Efficacy of Novel Fungicides for the Management of Sheath Blight of Rice Caused by *Rhizoctonia solani* (Kuhn)

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Abstract— *In the present studies eight fungicides were evaluated against the sheath blight disease of rice during Kharif-2021-23. Among the different fungicides evaluated, two sprays of azoxystrobin 18.2 + difenoconazole 11.4 (29.6 SC) at 0.03 per cent (10 ml/10 l. water) or trifloxystrobin 25 + tebuconazole 50 (75 WG), 0.03 per cent (04g/10 l.water) for effective management of sheath blight. First spray should be applied at appearance of disease and second spray at booting stage. PHI 31 days for azoxystrobin 18.2 + difenoconazole 11.4 (29.6 SC) or 21 days for trifloxystrobin 25 + tebuconazole 50 (75 WG). The other effective fungicides were viz., fluxapyroxad 62.5g/l FS + epoxiconazole 62.5 g/L EC, tebuconazole 25.9 EC, Flusilazole 12.5 + carbendazim 25 (37.5 SE), Kresoxim methyl 44.3 SC, Zineb 68 + hexaconazole 4 (72 WP) and Propiconazole 25 EC.*

Keywords— Rice, Sheath blight, Fungicides, Rhizoctonia solani.

I. INTRODUCTION

Rice (*Oryza sativa* L.) is one of the popular cereal crop as well as staple food for more than two-thirds of the Indian population and playing a vital role in the people's food, feed and livelihood security. Sheath blight disease is potentially an emerging fungal disease is and major biotic constraint of rice in almost all rice growing areas of India. Sheath blight of paddy caused by *Rhizoctonia solani* Kuhn [Thanatephorus cucumeris (Frank) Donk]. The potential losses occur due to sheath blight singly in India up to 51.3 per cent (Rajan, 1987). Sheath blight is currently ranked second position, it is a widely distributed soil-borne plant parasitic-saprophytic fungus (Mirmajlessi *et al*., 2012). Sheath blight, also known as "oriental sheath and leaf blight" of rice was first reported in Japan by Miyake (1910) Subsequently, its occurrence was recorded throughout the temperate and tropical rice growing areas including Africa, Bangladesh, Brazil, Burma, Colombia, China, Cuba, Germany, Fiji, Formosa, India, Indonesia, Iran, Korea, Liberia, Madagascar, Malaya, Malaysia, Netherland, Nigeria, Papua New Guinea, Philippines, Russia, Senegal, Sri Lanka, Surinam, Taiwan, Thailand, Trinidad, Tobago, UK, USA, Venezuela and Vietnam (Singh *et al*., 2016).

II. MATERIALS AND METHODS

A field experiment was conducted at Main Rice Research Centre, NAU,Navsari, Gujarat during kharif, 2021-23 to find out most effective fungicides for the management of sheath blight disease. Experiment was carried out in Randomised Block Design (RBD) with nine treatments with three replications. Cultivar used during experiment was GR-11 and the gross plot size was 5.4 m x 3.6 m. square and the recommended agronomical packages of practices were followed for conducting the experiment. Two sprays of fungicides were given for each treatment. First spray was given at the appearance of disease and second spray at booting stage. For recording the intensity of sheath blight, 30 hills/plot were randomly selected and labelled, these labelled plants were observed for disease intensity using methods described in Standard Evaluation System (SES) for

Rice (IRRI 2013). The grain and straw yield were recorded from net plot area recorded at the time of harvest of crop. Residue analysis was also carried out and then data was statistically analyzed.

Formula for calculating per cent disease intensity is

$$\mathrm{PDI} = \frac{\text{Sum of score}}{\text{No.of observation} \times \text{Highest number of rating scale}} \times 100 \quad (1)$$

