23	48.41
3	Hexaconazole 5% EC	1 ml/l	40.63(39.62)	28.78(32.46)	3328	63.33	15	41.79	45.57
4	Tebuconazole 50% + Trifloxystrobin 25% WG	1 gm/l	27.79(31.83)	21.68(27.75)	4204	70.10	18	60.18	59.00
5	Tricyclazole + Tebuconazole 36% SC	2 ml/l	31.08(33.90)	24.24(29.50)	3806	66.15	16	55.47	54.16
6	Tricyclazole 45% + Hexaconazole 10% WG	1gm/l	30.47(33.52)	23.98(29.29)	3967	67.05	17	56.34	54.65
7	*Pseudomonas flourosense*	10 gm/l	51.69(45.99)	33.35(35.29)	2533	60.58	13	25.94	36.93
8	*Bacillus subtilis*	10 gm/l	52.96(46.73)	36.05(36.94)	2311	59.77	13	24.12	31.82
9	Nimbicidine	3 ml/l	48.32(49.76)	31.48(34.15)	2861	62.58	14	30.77	40.46
10	control	-----	69.80(56.70)	52.88(46.68)	2034	45.99	10		
	S.Em.±		1.50	1.12	124.46	3.67	1.10		
	CD at 5%		4.47	3.32	369.80	10.91	3.27		

Fig 1: Overall view of experimental field

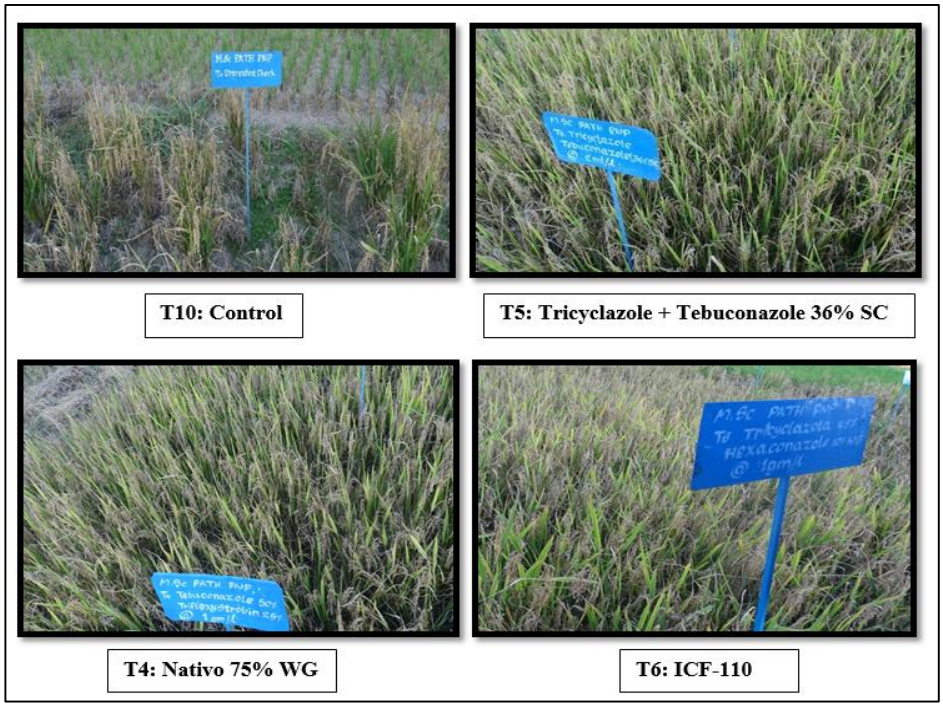

Fig 2: Best treatments observed against blast of rice

Results and Discussions

The results obtained indicates that, all the treatments recorded significantly reduced leaf blast incidence and per cent neck blast incidence compared to untreated control. Nativo was found best among all the treatments with least per cent disease index of 27.79% of leaf blast and per cent neck blast incidence of 21.68%.Tricyclazole + Tebuconazole 36% SC

And ICF-110 were on par with each other with leaf blast incidence of 31.08% and 30.47% and neck blast incidence of 24.24% and 23.98%. Among the systemic fungicides, Tricyclazole found effective against leaf blast (34.28%) and neck blast 26.46% when compared to control (69.80% and 52.88%). *Bacillus subtilis* was found less effective in checking both leaf blast and neck blast disease. The highest per cent disease reduction over control was recorded in Nativo with leaf blast 60.18% and neck blast incidence of 59.00%. The least per cent disease reduction over control was recorded in *Bacillus subtilis* (24.12% and 31.82%). Further, the highest yield was recorded in Nativo (4204kg/ ha) followed by ICF-110 (3967 kg/ ha) Tricyclazole + Tebuconazole 36% SC (3806 kg/ ha) and Tricyclazole (3633 kg/ ha) when compared to control. The least grain yield was observed in *Bacillus subtilis* (2311 kg/ ha) when compared to other treatments (Table 2 and Plate 2). There was not much significant difference between treatments with regard to average plant height taken at harvest. Maximum plant height was recorded in Nativo (70.10 cm) followed by ICF-110 (67.05 cm) and Tricyclazole + Tebuconazole 36% SC (66.15 cm). Minimum plant height was recorded in untreated control (45.99 cm).

All the treatments evaluated under field condition showed significant differences in blast disease reduction and grain yield. The results are supported by the work of [14] who reported that application of Nativo 75WG was found most effective in controlling leaf blast as it controlled to the extent of 84 per cent compared to control [15].Reported that Nativo 75% WG and Tricyclazole were found quite effective against the leaf and neck blast of paddy. Bio-agents were less effective as compared to fungicides. The results obtained are also in agreement with the work of [16] who reported ICF-110 resulted in significant reduction (67.8%) in neck blast incidence over control and application of Tricycalzole 75 WP alone reduced neck blast incidence by 69.2 per cent. Another comi-product Tricyclazole + Tebuconazole 36% SC was found effective against both leaf and neck blast because Tricyclazole is rapidly absorbed by rice plant and translocated towards leaf tips. In rice blast, the melanin pigment is needed for the hardening of the appressorium and inhibition of the pigment formation in appressorium makes it unable to mechanically penetrate the host plant and Tebuconazoledemethyle inhibitor and is rapidly absorbed by plants.

From the farmers point of view, the chemical which gives maximum yield is more important. Hence in the present study, three sprays of Nativo @ 1gm/l not only reduced the disease incidence but also given the higher yield (4204 kg/ ha) followed by ICF-110 (3967 kg/ ha), Tricyclazole + Tebuconazole (3806 kg/ ha), and Tricyclazole (3633kg/ha). This is obviously due to their mode of action and also lowering of both leaf and neck blast incidence.

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