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Bioefficacy of Prochloraz 45% EC against Blast Disease in Rice

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ABSTRACT: Rice diseases caused by fungi are considered the main constraint in rice production and cause both qualitative and quantitative losses. Rice blast caused by *Pyricularia oryzae* is the most severe and widely distributed disease of rice worldwide having significant economic importance, resulting in yield losses of up to 50%. Therefore to know the effect of Prochloraz 45% EC on blast (*Pyricularia oryzae*) disease of rice crop the experiment was laid out with 6 treatments and replicated four times in RBD design at ARS, Gangavati. The variety BPT-5204 was sown with the spacing of 20 cm x 10 cm in plot size of 5 X 5 m^2 with all regular agronomic practices followed as per the standard package of practice of University of Agricultural Sciences, Raichur. The fungicide Prochloraz 45% EC was applied as foliar spray treatment in the replicated plots just after the appearance of blast disease in the main field. The observations were recorded on the basis of scoring of the diseases as per the standard disease rating scale. Among the treatments, Prochloraz 45% EC @ 1250 ml/ha and Prochloraz 45% EC @ 1000 ml/ha were found to be the best treatments as there were 6.35 PDI and 6.56 PDI of leaf blast disease in rice were recorded, respectively as compared to 38.30 PDI of leaf blast disease in untreated control during first season at terminal observation. Similarly, during second season Prochloraz 45% EC @ 1250 ml/ha recorded 6.50 PDI which was on par with Prochloraz 45% EC @ 1000 ml/ha (6.83 PDI) and found superior than rest of the treatments at terminal observation. Maximum PDI i.e. 39.03 was recorded under untreated control condition. Prochloraz 45% EC @ 1250 ml/ha and Prochloraz 45% EC @ 1000 ml/ha were again recorded its superiority during all the observation days. The highest paddy yield was obtained from the treatment with Prochloraz 45% EC @ 1250 ml/ha i.e. 48.86 q/ha and 49.60 q/ha during first and second season, respectively. Minimum paddy yield i.e. 34.41 q/ha and 35.90 q/ha were recorded on untreated control treatment during first and second season, respectively.

Keywords: Blast, Disease, Paddy, Prochloraz 45% EC and Yield.

INTRODUCTION

Rice (*Oryza sativa* L) is the world's most important staple food crop of 2.7 billion people and is critically important for food security of the world. Of the world rice production 476 million tonnes, India is producing 22.1 per cent of it (105 million tonnes of rice), in an area of 44 million hectares (Anon., 2020). Rice diseases caused by fungi are considered the main constraint in rice production and cause both qualitative and quantitative losses (Law *et al.*, 2017). In particular, rice blast disease caused by *Pyricularia oryzae* (*Magnaporthe grisea*) has been reported as the most significant disease, resulting in yield losses of up to 50% (Nalley *et al.*, 2016). Rice blast caused by *Pyricularia oryzae* is the most severe and widely distributed disease of rice worldwide having significant economic importance. Presently in India, blast is especially problematic in temperate areas, hilly tracts, tropical uplands and in delta regions. The pathogen infects leaf, node, collar and neck causing leaf blast, nodal blast, collar blast and neck blast. Blast disease is major constrain of rice production reported to cause extensive damage in crop production. In the recent past, blast has become major threat, especially under intensive rice cultivation. Monoculture of high-yielding semi-dwarf rice varieties, heavy doses of nitrogenous fertilizers, imbalance use of fertilizer and the favourable micro-environment facilitated by the crop density are implicated as the major factors favouring the severe fungal infection cause sharp increase in the disease incidence and ultimately reduce rice production. (Savary *et al.*, 1995; Cu *et al.*, 1996). In view of this, fungicides / pesticides / new molecules occupy a major share and contribute greatly towards disease management. It is mainly because of their convenience, easily available, effectiveness and broad spectrum. In such cases, the disease in susceptible rice varieties is managed by the application of chemical fungicides (Chou *et al.*, 2020). Hence, chemical control is still widely practiced and is the most successful strategy for

managing crop losses due to blast globally (Kumar *et al*., 2021). Therefore, an effective management of crop is required from early stage of diseases development which can be assured by proper fungicides. Keeping in view the increasing demand of rice in the local markets as well as its huge export potential and the challenge of disease management, the present study has been conducted to evaluate the fungicide Prochloraz 45% EC against blast and sheath blight diseases of paddy crop

MATERIALS AND METHODS

The experiment was laid out with six treatments and replicated four times in RBD design at ARS, Gangavati. The variety BPT-5204 was sown in plot size of 5 × 5 m^2 with all regular agronomic practices followed as per the standard package of practice of University of Agricultural Sciences, Raichur. The fungicides were applied as foliar spray treatment in the replicated plots just after the appearance of blast disease in the main field and standard agronomic practices were adopted for the *Kharif* 2014-15 and 2015-16 cultivation season. The fungicides were applied as foliar spray treatment using Knapsack sprayer fitted with hollow cone nozzle in randomized block design in the replicated plots just after the appearance of blast disease in the main field and standard agronomic practices were adopted on susceptible variety BPT-5204. The plots were inspected regularly to see the disease development and further two more spray were applied at an interval of 10 days. To know the effect of Prochloraz 45% EC on the Blast (*Pyricularia oryzae*) of rice crop observation for disease incidence were recorded before as well as 10 days after each spray from the randomly selected ten hills per plot and efficacy of molecule in controlling of the disease (Table 1).

