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Evaluation of fungicides for the management of blast diseases of rice under field condition

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Abstract

Rice (*Oryza sativa* L.) is the principal staple food for more than two billion people; most of them live in rural and urban areas of tropical and subtropical Asia. An experiment was conducted during *Kharif* 2014 and 2015 to know the impact of eight fungicide treatments. Among eight treatments, Tricyclazole 45% + Hexaconazole 10% WG @ 1.0 g/L and Tricyclazole 75% WP @ 0.6 g/L were on par with each other with least pooled leaf blast disease index of 21.15% and 23.25% and neck blast disease incidence of 17.43% and 19.65% respectively followed by followed by Tricyclazole 18% + Mancozeb 62% WP @ 2.5 g/L. Further, the highest pooled yield was recorded in Tricyclazole 45% + Hexaconazole 10% WG @ 1.0 g/L (4450 kg/ha) followed by Tricyclazole 75% WP @ 0.6 g/L (4001.85 kg/ ha). However, when cost benefit ratio was calculated, Tricyclazole 45% + Hexaconazole 10% WG (1.67) and Tricyclazole 75% WP (1.61) respectively.

Keywords: Management, blast, disease and 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].

China and India account for roughly 50 % of the world's total rice area and jointly produce 55 % of world's rice. Other major rice-growing countries are Indonesia, Bangladesh, Vietnam, and Thailand, which produce respectively nine, six, five, and four percent of world's rice.

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 per cent 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 favourable 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 new combi product and systemic fungicides.

Material and Methods

An experiment was conducted during *Kharif* 2014 and 2015 at AHRS, Ponnampet. The susceptible variety Intan were sown on 05/07/2014, 16/07/2015 and transplanted on 08/08/2014, 24/08/2015 respectively in RCBD with 3 replications and 10 treatments. The spacing followed was 15 X 15 cm and total plot size were 10.12 m² (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 50% 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 per cent neck blast incidence at third spray and at harvest, The leaf blast incidence was calculated by using formula given by ^[12].

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

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

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

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



Fig 1: Best treatments observed against blast of rice

Table 1: Evaluation of Fungicides for the Management of blast diseases of rice under field condition

T. No.	Treatments Details	Dosage / L	Leaf blast PDI			Leaf blast PDC	Neck blast PDI			Neck blast PDC	Grain yield Kg/ha		
			2014	2015	Pooled		2014	2015	Pooled		2014	2015	Pooled
T ₁	Tricyclazole 45% + Hexaconazole 10% WG (ICF-110)	1.0 g	22.64 (28.35)*	19.66 (26.22)	21.15 (27.30)	66.99	18.92 (25.62)	15.94 (23.31)	17.43 (24.50)	69.96	4700.00	4200.00	4450.00
T ₂	Tricyclazole 18%+ Mancozeb 62% WP (MERGER)	2.5 g	27.27 (31.45)	24.29 (29.47)	25.78 (30.47)	59.77	23.47 (28.91)	20.49 (26.85)	21.98 (27.91)	62.12	4251.84	3751.86	4001.85
T ₃	Tricyclazole 75% WP	0.6 g	24.63 (29.76)	21.88(27.89)	23.25 (28.84)	63.72	21.14 (27.31)	18.16 (25.14)	19.65 (26.25)	66.14	4496.30	3996.30	4246.30
T ₄	Hexaconazole 5% EC	2.0 ml	28.42 (32.17)	25.44 (30.21)	26.93 (31.20)	57.97	25.49 (30.27)	22.51 (28.24)	24.00 (29.27)	58.64	4055.55	3555.57	3805.56
T ₅	Mancozeb 75% WP	2.0 g	41.14 (39.90)	38.16 (38.13)	39.65 (39.02)	38.12	35.60 (36.59)	32.60 (34.78)	34.10 (35.70)	41.24	3350.92	2850.94	3100.93
T ₆	Mancozeb 63% WP + Carbendazium 12% WP (Companion)	1.5 g	34.62 (36.04)	31.64 (34.20)	33.13 (35.12)	48.30	28.27 (33.67)	25.29 (30.10)	26.78 (31.09)	53.85	3594.43	3094.45	3344.44
T ₇	Carbendazium 50% WP	1.0 g	30.62 (33.60)	27.64 (31.71)	29.13 (32.66)	54.54	26.34 (31.62)	23.11 (28.73)	24.73 (29.82)	57.38	3887.95	3387.97	3637.96
T ₈	Control	-	67.07 (55.07)	61.09 (51.46)	64.08 (53.25)	-	60.65 (51.45)	55.40 (48.15)	58.03 (49.68)	-	2853.70	2428.70	2641.20
	CV (%)		6.03	6.40	6.20		6.62	8.79	8.33		6.86	7.25	6.97
	CD (0.05)		3.35	3.37	3.35		3.32	4.15	4.06		405.24	374.88	386.07

Table 2: An economic analysis of fungicides against blast disease of Rice under field condition

