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Efficacy of Fungicides Against Grain Discoloration Disease of Rice

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Abstract

Rice (*Oryza sativa* L.) is one of the important cereal crop grown extensively in Gujarat. It suffers from grain discoloration fungal disease causing heavy losses at maturity stage of rice. A field experiment was laid out with the single and new combinations fungicides against rice grain discoloration disease under field conditions during *kharif*-2013-14, 2014-15 and 2015-16. Six fungicides at various concentrations were screened against rice grain discoloration disease. The trifloxystrobin 25% + tebuconazole 50% (0.03 %) @ 0.4 g l^{-1} and propiconazole 25 EC (0.025 %) @ 1.0 ml l^{-1} was found effective against rice grain discoloration and recorded significantly higher healthy grains.

Keywords: Fungicides, grain discoloration, *Oryza sativa*

1. Introduction

Rice (*Oryza sativa* L.) is the staple food crop for people of south, south-east and eastern Asia where 90% of the world's rice is produced and consumed. It is grown in 114 countries across the world on an area of about 160 million hectares with annual production of 494.3 million tones and total supply of 711.5 million tonnes (Anonymous, 2016). The occurrence of grain discoloration has increased in South Gujarat in mid late and late varieties. It is major problem in rice cultivation as it reduces quality and quantity of rice production. It causes loss to producer and agro processors. The infected grain remain unfilled or discolored, become chaffy which are light in weight and during milling become powder or break resulting in poor recovery. Considering the importance of disease, a field experiment with different newer as well as combination of fungicides available in the market was laid out to test their efficacy against grain discoloration disease of rice.

2. Materials and Methods

A field experiment was laid out in randomized block design with six fungicides keeping three replications. Fungicides and their concentrations used for spraying to control the grain discoloration of rice are mentioned in Table 1.

Efficacy of each fungicide was compared with control plot, which was sprayed with water only. The gross plot size was 5.4×3.6 m^2 and net plot size was 5.1×3.2 m^2. with 15×20 cm^2. A popular rice variety Jaya was used for the study. Seeds were sown in the month of June and planted in July. Before sowing, healthy seeds were water soaked overnight and incubated in the gunny bags for better sprouting in the nursery. The land was prepared by puddling method. All standard agronomic practices were followed except using higher nitrogenous (150 kg ha^{-1}) fertilizer dose than the normal dose (N2:P_2O5:K_2O: 100:30:00). The first spray of fungicides on *cv*. Jaya was carried out at boot leaf stage and the remaining two sprays were carried out after 10 days interval. Ten hills from each treatment were randomly selected and labeled. These labeled plants were observed for disease incidence, discolored, unfilled, healthy grains and the yield of grain and straw per plot was also recorded.

Table 1: Fungicides and their dosage

Sr. No	Treatments details	Conc. (%)	Dosage (l^{-1})
T_1	Trifloxystrobin 25% + Tebuconazole 50% (75 WG)	0.03	0.4 g
T_2	Kresoxim methyl 44.3 SC	0.05	1.0 ml
T_3	Azoxystrobin 25 SC	0.025	1.0 ml
T_4	Tricyclazole 75 WP	0.05	0.6 g
T_5	Carbendazim 50 WP	0.025	1.0 g
T_6	Propiconazole 25 EC	0.025	1.0 ml
T_7	Check / Control	-	-

3. Results and Discussion

Effectiveness of fungicides was compared with control, where no fungicide was sprayed. The percentage of healthy grains, discolored grains and unfilled grains were work out and presented in Table 2 and 3.

3.1. Healthy grains

The results on effect of fungicides on healthy grains are given in Table 2. The treatment trifloxystrobin 25% + tebuconazole 50% found significantly superior which was at par with propiconazole 25 EC and carbendazim 50 WP during 1st year and treatment propiconazole 25 EC during 2nd year. While in 3rd year, the treatment propiconazole 25 EC recorded significantly produced higher healthy grains which was at par with treatment trifloxystrobin 25% + tebuconazole 50%. In case of pooled results, the treatments trifloxystrobin 25% + tebuconazole 50% (75 WG) produced significantly higher healthy grain which was at par with propiconazole (25 EC). The year effect was found non significant.

