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EVALUATION OF FLUTRIAFOL 23% W/W SC AGAINST SHEATH BLIGHT AND BROWN SPOT OF PADDY IN COASTAL SALINE ZONE

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ABSTRACT

Sheath blight of rice incited by *Rhizoctonia solani* and brown spot of rice caused by *Bipolaris oryzae* are reported in severe form in coastal zone of West Bengal and causes considerable yield losses. A variety of fungicides with new molecules are available in the market claiming varying degree of control. To assess the efficacy of different fungicide formulations at recommended doses against sheath blight and brown spot diseases, the study was conducted at Bahadurpur village, south 24 parganas, West Bengal to test the efficacy of these new fungicide under coastal climatic conditions of West Bengal. Flutriafol 23% w/w (250 g/L) SC @ 600 ml/ha was significantly superior in controlling the sheath blight and brown spot disease intensity in paddy and in increasing the grain yield, which was at par with Flutriafol 23% w/w (250 g/L) SC @ 500 ml/ha. Flutriafol 23% w/w (250 g/L) SC @ 400 ml/ha, Propiconazole 25% EC @ 500 ml/ha and Propineb 70% WP @ 2000 g/ha were comparatively less effective treatments. There was no phytotoxicity to crop due to the application of various treatments. Hence, it is concluded that Flutriafol 23% w/w (250 g/L) SC @ 500-600 ml/ha (*i.e.* 125-150 g *a.i*/ha) can be safely used in the management of sheath blight and brown spot diseases of paddy.

Key words : Coastal plain zone, Disease incidence, Fungicides, Sheath blight.

Introduction

In rice, sheath blight incited by *Rhizoctonia solani* is a major disease which causes great yield loss in most rice growing regions of the world. It is an important pathogen in coastal zone of India too. In Odisha rice (*Oryza sativa* L.) is staple food and is cultivated extensively throughout the state on an area of 4 million hectares, which accounts for 46% of the total cultivated area and contributes about 88% of total cereal production in the state (Anonymous, 2013). Sheath blight causes about 11.1-58% losses in yield depending on the disease severity and varieties (Chahal *et al*., 2003). In severe cases, the disease can cause up to 100 % loss in grain yield in susceptible varieties (Gangopadhyay and Chakrabarty, 1982). The disease occurs regularly in the region and causes substantial loss in productivity (Pal *et al*., 2015). The disease has become prevalent and economically important under irrigated conditions due the fast-growing nature of the pathogen in intensified rice cropping systems with cultivation of dwarf, high-tillering, high-yielding varieties, high plant densities and increased levels of fertilizers (Chahal *et al*., 2003). Intensification of cropping system leads to development of suitable micro-climate for the growth and development of the pathogen leading to potential yield losses due to the disease. However, sheath blight can be effectively controlled with the application of systemic fungicides. As the resistant cultivars are not available, the disease management relies mainly on chemical management, however the cultural practices may also be followed to minimize the disease but these are quiet tactful and tend to be untenable in intensified rice cultivation system in the region (Singh *et al*., 2016). The emergence of *R. solani* as a major rice pathogen has been attributed to the intensification of the rice-cropping system

characterized by the development of new, short-statured, high-tillering, high yielding varieties and an increase in nitrogen fertilization inducing a favourable micro-climate for the pathogen. A number of fungicides are available in the market claiming varying degree of control against the pathogen (Bag *et al.*, 2016; Growth and Bond, 2006). As the pathogen is fast growing and is reported to spread through aerial mycelial growth under high humidity and high temperature conditions, foliar application of fungicides is recommended to manage the disease. The study was conducted at Regional Research and Technology Transfer Station-Coastal Zone (RRTTS-CZ), OUAT, Bhubaneswar, Odisha to assess the efficacy of newer fungicide formulations at recommended doses against sheath blight disease in Odisha condition.

Materials and Methods

Natural incidence of sheath blight in various experimental plots was negligible (<1) during 2023. Hence, the single plant of each ten randomly selected hills, leaving the border rows hills, was inoculated with purified culture of causal fungus, *Rhizoctonia solani*, two days before first spraying to facilitate establishment of pathogen. The plot wise observations of randomly selected and inoculated hills were recorded as per standard procedure 15 days after each spray. The sheath blight disease was assessed based on percentage of leaf/sheath area affected on 10 randomly selected hills/plot. The sheath blight severity was scored using standard 0-9 scale described below, at 0 day i.e before first spray and at 15 days after 1st, 2nd and 3rd sprays.