Method of observation. Disease scoring against blast and sheath blight disease of rice was made following 0-9 disease rating scale of Standard Evaluation System of IRRI (2014). Scoring was done before each treatment spray. Twenty plants were selected at random in the middle 1 sq.m area, from each plot and scored for each plant (hill) and per cent disease index (PDI) was calculated. Observations on blast of disease was recorded in each replicated plot for each treatment on the day of treatment spray and 10th day after each spray and per cent disease incidence was calculated after each spray based on standard procedure.

Table 1: Diseases rating scale for paddy leaf blast disease evaluation.

Sr. No.	Description	Score
1	No lesions observed	0
2	Small brown specks of pin-point size or larger brown specks without sporulation center	1
3	Small roundish to slightly elongated, necrotic gray spots, about 1-2 mm in diameter, with a distinct brown margin	2
4	Lesion type is the same as in scale 2, but a significant number of lesions are on the upper leaves	3
5	Typical susceptible blast lesions 3 mm or longer, infecting less than 4 % of the leaf area	4
6	Typical blast lesions infecting 4-10 % of the leaf area	5
7	Typical blast lesions infection 11-25 % of the leaf area	6
8	Typical blast lesions infection 26-50 % of the leaf area	7
9	Typical blast lesions infection 51-75 % of the leaf area and many leaves are dead	8
10	More than 75 % leaf area affected	9

Per cent Disease Index (PDI). Observation on intensity of disease was observed in each replicated plot for each treatment. The severity of the disease was recorded as PDI. The scores of the twenty selected plants were converted to PDI using the formula mentioned below.

$$\text{Percent Disease Index (PDI)} = \frac{\text{Sum of numerical rating}}{\text{Total no. of plants observed} \times \text{Maximum rating scale}} \times 100$$

Grain yield. In order to record the yield, after final crop harvesting, the plants were sun dried, thrashed and grains were separated by winnowing. The grain yield of the net plot was recorded separately from individual replicated plots of experimental treatment and average paddy yield was recorded and converted to quintal per hectare and was statistically analyzed.

RESULTS AND DISCUSSION

Among the treatments, Prochloraz 45% EC @ 1250 ml/ha and Prochloraz 45% EC @ 1000 ml/ha were found to be the best treatments as there were 6.35 PDI and 6.56 PDI of leaf blast disease in rice were recorded respectively as compared to 38.30 PDI of leaf blast disease in untreated control during first season at terminal observation (Table 2). Prochloraz 45% EC @ 1250 ml/ha and Prochloraz 45% EC @ 1000 ml/ha were recorded its superiority during all the observation days. The effect of foliar treatment on blast disease control with Prochloraz 45% EC @ 1250 ml/ha and Prochloraz 45% EC @ 1000 ml/ha were statistically on par with each other.

Similarly, during second season Prochloraz 45% EC @ 1250 ml/ha recorded 6.50 PDI which was on par with Prochloraz 45% EC @ 1000 ml/ha (6.83 PDI) and found superior than rest of the treatments at terminal observation (Table 2). Maximum PDI i.e. 39.03 was recorded under untreated control condition during second season trial. Prochloraz 45% EC @ 1250 ml/ha and Prochloraz 45% EC @ 1000 ml/ha were again recorded its superiority during all the observation days.

Rice yield. The result presented in the Table 2 and 3 showed that highest paddy yield was obtained from the treatment with Prochloraz 45% EC @ 1250 ml/ha i.e. 48.86 q/ha and 49.60 q/ha during first and second season respectively which was also at par with

Prochloraz 45% EC @ 1000 ml/ha recorded 48.72 q/ha and 49.37 q/ha of paddy yield during first and second season respectively. All the treatments were significantly superior with respect to control (Table 2 & 3). Minimum paddy yield i.e. 34.41 q/ha and 35.90 q/ha were recorded on untreated control treatment during first and second season respectively.

Table 2: Efficacy of Prochloraz 45% EC on Blast disease incidence and Yield of Rice during *Kharif* (1st Season).