III. RESULTS AND DISCUSSIONS

The results of the experiments indicated that the different treatments had significantly reduced the per cent sheath blight disease intensity over control during all the years as well as in pooled results. The results on per cent disease intensity are given in (Table.1) The treatment azoxystrobin 18.2 + difenoconazole 11.4 @ 1.0 ml/l was found significantly superior and recorded minimum disease severity (16.87 %) which was at par with trifloxystrobin 25 + tebuconazole 50 WG @ 0.4 g/l with disease severity (19.03 %). The next best treatment in order of merit was fluxapyroxad 62.5g/l FS + epoxiconazole 62.5 g/L EC @ 1.25 ml/l during 1st year. The treatment azoxystrobin 18.2 + difenoconazole 11.4 @ 1.0 ml/l was found significantly superior and recorded minimum disease severity (18.32%) which was statistically at par with trifloxystrobin 25 + tebuconazole 50 WG @ 0.4 g/l with disease severity (20.72 %). The next best treatment in order of merit was tebuconazole 25.9 EC @ 1.0 ml/l during 2nd year. While, in 3rd year the treatment azoxystrobin 18.2 + difenoconazole 11.4 @ 1.0 ml/l was observed significantly superior and recorded minimum disease intensity (15.70 %) which was statistically at par with trifloxystrobin 25 + tebuconazole 50 WG @ 0.4 g/l with disease severity (18.23 %). The next best treatment in order of merit was treatment tebuconazole 25.9 EC @ 1.0 ml/l. In case of pooled results, the treatment azoxystrobin 18.2 + difenoconazole 11.4 @ 1.0 ml/l was found significantly superior and recorded minimum disease intensity (24.30%) which was at par with trifloxystrobin 25 + tebuconazole 50 WG @ 0.4 g/l (26.02%). The next best treatment in order of merit was tebuconazole 25.9 EC @ 1.0 ml/l (29.13%). The year effect in polled analysis was found non significant.

The results on grain and straw yield of rice affected by different treatments are given in (Table 2) result indicated that the effects of different treatments were found to be significant during all the individual years as well in pooled result. All the treatments were found superior over control. The significantly highest grain yield (6291 kg/ha) and straw yield (7659 kg/ha) was recorded in treatment (T_3) azoxystrobin 18.2 + difenoconazole 11.4 @ 1.0 ml/l which was statistically at par with the treatment (T_7) trifloxystrobin 25 + tebuconazole 50 WG @ 0.4 g/l grain yield (5882 kg/ha) and straw yield (7292 kg/ha) and fluxapyroxad 62.5g/l FS + epoxiconazole 62.5 g/L EC @ 1.25 ml/l. with grain yield (5515 kg/ha) in the 1st year. During 2nd year significantly higher grain yield (6025kg/ha) and straw yield (7302kg/ha) was recorded in treatment (T_3) azoxystrobin 18.2 + difenoconazole 11.4 @ 1.0 ml/l which was at par with the treatment (T_7) trifloxystrobin 25 + tebuconazole 50 WG @ 0.4 g/l grain yield (5739 kg/ha), straw yield (6883kg/ha) and treatment (T_2) tebuconazole 25.9 EC @ 1.0 ml/l. with grain yield (5331 kg/ha) straw yield (6413kg/ha). While, in 3rd year also the treatment T_3 was recorded significantly higher grain (6250 kg/ha) and straw yield (7455 kg/ha) which remained statistically at par with treatment T_7 for yield of grain 5903 and straw 7149 kg/ha. In case of pooled results, the treatments T_3 *i.e.* azoxystrobin 18.2 + difenoconazole 11.4 @ 1.0 ml/l was recorded significantly higher grain yield (6189 kg/ha) and straw yield (7472 kg/ha) which was at statistically par with T_7 *i.e.* trifloxystrobin 25 + tebuconazole 50 WG @ 0.4 g/l for grain (5842 kg/ha) and straw yield (7108 kg/ha). More or less similar results were reported by earlier workers for efficacy of different fungicides under field condition that is tebuconazole + trifloxystrobin, (Raji *et al.* 2016), azoxystrobin+ difenoconazole (Bhuvaneswari and Raju, 2012), tebuconazole + trifloxystrobin and hexaconazole (Bag, 2009), propiconazole and fluxapyroxad (Uppala and Zhou 2018), Lore *et al.* (2007) found that propiconazole was most effective fungicides followed by carbendazim. Efficacy of propiconazole + difenconazole followed by hexaconazole was found effective by other workers in reducing the disease (Surulirajan and Khandari, 2003; Suryadai and Kadir, 1989).