Scale used to record brown spot disease intensity

Scale	Description
0	No infection
1	Vertical spread of the disease up to 20% of plant height
3	Vertical spread of the disease up to 21 - 30% of plant height
5	Vertical spread of the disease up to 31 -45% of plant heights
7	Vertical spread of the disease up to 46 - 65% of plant height
9	Vertical spread of the disease more than 66% of plant height

Natural incidence of brown spot disease was allowed. The plot wise observations of 15 randomly selected hills, leaving the border rows hills, were recorded, based on percent leaf area affected following the standard 0 – 5 scale described below, at 0 day *i.e.*; before first spray and at 15 days after 1st, 2nd and 3rd sprays.

Scale used to record brown spot disease intensity

Scale	Description
0	No infection
1	1 – 10 per cent hill area infected
2	10 – 15 per cent hill area infected
3	15 – 25 per cent hill area infected
4	25 – 50 per cent hill area infected
5	> 50 per cent hill area infected

The percent disease intensity (PDI) was calculated to estimate the severity of sheath blight and brown leaf spot diseases as per the following formula (Mayee and Dater, 1986).

$$PDI = \frac{\text{Sum of numerical ratings}}{\text{Total no. of samples x maximum of rating Scale}} \times 100$$

Visual observations were recorded before spray and at 1, 3, 5, 7, 10 and 15 days after spray of various treatments for phytotoxicity symptoms. The phytotoxicity parameters observed were leaf injury on tips/surface, chlorosis, necrosis, vein clearing, scorching, wilting, epinasty and hyponasty. The leaf injury on tips/surface was assessed based on 1-10 scale as per details given below:

Scale	Phytotoxicity (%)
1	0-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

Results and Discussion

The field experiment was conducted at Bahadurpur, South 24 parganas, West Bengal during 2014 with six treatments taking three fungicides with four replications following randomized block design (RBD). Results of experiment indicated that PDI for sheath blight ranged from 5.1 – 22.7, 8.6 – 28.0, 9.5 – 33.9 at 15 days after 1st, 2nd and 3rd spray, respectively. There was significant reduction of PDI by fungicide treatments at all three dates of observation after each spray as compared to control. After each spray, the PDI was found lowest in treatment, Flutriafol 23% w/w (250 g/L) SC @ 600 ml/ha and highest

Table 1 : Effect of Flutriafol 23% w/w (250 g/L) SC against sheath blight disease of paddy, 2023.

Treatments	Dose /ha	PDI before 1st spraying*	PDI at 15 days after 1st spraying	PDI at 15 days after 2nd spraying	PDI at 15 days after 3rd spraying (Terminal observations)	Per cent disease reduction over control (Terminal observations)
Flutriafol 23% w/w (250 g/L) SC	400 ml	<1	10.5	14.4	17.0	49.9
Flutriafol 23% w/w (250 g/L) SC	500 ml	<1	6.8	10.1	11.3	66.7
Flutriafol 23% w/w (250 g/L) SC	600 ml	<1	5.1	8.6	9.5	72.0
Propiconazole 25% EC	500 ml	<1	8.2	11.1	13.6	59.9
Propineb 70% WP	2000 g	<1	11.6	14.8	16.6	51.0
Control (water spray)	-	<1	22.7	28.0	33.9	0.0
SEm (±)		NS	0.6	0.5	0.7	
CD 0.05			1.8	1.6	2.0	

PDI = Percent disease index; NS= Non significant; *Observations were recorded 2 days after inoculation i.e before 1st spray.

Table 2 : Effect of Flutriafol 23% w/w (250 g/L) SC against brown spot disease of paddy, 2023.

Treatments	Dose /ha	PDI before 1st spraying*	PDI at 15 days after 1st spraying	PDI at 15 days after 2nd spraying	PDI at 15 days after 3rd spraying	Per cent disease reduction over control
Flutriafol 23% w/w (250 g/L) SC	400 ml	4.9	8.4	10.0	13.9	46.1
Flutriafol 23% w/w (250 g/L) SC	500 ml	5.8	7.2	8.4	10.6	58.9
Flutriafol 23% w/w (250 g/L) SC	600 ml	4.9	5.4	6.3	9.4	63.6
Propiconazole 25% EC	500 ml	5.0	10.6	13.0	15.6	39.5
Propineb 70% WP	2000 g	5.5	8.1	8.6	12.3	52.3
Control (water spray)	-	4.8	13.8	18.7	25.8	0.0
SEm (±)		NS	0.4	0.4	0.5	
CD 0.05		-	1.1	1.4	1.6	

PDI = Percent disease index ; NS = Non-significant ; * Natural incidence of the disease was allowed.

in control.

