International Journal of Tropical Agriculture
Volume 40, Numbers (3-4) • 2022 : pp. 403-408
ISSN: 0254-8755

Investigation of Fungicides for the Management of Blast Diseases of Paddy

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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* 2019 and 2020 to know the impact of seven fungicide treatments. Among seven treatments, Azoxystrobin 18.2 % w/w + Difenoconazole 11.4% w/w SC @ 1.0 ml/L and Prochloraz 23.5% w/w + Tricyclazole 20.0% w/w SE @ 2 ml/L were on par with each other with least pooled leaf blast disease index of 17.15% and 19.03% and neck blast disease incidence of 13.68 % and 15.73% respectively followed by Tricyclazole 75% WP @ 0.6 g/L. Further, the highest pooled yield was recorded in Azoxystrobin 18.2 % w/w + Difenoconazole 11.4% w/w SC @ 1.0 ml/L (3811.15 kg/ha) followed by Prochloraz 23.5% w/w + Tricyclazole 20.0% w/w SE @ 2 ml/L (3589.58 kg/ha). However, when cost benefit ratio was calculated, Azoxystrobin 18.2 % w/w + Difenoconazole 11.4% w/w SC (1.53) and Tricyclazole 75% WP (1.45) respectively followed by followed by Prochloraz 23.5% w/w + Tricyclazole 20.0% w/w SE (1.36).

Keywords: Management, Paddy, Blast, Disease and Fungicides.

INTRODUCTION

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. Rice is grown on millions of small farms with an average size ranging from 0.4- 3.5 ha, primarily to meet family needs. Rice is the important cereal crop grown throughout the world and is the second most staple food crop of the world next to wheat and staple food for two third of world's population (Abodolereza and racionzer, 2009).

Starting in 2500 B.C. rice has been a source of food for people. Rice production originated in China, and was spread to countries such as Sri Lanka and India. It is believed that rice was brought to West Asia and Greece in 300 B.C. by Alexander the Great's armies.

China and India account for roughly 50 per cent of the world's total rice area and jointly produce 55 per cent 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.

Projection of India rice production target for 2025 AD is 140 million tons, which can be achieved only by increasing the rice production by over 2 million tons per year in the coming decade and this has to be achieved against back drop of diminishing natural resource such as land and water.

Globally, rice is cultivated with an area about 161.4 million hectare, production of about 633.3 million tonnes with a productivity of 3.14 tonnes per hectare (Anon, 2017). In India area under rice

Article History: Received: 11 September 2022; Revised: 20 October 2022; Accepted: 30 October 2022

cultivation is 44 million hectare and production of about 104 million tonnes with productivity of about 2.4 tonnes per hectare (Anon, 2017). In Karnataka, rice is cultivated with an area of 13.43 lakh ha, production of 39.53 lakh tonnes and productivity of 3.09 tonnes per hectare (Anon, 2017).

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 (Hollier, *et al.*, 1984). 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 (Gilbert, *et al.*, 2004). Heavy yield losses have been reported in many rice growing countries *viz.*, 75, 50 and 40 percent grain loss was occur in India (Padmanabhan, 1965), Philippines (Ou, 1985) and Nigeria (Awodera and Esuruoso, 1975). The pathogen can cause damage up to 90% and sometime total crop loss under favourable conditions (Samira, *et al.*, 2002). The rice blast fungus can causes symptoms like leaf blast, nodal blast and neck or panicle blast. The most severe stage is neck blast (Bonman, *et al.*, 1989). The usual practices followed for management of blast disease of rice includes use of resistant varieties, use of fungicides, application of fertilizers and irrigations (Georgopoulos and Ziogas, 1992, Naidu and Reddy, 1989). Thus, the study was conducted for the management of blast disease of rice under field condition by using new combi product and systemic fungicides.

MATERIALS AND METHODS

An experiment was conducted during *Kharif* 2019 and 2020 at AHRS, Ponnampet. The susceptible variety Intan were sown on 16/07/2019, 29/07/2020 and transplanted on 20/08/2019 & 31/08/2020 respectively in RCBD with 4 replications and 8 treatments. The spacing followed was 15 X 15 cm and total plot size were 6.75 m^2 (Table 1 and Plate 1). Totally two sprays were given, first at appearance of the leaf blast disease as prophalytic spray and second spray 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 after first spray by using 0-9 scale given by IRRI (1996) and for the neck blast as percent neck blast incidence at second spray and at harvest, The leaf blast incidence was calculated by using formula given by Wheeler, 1969.

