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EVALUATION OF READY-MIX FUNGICIDES AGAINST GRAIN DISCOLOURATION OF RICE

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Abstract:
Rice (*Oryza sativa* L.) is the most widely produced food crop in the world, providing sustenance for almost half of the world's population. The crop subjected to various biotic and abiotic stresses as a result of varying climatic and ecological conditions. Several microorganisms are considered to be the main cause of grain discolouration, which has been recorded in all rice-growing countries across the world. Seven ready-mix fungicides *viz.*, tebuconazole 50% + trifloxystrobin 25% WG, tricyclozole 20.4% w/w + azoxystrobin 6.8% w/w SC, tricyclozole 18.0% w/w + tebuconazole 14.4% w/w SC, propiconazole 13.9% + difenoconazole 13.9% EC, fluopyram 17.7% w/w +tebuconazole 17.7% w/w SC, picoxystrobin 7.05% + propiconazole 11.7% SC, hexaconazole 4% + zineb 68% WP were tested against the pathogens causing grain discolouration of rice. Least per cent of panicle discolouration (9.80%) and spikelet discolouration (8.83%), while maximum grain and straw yield (7704 and 9251 kg/ha, respectively) were recorded under the treatment tebuconazole 50% + trifloxystrobin 25% WG followed by tricyclozole 20.4% w/w + azoxystrobin 6.8% w/w SC, where per cent of panicle and spikelet discolouration was 11.11 and 9.90, respectively and grain and straw yield was 6796 and 8273 kg/ha, respectively.

Keywords- Grain discolouration, ready mix fungicides, rice.

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Introduction:

Globally, rice is the most important crop in terms of its contribution to human diets and value of production. Rice provides 35 to 80% of the calories consumed by 3.3 billion peoples in Asia, and 8% of the food energy for one billion people in Africa, Latin America and the Caribbean. The crop occupies an area of 45.07 million hectares with the production of 122.27 million tonnes and productivity of 2713 kg per ha in India (Anonymous, 2021). The productivity of the crop get affected by the many diseases and disorders associated with the crop. Grain discolouration of rice is becoming a serious problem in India and several fungi are found associated with this disease. The discolouration of rice grain may be due to the infection of various organisms before or after harvest, the damage done by it varies according to the season and locality (Ou, 1985). Several microorganisms are considered as major reason behind grain discoloration and it is one of the most degrading factor

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reported from all rice growing countries of the world (Sumangala *et al*., 2010). Tullis (1936) isolated many fungi genera associated with grain discolouration in USA. Grain discolouration is caused by many fungi such as *Alternaria, Bipolaris, Botrytis, Cephalosporium, Chaetomium, Cladosporium, Ephelis, Pyricularia, Fusarium, Phoma, Curvularia* and bacteria as *Pseudomonas, Xanthomonas etc*. *Alternaria spp*. and *Curvularia lunata* is the most common to cause discolouration. Mustafa and Mohsan (2017) reported six fungal species *Alternaria alternata, Dreschelera oryzae, Curvularia oryzae, Fusarium moniliforme, Cercospora oryzae* and *Helminthosporium oryzae* are found to be associated with discoloured panicles of different varieties of rice in the field. The prevalence of the disease varies with respect to season and localities where the crop is being cultivated. Grain discoloration is now spreading almost in all the states of India like Andhra Pradesh, Tamil Nadu, Kerala, Orissa, Jharkhand, Bihar, West Bengal, Assam, Eastern Uttar Pradesh, Gujarat, Haryana, Punjab, Uttarakhand and Chhattisgarh.