Lowest percent disease intensity (PDI) was recorded in the treatment, Flutriafol 23% w/w (250 g/L) SC @ 600 ml/ha (5.1 – 9.5) followed by Flutriafol 23% w/w (250 g/L) SC @ 500 ml/ha (6.8 – 11.3), Propiconazole 25% EC @ 500 ml/ha (8.2 – 13.6). Flutriafol 23% w/w (250 g/L) SC at its lowest dose *i.e* 400 ml/ha (10.5 – 17.0), Propineb 70% WP @ 2000 g/ha (11.6 – 16.6) recorded comparatively higher disease incidence, though significantly lower than control treatment (22.7 – 33.9) (Table 1).

Table 3 : Effect of Flutriafol 23% w/w (250 g/L) SC on the grain yield of paddy, 2014.

Treatments	Dose /ha	Grain yield (Tons/ ha)
Flutriafol 23% w/w (250 g/L) SC	400 ml	6.1
Flutriafol 23% w/w (250 g/L) SC	500 ml	6.4
Flutriafol 23% w/w (250 g/L) SC	600 ml	7.4
Propiconazole 25% EC	500 ml	6.2
Propineb 70% WP	2000 g	5.7
Control (water spray)	-	5.1
SEm (±)		0.2
CD @ 0.05		0.5

Percent reduction of disease over control calculated based on PDI at 15 days after third spray ranged from 49.9 to 72.0%. Significant higher reduction of disease over control was observed in treatment, Flutriafol 23% w/w (250 g/L) SC @ 600 ml/ha (72.0%) followed by Flutriafol 23% w/w (250 g/L) SC @ 500 ml/ha (66.7%), Propiconazole 25% EC @ 500 ml/ha (59.9 %), Propineb 70% WP @ 2000 g/ha (51.0 %) and lower dose of Flutriafol 23% w/w (250 g/L) SC @ 400 ml/ha (49.9%) in the decreasing order of effectiveness (Table 1).

Table 4 : Phytotoxic effect of Flutriafol 23% w/w (250 g/L) SC at different doses on paddy, 2023.

Days of observation after spray	Treatments with dosage	Phytotoxicity symptoms							
		Leaf Injury on tip/surface	Chlorosis	Necrosis	Scorching	Vein-clearing	Epinasty	Hyponasty	Wilting
7th day	Flutriafol 23% w/w (250 g/L) SC @ 400 ml/ ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Flutriafol 23% w/w (250 g/L) SC @ 500ml/ ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Flutriafol 23% w/w (250 g/L) SC @ 600 ml/ ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Flutriafol 23% w/w (250 g/L) SC @ 1200 ml/ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Propiconazole 25% EC @ 500 ml/ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Propineb 70% WP @ 2000 g/ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Control (water spray)	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
10th day	Flutriafol 23% w/w (250 g/L) SC @ 400 ml/ ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	[Flutriafol 23% w/w (250 g/L) SC @ 500ml/ ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Flutriafol 23% w/w (250 g/L) SC @ 600 ml/ ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Flutriafol 23% w/w (250 g/L) SC @ 1200 ml/ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Propiconazole 25% EC @ 500 ml/ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Propineb 70% WP @ 2000 g/ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Control (water spray)	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
15th day	Flutriafol 23% w/w (250 g/L) SC @ 400 ml/ ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Flutriafol 23% w/w (250 g/L) SC @ 500ml/ ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Flutriafol 23% w/w (250 g/L) SC @ 600 ml/ ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Flutriafol 23% w/w (250 g/L) SC @ 1200 ml/ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Propiconazole 25% EC @ 500 ml/ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Propineb 70% WP @ 2000 g/ha	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Control (water spray)	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil

*Scale (1-10): 1= 0-10%, 2= 11-20%, 3= 21-30%, 4=31-40%, 5=41-50%, 6=51-60%, 7=61-70%, 8=71-80%, 9=81-90%, 10= 91-100%.