T. No.	Treatment	Cost of The chemical (Rs)/lt or Kg	Qty required/ ha* in 1 spray ml/gm	Total cost of chemical/ ha in 1 spray (Rs)	Cost of cultivation (Rs)	Total cost (Rs.)	Additional cost over control (Rs.)	Yield (kg/ha)	Total returns (Rs)**	Net returns (Rs)	Additional Returns over Control (Rs)	Incremental B:C	B:C
1	2	3	4	5	6	7(5+6)	8	9	10	11(10-7)	12	13(12/8)	14(10/7)
T ₁	Tricyclazole 45% + Hexaconazole 10% WG (ICF-110)	1600	1000	1600	43823	45423	1600	4450.00	75650.00	30227.00	29149.60	18.22	1.67
T ₂	Tricyclazole 18%+ Mancozeb 62% WP (MERGER)	600	2500	1500	43823	45323	1500	4001.85	68031.45	22708.45	21631.05	14.42	1.50
T ₃	Tricyclazole 75% WP	1666	600	1000	43823	44823	1000	4246.30	72187.10	27364.10	26286.70	26.29	1.61
T ₄	Hexaconazole 5% EC	550	2000	1100	43823	44923	1100	3805.56	64694.52	19771.52	18694.12	16.99	1.44
T ₅	Mancozeb 75% WP	300	2000	600	43823	44423	600	3100.93	52715.81	8292.81	7215.41	12.03	1.19
T ₆	Mancozeb 63% WP + Carbendazium 12% WP (Companion)	600	1500	900	43823	44723	900	3344.44	56855.48	12132.48	11055.08	12.28	1.27
T ₇	Carbendazium 50% WP	1240	1000	1240	43823	45063	1240	3637.96	61845.32	16782.32	15704.92	12.67	1.37
T ₈	Control	-	-	-	43823	43823	0	2641.20	44900.40	1077.40	-	-	1.02

Results and Discussions

The pooled data results obtained indicates that, all the treatments recorded significantly reduced the pooled per cent leaf blast disease index and per cent neck blast disease incidence compared to untreated control. Tricyclazole 45% + Hexaconazole (ICF-110) 10% WG @ 1.0 g/L and Tricyclazole 75% WP @ 0.6 g/L were on par with each other with least pooled leaf blast disease index of 21.15% and 23.25% and neck blast disease incidence of 17.43% and 19.65% respectively, followed by Tricyclazole 18% + Mancozeb 62% WP (MERGER) @ 2.5 g/L treatment was with pooled leaf blast disease index of 25.78% and pooled neck blast incidence of 21.98% when compared to control (64.08% and 58.03%).

The maximum leaf blast per cent disease reduction over control (PDC) was observed in Tricyclazole 45% + Hexaconazole 10% WG @ 1.0 g/L (66.99 PDC) followed by Tricyclazole 75% WP @ 0.6 g/L (69.96 PDC).

Further, in the pooled data of yield observations, the highest pooled yield was recorded in Tricyclazole 45% + Hexaconazole 10% WG @ 1.0 g/L (4450 kg/ha) followed by Tricyclazole 75% WP @ 0.6 g/L (4001.85 kg/ ha) when compared to control (2428.70 kg/ha). The least pooled grain yield was observed in Mancozeb 75% WP @ 2.0 g/L (3350.93 kg/ ha) when compared to other treatments (Table 1 and Plate 1).

All the treatments evaluated under field condition showed significant differences in blast disease reduction and grain yield. The results obtained are also in agreement with the work of [14] who reported ICF-110 resulted in significant reduction (67.8%) in neck blast incidence over control and application of Tricyclazole 75% WP alone reduced neck blast incidence by 69.2 per cent.

Economics of fungicidal evaluation

The economics of cost benefit ratio has been worked out for different fungicides and are presented in Table 2. The highest total returns were obtained by Tricyclazole 45% + Hexaconazole 10% WG @ 1.0 g/L (Rs. 75650.00) followed by Tricyclazole 75% WP @ 0.6 g/L (Rs.72187.10). Similarly net returns and additional net returns over control were also high in Tricyclazole 45% + Hexaconazole 10% WG @ 1.0 g/L (Rs. 30227.00 and Rs. 29149.60 respectively) followed by Tricyclazole 75% WP @ 0.6 g/L (Rs. 27364.10 and Rs. 26286.70 respectively) than any other fungicides. However, when cost benefit ratio was calculated, Tricyclazole 45% + Hexaconazole 10% WG (1.67) and Tricyclazole 75% WP (1.61) proved better because of curative effect and systemic in nature of the chemical than any other fungicides.

However from the farmer's point of view, the economics of disease management is important. In the present investigation the Tricyclazole 45% + Hexaconazole 10% WG @ 1.0 g/L has given highest total returns, net returns and additional returns over control than any other fungicides. The Tricyclazole 75% WP @ 0.6 g/L was next in order with respect to all the three above mentioned parameters. This is obviously due to their mode of action and also lowering of both leaf and neck blast incidence.

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