

Original Research Article

A new strobilurin group of fungicide for the management of blast disease of paddy

Short Title: Management of blast disease of paddy

ABSTRACT

A new strobilurin group of fungicide, pyraclostrobin 100 g/l CS (Seltima 100 g/l CS) was evaluated for its bio-efficacy against rice leaf blast disease under field condition during *Kharif* 2013 and 2014 at Agricultural research station, Gangavathi, Karnataka, India. The test fungicide, pyraclostrobin 100 g/l CS was found effective against leaf blast disease which recorded least percent disease index (PDI) of 14.20 and 16.48 @ 75 g a.i./h and @ 100g a.i./h, respectively. Other fungicides such as tricyclazole 75 WP (300 g/h), Carbendazim 50 WP (500g/h) and Isoprothiolane 40 EC (750 ml/h) recorded significantly more PDI than pyraclostrobin 100 g/l CS. Due to difference in the PDI of leaf blast disease, different treatments recorded statistically significant yield differences. The highest yield (67.78 q/h) was recorded in the treatment of pyraclostrobin 100 g/l CS @ 75 g a.i./h followed by the same chemical @ 100 g a.i./h (66.87 q/h). Therefore, Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS) @ 75-100 g a.i./h can be used for effective management of leaf blast disease.

Key words: Leaf Blast, Pyraclostrobin 100 g/l CS, PDI, Tricyclazole 75 WP

1. INTRODUCTION

Rice (*Oryza sativa* L.) is an important supplier of staple food and food security to millions of population in the world and is one of the major food crops of India. Ever growing population in the world particularly in India is further demanding the enhanced production of rice. Under field condition, the productivity of rice is affected by many biotic and abiotic factors. Among the different biotic constraints, diseases caused by fungal pathogens such as blast is the most

29 frequent and ferocious disease in irrigated rice of both temperate and subtropical areas and
30 which causes damage at all stages of crop growth [8].

31 Rice blast caused by *Pyricularia oryzae* Cavara [synonym *Pyricularia grisea* Sacc.
32 the anamorph of *Magnaporthe grisea* (Herbert) Yaegashi and Udagawa], is one of the most
33 destructive and wide spread disease of rice [15]. Blast epidemic causes the complete defeat of
34 seedling [10] at the nursery and in field condition [27] and causes up to 80% of total yield
35 reduction [9,18]. Due to non availability of location specific resistance varieties for blast
36 disease, the chemical control is an important strategy for the farmers to harvest economic
37 yield. Moreover, poor bio-efficacy of the biocontrol agents under the severe epidemic
38 condition makes the chemical control is an inevitable and ultimate means for blast disease
39 management for farmers. Chemical restraint of the blast diseases is successful at field level in
40 majority of the cases [6,16,19,20,21,30,32] Fungicidal control is largely practiced for blast
41 disease in many temperate or subtropical rice growing countries, primarily in Japan, China,
42 South Korea, Taiwan and Vietnam [20].

43 Historically, copper and mercury based fungicides were in use against blast, but were
44 found not suitable because of phytotoxicity and mammalian toxicity. Present day products are
45 mainly systemic with a residual action of 15 days at least. The modern rice fungicides include
46 Isoprothiolane, Probenazole, Pyroquilon, Tricyclazole [13] and most of the other fungicides
47 like Benomyl, Carbendazim, Chloroneb, Captafol, Mancozeb, Zineb, Edifenphos,
48 Iprobenphos, Thiophanate, Carboxin, Kitazin, Flutolanil, etc. are found to be effective for
49 blast disease management under field conditions [2,11,17,24,31]. Fungicides have been used
50 successfully to control blast, but their efficacy could vary with dose and geographical region.
51 Although, all the above mentioned fungicides are effective against blast disease, it has been
52 advised to rotate the fungicides to overcome the development of fungicide resistance in
53 targeted fungal population [26]. Due to continuous development of fungicide tolerance in

54 fungal population, it is inevitable to search for a new group of fungicide with different mode
55 of action so that new information on diverse fungicides with different modes of action can be
56 offered to farmers. Strobilurins (also known as β -methoxyacrylates) or QoI (Quinone
57 outside Inhibitors) fungicides, originally derived from a wild mushroom (*Strobilurus*
58 *tenacellus*) [1] were introduced for plant disease management in late 1990s [5]. Strobilurins,
59 are now the second largest group of fungicides, widely used on cereals [4]. The strobilurin
60 fungicides includes Azoxystrobin, Fluoxastrobin, Kresoxim-methyl, Metominostrobin,
61 Picoxystrobin, Pyraclostrobin and Trifloxystrobin which act against electron transport chain
62 in fungal mitochondrial synthesis in *cytochrome bc1*, are highly effective, and are suitable for
63 a wide range of crops including rice [4].