This is a complex disease where many fungal pathogens are associated on the glumes or kernel may be internally or externally or both the part of grain (Ou, 1985; Kheroda and Chhetry, 2008 and Arshad *et al*., 2009). Its common symptoms can be observed as darkening glumes or spikelets, brown to black colour in rotten glumes by one or more pathogens affected, intensity ranges from sporadic discolouration to whole grain. Maximum colonization of seed borne fungi was seen in the seed coat and endosperm as reported by Halgekar and Giri (2015). Ghose *et al.* (1960) reported approximately 20-25% loss due to the grain discolouration of rice. Baite *et al.* (2020) reported that the incidence of grain discolouration varies from variety to variety in the range 25-92%. The disease does not only degrade the seed quality but also the rice grain quality (Phat *et al*., 2005). The yield loss ranged from 0.1 and 60.2% due to grain discoloration (Baite *et al*., 2020).

Several strategies are adopted by the farmers to check the disease. Among these the use of fungicide is still the most popular measure among farmer's community. Persaud *et al.* (2020) successfully managed the disease under field condition by using mancozeb + azoxystrobin 75WG (3.0 g L^{-1}), propineb 70WP (5.0 g L^{-1}) and carbendazim 50SC (1.5 mL L^{-1}). It also increased the number of filled grain, test weight of 1000 grain and also overall grain yield. Pal *et al*., (2021) reported tebuconazole + trifloxystrobin 75 WG @ 0.4 g L−1 to be the best chemical fungicide to lower the disease incidence.

MATERIALS AND METHOD

The experiment was undertaken in Main Rice Research Station, Nawagam AAU, Anand (Latitude: 22-48, Longitude: 71-43 E, Altitude: 32.4 M) in the year 2021-22. The crop was raised by adopting all recommended practices. Seven fungicides *viz.*, tebuconazole 50% + trifloxystrobin 25% WG, tricyclozole 20.4% w/w +azoxystrobin 6.8% w/w SC, tricyclozole 18.0% w/w + tebuconazole 14.4% w/w SC, propiconazole 13.9% + difenoconazole 13.9% EC, fluopyram 17.7% w/w +tebuconazole 17.7% w/w SC, picoxystrobin 7.05% + propiconazole 11.7% SC, hexaconazole 4% + zineb 68% WP were tested against the fungi causing grain discolouration of rice.

Experimental details: Gurjari variety was taken for this field experiment. The nursery was grown on raised beds. All the recommended agronomical practices were adopted for raising the nursery. The experiment was established under transplanting conditions with the spacing of 15 × 20 cm. An untreated control was included in the trial for comparison. Total three sprays were applied, first at boot stage, second at 5-10% panicle emergence stage and third at 45-50% panicle emergence stage. Untreated plots were kept as check.

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Treatment details: The fungicides were tested on their recommended concentration as per CIBRC guideline. The doses were calculated as per 10 litre of water.

Table 1. Treatment details

Treatment no.	Treatment name	Concentration (%)	Dose
			Per 10 lit. of water (g/ml)
1	Tebuconazole 50% + Trifloxystrobin 25% WG	0.03	4. 00
2	Tricyclozole 20.4% w/w +Azoxystrobin 6.8% w/w SC	0.06	22. 00
3	Tricyclozole 18.0% w/w + Tebuconazole 14.4% w/w SC	0.07	22. 00
4	Propiconazole 13.9% + Difenoconazole 13.9% EC	0.03	10. 00
5	Fluopyram 17.7% w/w +Tebuconazole 17.7% w/w SC	0.04	12. 00
6	Picoxystrobin 7.05% + Propiconazole 11.7% SC	0.04	21. 00
7	Hexaconazole 4% + Zineb 68% WP	0.18	25. 00
8	Control (untreated)	-	-

Observation recorded: By fixing the sampling unit of 1 sq. m. at random in each plot per cent panicles and spikelets with glume discolouration were recorded. The grain and straw yield was recorded separately from net plot area of each treatment in kg/plot after harvesting and converted into kg/ha.