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

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 Panse and Sukathme, 1967. The original means were converted into arc sine transformed values. The yield was recorded at harvest in all the treatments.

RESULTS AND DISCUSSION

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. Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 1.0 ml/L and Prochloraz 23.5% w/w + Tricyclazole 20.0% w/w SE @ 2 ml/L were on par with each other with least pooled leaf blast disease index of 17.15% and 19.03% and neck blast disease incidence of 13.68% and 15.73% respectively followed by followed by Tricyclazole 75% WP @ 0.6 g/L treatment was with pooled leaf blast disease index of 23.30% and pooled neck blast incidence of 17.33% when compared to control (60.31% and 54.58%).

The maximum leaf blast per cent disease reduction over control (PDC) was observed in Azoxystrobin 18.2 % w/w +Difenoconazole 11.4% w/w SC @ 1.0 ml/L (71.56 PDC) and Prochloraz 23.5% w/w + Tricyclazole 20.0% w/w SE @ 2 ml/L (68.46 PDC) followed by Tricyclazole 75% WP @ 0.6 g/L (61.37 PDC). Similarly, the maximum neck blast per cent disease reduction over control (PDC) was observed in Azoxystrobin 18.2 % w/w +

Difenoconazole 11.4% w/w SC @ 1.0 ml/L (71.19 PDC) and Prochloraz 23.5% w/w + Tricyclazole 20.0% w/w SE @ 2 ml/L (71.19 PDC) followed by Tricyclazole 75% WP @ 0.6 g/L (68.25 PDC).

Further, in the pooled data of yield observations, the highest pooled yield was recorded in Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 1.0 ml/L (3811.15 kg/ha) and Prochloraz 23.5% w/w + Tricyclazole 20.0% w/w SE @ 2 ml/L (3589.58 kg/ha) followed by Tricyclazole 75% WP @ 0.6 g/L (3544.31 kg/ha) when compared to control (2416.61 kg/ha). The least pooled grain yield was observed in Hexaconazole 5% EC @ 2.0 ml/L (2966.96 kg/ ha) when compared to other treatments (Table 1 and Plate 1).

All the treatments investigated under field condition showed significant differences in blast disease reduction and grain yield. The results obtained are also in agreement with the work of Neelakanth, *et al.*, 2017, Wasimfiroz, *et al.*, 2018 and Hosagoudar, (2018 & 2019) who also reported the complete inhibition of growth of *Pyricularia oryzae* in Azoxystrobin 18.2 % w/w +Difenoconazole 11.4% w/w SC, Trifloxystrobin 25% + Tebuconazole 50% WG and Tricyclazole75% WP as effective fungicides against *Pyricularia oryzae*.

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 Azoxystrobin 18.2 % w/w + Difenoconazole 11.4% w/w SC @ 1.0 ml/L (Rs. 70506.28) followed by Prochloraz 23.5% w/w + Tricyclazole 20.0% w/w SE @ 2 ml/L (Rs.66407.23). Similarly net returns and additional net returns over control were also high in Azoxystrobin 18.2 % w/w + Difenoconazole 11.4% w/w SC @ 1.0 ml/L (Rs. 24523.28 and Rs. 23638.98 respectively) followed by Tricyclazole 75% WP @ 0.6 g/L (Rs. 20296.74 and Rs. 19412.44 respectively) than any other fungicides. However, when cost benefit ratio was calculated, Azoxystrobin 18.2 % w/w + Difenoconazole 11.4% w/w SC @ 1.0 ml/L (1.53) proved better because of curative effect, combi product, multisite mode of action 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 Azoxystrobin 18.2 % w/w + Difenoconazole 11.4% w/w SC @ 1.0 ml/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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Plate 1: Best treatment and untreated control observed against blast of paddy

Table 1: Investigation of Fungicides for the Management of Blast diseases of Paddy