64 In this view, present study was undertaken to appraise the field efficacy of
65 pyraclostrobin 100 g/l CS (commercially available as Seltima 100 g/l CS), a strobilurin group
66 of fungicide at different doses against blast disease of paddy under field conditions.

67 2. MATERIALS AND METHODS

68 A Field trial was conducted at the experimental fields of All India Co-ordinated Rice
69 Improvement Programme, Agricultural Research Station, Gangavathi, Karnataka (5.4319° N,
70 76.5315° E) during two consecutive *Kharif* seasons of 2013 and 2014. A popular rice variety
71 BPT5204 which is susceptible to blast disease was sown in the month of July and planted in
72 August (in both *Kharif* seasons). The healthy seeds were incubated in the gunny bags after
73 soaking over night for sprouting before sowing in the nursery. The land was prepared by
74 puddling method by applying one ploughing followed by two ploughing after one week. The
75 experiment was laid out in a randomized complete block design (RCBD) with a plot size of 5
76 x 4 m each for every treatment. Seedlings of 30 days old were planted in trail plots at 20X10
77 cm spacing. All standard agronomic practices were followed except using higher nitrogenous

(200 kg ha⁻¹) and lower pottasic (50 kg ha⁻¹) fertilizer dose than the normal dose (N₂:P₂O₅:K₂O::150:75:75).

The RCBD experiment comprises seven treatments with three replications each. The fungicide, Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS) was tested at different doses (62.5-100 g a.i/h) along with Tricyclazole 75 WP (300 g/h), Carbendazim 50% WP (500g/h) and Isoprothiolane 40% EC (750 ml/h). Bio-efficacy was evaluated by spraying all the test chemicals thrice at 10 days interval starting from the initiation of the disease.

Observations were recorded for disease severity in each treatment after each spray as per the standard method. The disease was measured on leaves using the disease rating scale of 0-9 developed by International Rice Research Institute (IRRI. 1996) for leaf blast disease. Further, the scored data was converted into per cent disease index (PDI) using formula given below. The data on the yield were recorded by marking 3 x 2 m section within each plot using a wire frame as described by [23] and tillers within the frame were cut and harvested in order to determine the yield.

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$$\text{PDI} = \frac{\text{Sum of the scores} \times 100}{\text{Number of Observation} \times \text{Highest Number in Rating Scale}}$$

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3. RESULT AND DISCUSSION

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Data obtained based on 0-9 SES scale was converted into PDI values. PDI values from two *Kharif* seasons were pooled to get the average PDI (Table 1). The pooled data indicated that the test fungicide Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS) was found to be more effective in reducing the leaf blast severity at its 75-100 g a.i/h concentration. There was significant difference among the treatments with respect to blast PDI and all fungicide treatments recorded significantly lower PDI compare to untreated control in all three observations. At final

105 observation (10 days after 3rd spray), lowest PDI (14.20) was recorded with Pyraclostrobin 100
106 g/l CS (Seltima 100 g/l CS) @ 100 g/h dose which is statically on par with same chemical at 75
107 g a.i./h dose.

108 In this experiment, the test chemical Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS) @
109 75-100g a.i./h has reduced blast PDI significantly compare to the tricyclazole 75 WP @ 300 g/h
110 (PDI 29.56) which is presently being widely used for blast disease management in India. This
111 could be due to repeated use of tricyclazole 75 WP for blast disease management in the country
112 from many years which may have lead to the development of resistant fungal population and
113 hence, reduced bio-efficacy under field condition. This observation is in agreement with the
114 previous report [26], where they have recommended the rotation of different groups of
115 fungicide for managing the development of fungicide resistance population.