3.2. Discolored grains

The spraying of fungicides significantly reduced the discolored grains than in control. The results on discolored grain are given in Table 2. The treatment T_1 found significantly superior which was at par with T_6, T_5 and T_4 during the 1st year and treatment T_6 during 2nd year. While in 3rd year, the treatment T_6 recorded significantly reduced the discolored grain which was at par with treatment T_1. In case of pooled results, the treatment trifloxystrobin 25% + tebuconazole 50% (75 WG) (T_1) significantly reduced the discolored grain which was at par with propiconazole (25 EC) (T_6) and carbendazim 50 WP (T_5). The year effect was found non significant.

3.3. Unfilled grains

The results on unfilled grain are given in Table 3. The spraying of fungicides significantly reduced the unfilled grain than in control. Among these fungicidal spray treatments, trifloxystrobin 25% + tebuconazole 50% (75 WG) (T_1) and propiconazole 25 EC (T_6) were at par. Both fungicides were found superior and significantly reduced the unfilled grains than the rest of fungicides. The year effect was found non significant. The present finding is more or less in line with earlier workers *viz*., Singh and Chand (1985) who reported that zineb, ridomil and carbendazim effectively manage the grain discoloration of rice. Sumangala et al. (2008) revealed that mancozeb at 0.3% (97.37% inhibition) was significantly superior among the non-systemic fungicides evaluated at three concentrations (0.1, 0.2 and 0.3%). Among the systemic fungicides, metalaxyl showed 98.48% inhibition of mycelial growth at 0.3% concentration followed by carbendazim (95.25% inhibition at 0.3%). Hafiz et al. (2009) found that carbendazim was best followed by Topsin M, Dithane M-45 and Ridomil, respectively. Diseased grains treated with both of these fungicides showed maximum germination and least seedling mortality.

Table 2: Effect of fungicidal sprays on healthy and discolored grain

Sr. No	Treatments	Healthy grain (%)				Discolored grain (%)			
		2013	2014	2015	Pooled	2013	2014	2015	Pooled
T_1	Trifloxystrobin 25 + Tebuconazole 50 (75 WG)	57.79 (71.50)	61.30 (76.75)	57.72 (71.25)	58.94 (73.17)	21.16 (13.25)	20.36 (12.25)	22.86 (15.25)	21.46 (13.58)
T_2	Kresoxim methyl 44.3 SC	53.14 (64.00)	53.28 (64.25)	53.18 (64.00)	53.20 (64.08)	24.72 (17.50)	26.68 (20.25)	26.82 (20.50)	26.07 (19.42)
T_3	Azoxystrobin 25 SC	51.80 (61.75)	50.63 (59.75)	47.44 (54.25)	49.96 (58.58)	25.09 (18.00)	29.50 (24.25)	30.81 (26.25)	28.47 (22.83)
T_4	Tricyclazole 75 WP	54.81 (66.75)	53.45 (64.50)	48.18 (55.50)	52.15 (62.25)	22.96 (15.25)	25.82 (19.00)	28.74 (23.25)	25.84 (19.17)
T_5	Carbendazim 50 WP	56.38 (69.25)	54.68 (66.50)	51.52 (61.25)	54.19 (65.67)	22.08 (14.25)	25.27 (18.25)	27.27 (21.00)	24.87 (17.83)
T_6	Propiconazole 25 EC	57.07 (70.25)	59.51 (74.00)	58.29 (72.25)	58.29 (72.17)	21.59 (13.75)	22.03 (14.25)	22.44 (14.75)	22.02 (14.25)
T_7	Check / Con-trol	43.71 (47.75)	45.58 (51.00)	39.46 (40.50)	42.92 (46.42)	29.16 (23.75)	32.26 (28.50)	36.56 (35.50)	32.66 (29.25)
	SEm±	1.37	1.41	1.89	1.57	1.07	1.04	1.29	1.14
	CD (*p*=0.05)	4.07	4.17	5.59	4.46	3.18	3.07	3.82	3.23
	C.V. %	6.14	6.21	7.42	6.96	9.02	7.97	9.24	8.79
	Y×T				N.S				N.S