Effect of Flutriafol 23% w/w (250 g/L) SC against brown spot disease in paddy

Before imposing the treatment *i.e* before first spray brown spot disease PDI ranged from 4.8 – 5.8 in various treatments before first spray (Table 2). The observations recorded 15 days after each spray showed that there was significant reduction in percent disease intensity in all the treatments as compared to control. In all the three sprays, lowest percent disease intensity was recorded in the treatment, Flutriafol 23% w/w (250 g/L) SC @ 600 ml/ha (5.4 – 9.4) followed by Flutriafol 23% w/w (250 g/L) SC @ 500 ml/ha (7.2 – 10.6), Propineb 70% WP @ 2000 g/ha (8.1 – 12.3), Flutriafol 23% w/w (250 g/L) SC @ 400 ml/ha (8.4 – 13.9) and Propiconazole 25% EC @ 500 ml/ha (10.6 – 15.6) as compared to control treatment (13.8 – 25.8) (Table 2).

Percent reduction of disease over control calculated based on PDI at 15 days after third spray ranged from 39.5 to 63.6%. Higher reduction of disease intensity was observed in treatment Flutriafol 23% w/w (250 g/L) SC @ 600 ml/ha (63.6%) followed by Flutriafol 23% w/w (250 g/L) SC @ 500 ml/ha (58.9 %). Propineb 70% WP @ 2000 g/ha (52.3%), Flutriafol 23% w/w (250 g/L) SC @ 400 ml/ha (46.1%), Propiconazole 25% EC @ 500 ml/ha (39.5%) were next in order of effectiveness (Table 2).

Effect of Flutriafol 23% w/w (250 g/L) SC on grain yield

The grain yield of paddy increased significantly in all the fungicidal treatment as compared to control. Significantly highest grain yield was recorded in the treatment, Flutriafol 23% w/w (250 g/L) SC @ 600 ml/ha (7.4 t/ha). This was followed by Flutriafol 23% w/w (250 g/L) SC @ 500 ml/ha (6.4 t/ha), Propiconazole 25% EC @ 500 ml/ha (6.2 t/ha), lower dose of Flutriafol 23% w/w (250 g/L) SC@ 400 ml/ha (6.1 t/ha) and Propineb 70% WP @ 2000 g/ha (5.7 t/ha) whereas the grain yield was 5.1 t/ha in the control (Table 3).

Phytotoxicity of Flutriafol 23% w/w (250 g/L) SC on paddy

Flutriafol 23% w/w (250 g/L) SC was evaluated for phytotoxicity at doses of 400, 500, 600 and 1200 ml/ha along with sole concentration of Propiconazole 25% EC (500 ml/ha), Propineb 70% WP (2000 g/ha) and control. Observations were recorded before spray and at 1, 3, 5, 7, 10 and 15 days after spray. The symptoms of phytotoxicity observed were leaf injury on tips/surface, chlorosis, necrosis, vein clearing, scorching, wilting, epinasty and hyponasty. Results of phytotoxicity experiment revealed that tested products, Flutriafol 23% w/w (250 g/L) SC at concentrations of 400, 500, 600 and 1200 ml/ha, Propiconazole 25% EC (500 ml/ha) and Propineb 70% WP (2000 g/ha) were non phytotoxic as no symptoms of phytotoxicity was noticed on the aerial parts of the paddy including leaves (Table 4).

Conclusion

The efficacy of Flutriafol 23% w/w (250 g/L) SC was evaluated against sheath blight and brown spot diseases incidence on paddy. The results revealed that Flutriafol 23% w/w (250 g/L) SC @ 600 ml/ha was significantly superior in controlling the sheath blight and brown spot disease intensity in paddy and in increasing the grain yield, which was at par with Flutriafol 23% w/w (250 g/L) SC @ 500 ml/ha. Flutriafol 23% w/w (250 g/L) SC @ 400 ml/ha, Propiconazole 25% EC @ 500 ml/ha and Propineb 70% WP @ 2000 g/ha were comparatively less effective treatments. There was no phytotoxicity to crop due to the application of various treatments. Hence, it is concluded that Flutriafol 23% w/w (250 g/L) SC @ 500-600 ml/ha (*i.e.* 125-150 g *a.i*/ha) can be safely used in the management of sheath blight and brown spot diseases of paddy.

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