Tr. No.	*Treatments Details*	*Dosage / L*	*Leaf blast PDI*			*Leaf blast PDC*	*Neck blast PDI*			*Leaf blast PDC*	*Grain yield Kg/ha*		
			2019	*2020*	*Pooled*		*2019*	*2020*	*Pooled*		*2019*	*2020*	*Pooled*
T_1	Prochloraz 23.5% w/w + Tricyclazole 20.0% w/w SE	2.0 ml	19.53 (26.14)*	18.54 (25.39)	**19.03 (25.77)**	68.46	16.23 (23.54)	15.24 (22.72)	**15.73 (23.14)**	71.19	3595.93	3583.23	**3589.58**
$\mathbf{T_2}$	Prochloraz 45% EC	2.0 ml	25.68 (30.46)	24.68 (29.79)	**25.18 (30.13)**	58.26	19.28 (26.05)	18.29 (25.30)	**18.78 (25.68)**	65.60	3306.86	3297.33	**3302.10**
$\mathbf{T_3}$	Tricyclazole 75% WP	0.6 g	23.80 (29.20)	22.81 (28.52)	**23.30 (28.86)**	61.37	17.83 (24.97)	16.84 (24.19)	**17.33 (24.58)**	68.25	3549.87	3538.75	**3544.31**
$\mathbf{T_4}$	Azoxystrobin 18.2 % w/w + Difenoconazole 11.4% W/W SC	1.0 ml	17.65 (24.81)	16.66 (24.04)	**17.15 (24.43)**	71.56	14.18 (22.00)	13.18 (21.13)	**13.68 (21.57)**	74.94	3816.71	3805.59	**3811.15**
$\mathbf{T_5}$	Difenoconazole 25EC	1.0 ml	27.18 (31.37)	25.68 (30.39)	**26.43 (30.88)**	56.19	22.25 (28.11)	21.26 (27.37)	**21.75 (27.74)**	60.15	3179.80	3167.09	**3173.44**
$\mathbf{T_6}$	Hexaconazole 5% EC	2.0 ml	31.75 (34.26)	30.75 (33.65)	**31.25 (33.95)**	48.19	21.75 (27.79)	20.76 (27.07)	**21.25 (27.44)**	61.06	2973.32	2960.61	**2966.96**
$\mathbf{T_7}$	Propiconazole 25% EC	1.0 ml	29.69 (32.97)	27.94 (31.83)	**28.81 (32.40)**	52.23	25.10 (30.08)	24.11 (29.40)	**24.60 (29.74)**	54.92	3094.03	3081.32	**3087.67**
$\mathbf{T_8}$	Control	-	60.94 (51.36)	59.69 (50.63)	**60.31 (50.99)**	-	55.08 (47.95)	54.08 (47.37)	**54.58 (47.66)**	-	2422.17	2411.05	**2416.61**
	Mean		29.53 (32.57)	28.34 (31.78)	**28.93 (32.18)**		23.96 (28.81)	22.97 (28.07)	**23.46 (28.44)**		3242.34	3230.62	**3589.58**
	SEm±		1.00	1.13	1.06		1.12	1.28	1.19		116.15	115.87	116.00
	CV (%)		5.75	6.78	6.20		7.62	8.94	8.19		7.34	7.35	7.34
	CD (0.05)		2.93	3.34	3.11		3.31	3.78	3.51		341.59	340.77	341.17

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

Tr. No.	*Treatment*	*Cost of The chemical (Rs)/lt or Kg*	*Qty required/ ha* in 2 spray ml/gm*	*Total cost of chemical/ ha in 2 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)*	*B:C*
1	2	*3*	*4*	*5*	*6*	*7(5+6)*	*8*	*9*	*10*	*11(10-7)*	*12*	*13(10/7)*
T_1	Prochloraz 23.5% w/w + Tricyclazole 20.0% w/w SE	2416/-	2000	4832	43823	48655	4832	3589.58	66407.23	17752.23	16867.93	1.36
T_2	Prochloraz 45% EC	2500/-	2000	5000	43823	48823	5000	3302.10	61088.85	12265.85	11381.55	1.25
T_3	Tricyclazole 75% WP	2416/-	600	1450	43823	45273	1450	3544.31	65569.74	20296.74	19412.44	1.45
T_4	Azoxystrobin 18.2 % w/w + Difenoconazole 11.4% W/W SC	2160/-	1000	2160	43823	45983	2160	3811.15	70506.28	24523.28	23638.98	1.53
T_5	Difenoconazole 25EC	3566/-	1000	3566	43823	47389	3566	3173.44	58708.64	11319.64	10435.34	1.24
T_6	Hexaconazole 5% EC	700/-	2000	1400	43823	45223	1400	2966.96	54888.76	9665.76	8781.46	1.21
T_7	Propiconazole 25% EC	1800/-	1000	1800	43823	45623	1800	3087.67	57121.9	11498.9	10614.6	1.25
T_8	Control	-		-	43823	43823	0	2416.61	44707.29	884.285	0	1.02

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