TABLE 1
EFFECT OF DIFFERENT TREATMENTS ON PER CENT DISEASE INTENSITY OF SHEATH BLIGHT OF RICE

Sr. No.	Treatments	Per cent Disease Intensity			
		2021	2022	2023	Pooled
T_1	Fluxapyroxad 62.5g/l FS + Epoxiconazole 62.5 g/L EC	22.10 (27.96) cba	25.10 (30.04) cba	27.03 (31.31) cb	24.74 (29.77)c
T_2	Tebuconazole 25.9 EC	22.57 (28.36)cb	24.85 (29.85) cba	23.77 (29.17) ba	23.73 (29.13)cb
T_3	Azoxystrobin 18.2 + difenoconazole 11.4 (29.6 SC)	16.87 (24.23)a	18.32 (25.32)a	15.70 (23.34)a	16.96 (24.30)a
T_4	Flusilazole 12.5 + carbendazim 25 (37.5 SE)	24.10 (29.38)c	25.57 (30.36)cba	27.90 (31.87) cb	25.86 (30.54)c
T_5	Kresoxim methyl 44.3 SC	26.37 (30.89)c	27.63 (31.67)cb	30.23 (33.33) c	28.08 (31.96)c
T_6	Zineb 68 + hexaconazole 4 (72 WP)	27.23 (31.43)c	28.65 (32.34)c	31.80 (34.32) c	29.23 (32.70)c
T_7	Trifloxystrobin 25 + tebuconazole 50 (75 WG)	19.03 (25.84)ba	20.72 (27.01)ba	18.23 (25.22)ba	19.33 (26.02)ba
T_8	Propiconazole 25 EC	26.07 (30.70)c	27.48 (31.59)cb	24.97 (29.96) cba	26.17 (30.75)c
T_9	Control	40.10 (39.27)d	42.23 (40.51)d	45.80 (42.59)d	42.71 (40.79)d
	S.Em ±	1.01	1.37	1.09	0.69
	C.D. at 5%	3.01	4.09	3.27	1.95
	C.V. %	5.84	7.64	6.04	6.70
	Y x T	-			N.S

Treatment means with the letter(s) in common by DNMRT at 5% level of significance

TABLE 2
THE EFFECT OF FUNGICIDAL TREATMENTS ON YIELD PARAMETERS.

Sr. No.	Treatments	Grain Yield (kg/ha)				Straw Yield (kg/ha)			
		2021	2022	2023	Pooled	2021	2022	2023	Pooled
T_1	Fluxapyroxad 62.5g/l FS + Epoxiconazole 62.5 g/L EC	5515	5157	5249	5307	6556	6219	6516	6430
T_2	Tebuconazole 25.9 EC	5372	5331	5494	5399	6475	6413	6618	6502
T_3	Azoxystrobin 18.2 + difenoconazole 11.4 (29.6 SC)	6291	6025	6250	6189	7659	7302	7455	7472
T_4	Flusilazole 12.5 + carbendazim 25 (37.5 SE)	5198	4963	4841	5001	6434	6036	5984	6151
T_5	Kresoxim methyl 44.3 SC	4984	4698	4677	4786	6199	5964	6189	6117
T_6	Zineb 68 + hexaconazole 4 (72 WP)	4973	4657	4616	4749	6127	5739	5923	5930
T_7	Trifloxystrobin 25 + tebuconazole 50 (75 WG)	5882	5739	5903	5842	7292	6883	7149	7108
T_8	Propiconazole 25 EC	5065	4882	5433	5127	6332	5944	6536	6270
T_9	Control	4044	3891	4013	3983	5494	4882	5045	5140
	S.Em ±	285	233	246	148	350	318	274	182
	C.D. at 5%	856	698	738	421	1050	954	822	519
	C.V. %	9.42	8.01	8.30	8.6	9.32	8.96	7.79	8.62
	Y x T				N.S				N.S

IV. CONCLUSION

Field experiment with eight fungicides with two sprays carried out in Randomised Block Design (RBD) with three replications conducted to find out most effective fungicides for the management of sheath blight disease. Among the tested fungicides, azoxystrobin 18.2 + difenoconazole 11.4 (29.6 SC) at 0.03 per cent (10 ml/10 L. water) or trifloxystrobin 25 + tebuconazole 50 (75 WG), 0.03 per cent (04g/10 L. water) were found effective for management of sheath blight. The first spray should be given at appearance of disease and second spray at booting stage. PHI 31 days for azoxystrobin 18.2 + difenoconazole 11.4 (29.6 SC) or 21 days for trifloxystrobin 25 + tebuconazole 50 (75 WG).

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