Figures in the parenthesis are original value whereas outside the parenthesis is Arc sine transform value

Table 3: Effect of fungicidal sprays on unfilled grain

Sr. No	Treatments	Unfilled grain (%)			
		2013	2014	2015	Pooled
T_1	Trifloxystrobin 25 + Tebucon-azole 50 (75 WG)	22.77 (15.25)	19.22 (11.00)	21.30 (13.50)	21.10 (13.25)
T_2	Kresoxim methyl 44.3 SC	25.42 (18.50)	23.09 (15.50)	22.99 (15.50)	23.83 (16.50)
T_3	Azoxystrobin 25 SC	26.71 (20.25)	23.53 (16.00)	26.19 (19.50)	25.47 (18.58)
T_4	Tricyclazole 75 WP	25.07 (18.00)	23.94 (16.50)	27.36 (21.25)	25.46 (18.58)
T_5	Carbendazim 50 WP	23.82 (16.50)	22.86 (15.25)	24.84 (17.75)	23.84 (16.50)
T_6	Propiconazole 25 EC	23.47 (16.00)	19.73 (11.75)	21.01 (13.00)	21.41 (13.58)
T_7	Check / Con-trol	32.26 (28.50)	28.33 (23.00)	29.10 (24.00)	29.90 (25.17)
	SEm±	1.36	1.75	1.79	1.64
	CD (*p*=0.05)	4.03	5.18	5.29	4.66
	C.V. %	10.60	15.24	14.48	13.45
	Y×T		N.S		

Figures in the parenthesis are original value whereas outside the parenthesis is Arc sine transform value

3.4. Grain and straw yield

The results on grain and straw yield of paddy affected by different treatments are given in Table 4. The results indicated that effect of different treatments was significant during all the individual years as well in pooled results. All the treatments were found significantly superior over control for grain and straw yield of paddy. During 1st and 2nd year, the treatment T_1 recorded significantly higher grain and straw yield which was at par with T_6. While in 3rd year, the treatment T_6 recorded significantly higher grain and straw yield which was at par with treatment T_1. In case of pooled results, the treatments T_6 (propiconazole 25 EC) @ 1.0 ml l^{-1}) recorded significantly higher grain yield (5353 kg ha^{-1}) and straw yield (7011 kg ha^{-1}) which was at par with T_1 (trifloxystrobin 25% + tebuconazole 50%) @ 0.4 g l^{-1}) *i.e*. 5341 kg ha^{-1} grain and 7001 kg ha^{-1} straw yield.

Table 4: Effect of fungicidal treatments on yield parameters

Sr. No	Treatments	Grain Yield (kg ha^{-1})				Straw Yield (kg ha^{-1})			
		2013	2014	2015	Pooled	2013	2014	2015	Pooled
T_1	Trifloxystrobin 25 + Tebucon-azole 50 (75 WG)	4893	5723	5407	5341	6633	7322	7047	7001
T_2	Kresoxim methyl 44.3 SC	4370	4392	4979	4580	6296	5830	6419	6182
T_3	Azoxystrobin 25 SC	4320	3928	3960	4069	6204	6196	5913	6104
T_4	Tricyclazole 75 WP	4384	4852	4749	4662	6320	6748	6143	6404
T_5	Carbendazim 50 WP	4401	4888	4902	4730	6365	6872	6281	6506
T_6	Propiconazole 25 EC	4873	5418	5767	5353	6510	7215	7307	7011
T_7	Check / Con-trol	3428	3442	3462	3444	4994	5492	5744	5410
	SEm±	149	225	203	195	183	202	290	230
	CD (*p*=0.05)	444	670	605	554	543	601	862	652
	C.V. %	6.84	9.69	8.59	8.52	5.91	6.20	9.06	7.24
	Y×T	-	-	-	NS	-	-	-	NS

4. Conclusion

Among the six fungicides screened against rice grain discoloration disease, trifloxystrobin 25% + tebuconazole 50% @ 0.4 g l^{-1} and propiconazole 25 EC @ 1.0 ml l^{-1} was found most effective against rice grain discoloration.

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