116 Test chemical Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS) @ 62.5g a.i./h recorded
117 statistically on par PDI (27.37) as that of Tricyclazole 75 WP (300g/h). Highest PDI was
118 recorded in unsprayed control (47.24) followed by Isoprothiolane 40% EC @ 750 ml/h (PDI
119 39.51). Effectiveness strobilurin fungicides in reducing the blast disease compare to other
120 fungicides has also been reported previously [12]. Various experimental reports confirmed that
121 strobilurin compounds found to be effective in controlling other rice diseases like grain
122 discoloration [3], sheath rot and brown spot [7], Sheath blight [6,4]. In a recent report it was
123 evident that not only fungal diseases, viral disease like *Tobacco Mosaic Virus* infection is also
124 restricted in tobacco plant pre-treated with pyraclostrobin [14]. Effect of Trifloxystrobin
125 25%+Tebuconazole 50% 75WG, a strobilurin derived combi product in controlling the leaf
126 blast disease of paddy under field condition [29].

127 In the present study, significant increase in the grain yield was also observed in the plots
128 treated with test chemical Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS) @ 75-100 g a.i./h
129 (66.87-67.78 q/h) compare to the other fungicidal treatments which recorded the yield in the

range of 53.05-60.65 q/h. The lowest yield was recorded in the unsprayed control plots (45.3 q/h) (Table.2). Our results are in conformity with previous reports that the fungicides application increases the yield of rice [4,6,21,22,25,28,29].

4. CONCLUSION

In the present study, the fungicide Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS) @ 75-100 g a.i./h have found superior in reducing the leaf blast disease PDI and therefore increased the grain yield.

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Table-1: Effect of Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS) on blast disease of rice (Pooled from *Kharif* – 2013 &2014)

Sl. No.	Treatment	Dose a.i. (/ha)	Dose Formulati on (/ha)	Leaf Blast PDI (Pooled mean from two <i>kharif</i> seasons)*			
				Initial score	10 days after 1 st spray	10 days after 2 nd spray	Terminal score (10 days after 3 rd spray)
1	Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS)	62.5 g	625 ml	6.75 (15.06)	22.47 (28.30)	25.28 (30.19)	27.37 (31.56)
2	Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS)	75 g	750 ml	7.25 (15.64)	13.64 (21.64)	16.62 (24.06)	16.48 (23.95)
3	Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS)	100 g	1000 ml	5.5 (13.56)	12.48 (20.66)	13.59 (21.64)	14.20 (22.14)
4	Tricyclazole 75% WP	225 g	300 g	6.25 (14.82)	22.55 (28.35)	25.88 (30.53)	29.56 (32.93)
5	Carbendazim 50% WP	250 g	500 g	7.32 (15.68)	28.24 (32.14)	33.29 (35.24)	37.27 (37.62)
6	Isoprothiolane 40% EC	300 ml	750 ml	7.40 (15.79)	25.38 (30.26)	35.25 (36.42)	39.51 (38.94)
7	Control	-	-	6.11 (14.30)	36.60 (37.23)	44.41 (41.78)	47.24 (43.35)
CD at 5% level				NS	3.80	4.1	3.62
Coefficient of variance				--	12.83	11.54	13.56

* Figures in the parentheses represent arcsine transformed values

Table-2: Effect of Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS) on paddy grain yield

Sl. No.	Treatment	Dose a.i. (/ha)	Dose Formulati on (/ha)	Yield (q/h)		
				Kharif 2013	Kharif 2014	Pooled
1	Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS)	62.5 g	625 ml	62.50	58.80	60.65
2	Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS)	75 g	750 ml	70.20	65.35	67.78
3	Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS)	100 g	1000 ml	69.50	64.23	66.87
4	Tricyclazole 75% WP	225 g	300 g	63.60	56.80	60.2
5	Carbendazim 50% WP	250 g	500 g	58.10	51.15	54.63
6	Isoprothiolane 40% EC	300 ml	750 ml	57.50	48.60	53.05
7	Control	-	-	49.25	41.35	45.3
CD at 5% level				4.93	3.60	4.24
Coefficient of variance				10.52	11.35	11.1