Tr. No.	Treatments	Doses (per ha)		PDI of Blast disease				Paddy Yield (Q/ha)
		Formulations (g or ml)	g a.i.	Initial score	10 days after I spray	10 days after II spray	Terminal score (10 days after III spray)	
T1	Prochloraz 45% EC	750	337.5	9.40 (17.85)	9.25 (17.71)	8.76 (17.21)	8.71 (17.15)	40.54
T2	Prochloraz 45% EC	1000	450.0	9.43 (17.88)	7.14 (15.49)	6.98 (15.30)	6.56 (14.84)	48.72
T3	Prochloraz 45% EC	1250	562.5	9.39 (17.84)	7.04 (15.35)	6.89 (15.21)	6.35 (14.59)	48.86
T4	Tricyclazole 75% WP	400	300	9.56 (18.01)	8.99 (17.44)	8.44 (16.89)	8.35 (16.79)	44.50
T5	Carbendazim 50% WP	500	250	9.36 (17.82)	9.72 (18.15)	9.97 (18.39)	9.87 (18.29)	43.15
T6	Untreated control	-	-	9.77 (18.20)	18.21 (25.25)	28.84 (32.48)	38.30 (38.24)	34.41
	CD (0.05)	**--**	**--**	**NS**	**1.04**	**0.92**	**1.12**	**2.10**

*Data in the parenthesis is angular transformed value

Table 3: Efficacy of Prochloraz 45% EC on Blast disease incidence and Yield of Rice during *Kharif* (2nd Season).

Tr. No.	Treatments	Doses (per ha)		PDI of Blast disease				Paddy Yield (Q/ha)
		Formulations (g or ml)	g a.i.	Initial score	10 days after I spray	10 days after II spray	Terminal score (10 days after III spray)	
T1	Prochloraz 45% EC	750	337.5	9.62 (18.06)	9.49 (17.93)	9.12 (17.57)	8.90 (17.35)	41.27
T2	Prochloraz 45% EC	1000	450.0	9.76 (18.19)	7.41 (15.78)	6.91 (15.23)	6.83 (15.13)	49.37
T3	Prochloraz 45% EC	1250	562.5	9.79 (18.21)	7.35 (15.70)	6.68 (14.97)	6.50 (14.77)	49.60
T4	Tricyclazole 75% WP	400	300	9.57 (18.00)	9.43 (17.88)	9.34 (17.76)	9.09 (17.54)	44.99
T5	Carbendazim 50% WP	500	250	9.78 (18.21)	10.01 (18.44)	9.87 (18.30)	10.02 (18.45)	42.39
T6	Untreated control	-	-	9.55 (17.97)	17.00 (24.34)	26.50 (30.98)	39.13 (38.72)	35.90
	CD (0.05)	**--**	**--**	**NS**	**1.24**	**1.26**	**0.93**	**1.99**

*Data in the parenthesis is angular transformed value

Even though both systemic and non-systemic fungicides are used for chemical management, systemic fungicides offer better management of the disease (Naik *et al*., 2017; Gowdar *et al*., 2021). Timely application of selective fungicides between panicle differentiation and heading stage offers effective protection against the disease. Periodical monitoring of the rice field and application of fungicides at the initial stages of infection especially at booting stage is recommended for managing sheath blight in susceptible varieties (Singh *et al*., 2016; Uppala and Zhou 2018).

Several chemical formulations are in use for the control of blast in rice. The major focus in the development has been on the identification of fungicides with novel target sites and diverse modes of action. Application of chemicals such as Flutolanil, Carbendazim, Iprobenfos, Mancozeb, Thifluzamide and Validamycin also offers effective control of disease. The use of a single chemical with the same mode of application for a prolonged time leads to the evolution of resistance in the fungus (Uppala and Zhou, 2018). Hence, a combinatory chemical formulation such as Propiconazole + Difenoconazole (Kandhari, 2007); Prothioconazole + Tebuconazole 240 g/kg SC (Chen *et al*., 2021); Carbendazim 25% + Flusilazole 12.5% SE (Sanjay *et al*., 2012) etc., are recommended to manage the disease. The chemical method of control is applicable for all areas, irrespective of varieties and has an advantage in a reduction in disease occurrence, spread and enhance yield.

CONCLUSIONS

The foliar application of Prochloraz 45% EC @ 1000-1250 ml/ha were effective in control of blast disease incidence during both the seasons tested and resulting higher yield of rice. Prochloraz 45% EC @ 1000 ml/ha and Prochloraz 45% EC @ 1250 ml/ha were found on par at all the observation days during both the seasons. There was no any phyto-toxicity symptoms were noticed at recommended as well as higher doses of Prochloraz 45% EC. Hence, considering the efficacy and economics of fungicide use it can be concluded that Prochloraz 45% EC @ 1000 ml/ha is effective in managing the blast diseases of rice without any harmful effect on crop.

FUTURE SCOPE

The farmers have to follow the fungicide rotation in order to control the disease effectively. The disease incidence will be severe if we apply the same fungicide. The scientist can come with the new molecules which will reduce the disease incidence.

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Conflict of Interest. Authors have declared that no competing interests exist.

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