RESULTS AND DISCUSSION

The data were presented in Table 2 showed that the panicle infection ranged from 9.80 to 30.45%. The minimum infected panicles were recorded in tebuconazole 50% + trifloxystrobin 25% WG (9.80%) and tricyclozole 20.4% w/w + azoxystrobin 6.8% w/w SC (11.11%). They were having similar effect on per cent panicle discolouration. The spikelet infection ranged from 8.83% to 29.66%. Tebuconazole 50% + trifloxystrobin 25% WG, tricyclozole 20.4% w/w + azoxystrobin 6.8% and picoxystrobin 7.05% + propiconazole 11.7% SC were showing least per cent spikelet discolouration 8.83%, 9.90% and 11.77%, respectively. Grain yield and straw yield was also highest in tebuconazole 50% + trifloxystrobin 25% WG (7704 and 9251 kg/ha, respectively). In tebuconazole 50% + trifloxystrobin 25% WG per cent discolored panicle and per cent discolored spikelet were minimum, hence grain and straw yield was maximum.

Results revealed that combination of tebuconazole 50% + trifloxystrobin 25% WG shows effective result in reducing the panicle and spikelet infection. Trifloxystrobin interferes with the respiration process of the pathogen. It is a potential inhibitor of fungal germination and mycelial growth. Tebuconazole affects the formation of cell wall in fungus, hence inhibit spore germination and fungus

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growth. Goswami and Thind (2018) studied efficacy of different fungicides like trifloxystrobin + tebuconazole 75% WG (Nativo 75% WG), trifloxystrobin 50 WG, tebuconazole 250 EW, tricyclazole 75WP, Tilt (propiconazole 25 EC) against grain discolouration and reported moderate efficacy of Nativo 75% WG in grain discoloration management. He also observed in tebuconazole treated plants was doing well against the disease than propiconazole. Kumar *et al.* (2020) observed that single spray of Nativo75 WG (tebuconazole 50%+ trifloxystrobin 25%) @ 250 gram/ha in 500 litres of water at booting stage of the cultivar MTU 7029 may be highly effective method to grain discoloration at farmers field and to get maximum net profit. Pal *et al.* (2021) revealed lowest incidence of disease by application of tebuconazole + trifloxystrobin 75 WG @ 0.4 g /lt. in two year field trial.

Table 2: Effect of different ready-mix fungicides against per cent discoloured panicles and discolored spikelets, grain and straw yield of rice

SL NO.	TREATMENT	DISCOLOURED PANICLES (%)	DISCOLOURED SPIKELETS (%)	GRAIN YIELD(kg/ha)	STRAW YIELD(kg/ha)
1	Tebuconazole 50% + Trifloxystrobin 25% WG	9.8 (18.26)^{a}	8.83 (17.29)^{a}	7704^{a}	9251^{a}
2	Tricyclozole 20.4% w/w +Azoxystrobin 6.8% w/w SC	11.11 (19.47)^{a}	9.90 (18.34)^{a}	6796^{ab}	8273^{ab}
3	Tricyclozole 18.0% w/w + Tebuconazole 14.4% w/w SC	16.19 (23.73)^{bc}	18.97 (25.82)^{b}	5985^{bc}	7923^{bc}
4	Propiconazole 13.9% + Difenoconazole 13.9% EC	20.22 (26.72)^{cd}	22.11 (28.05)^{bc}	5499^{cd}	7710^{bc}
5	Fluopyram 17.7% w/w +Tebuconazole 17.7% w/w SC	26.31 (30.86)^{ef}	27.91 (31.89)^{cd}	5024de	7488^{bc}
6	Picoxystrobin 7.05% + Propiconazole 11.7% SC	12.12 (20.37)^{ab}	11.77 (20.06)^{a}	6007^{bc}	8212^{ab}
7	Hexaconazole 4% + Zineb 68% WP	21.74 (27.79)^{de}	25.84 (30.55)^{cd}	5275^{cde}	7536^{bc}
8	Control (untreated)	30.45 (33.49)^{f}	29.66 (33.00)^{d}	4403^{e}	6884^{c}
S. Em (±)		1.12	1.16	292.11	374.04
CD at 5%		3.30	3.43	859.25	1100.25
CV (%)		8.94	9.09	10.01	9.46

1. Figures in parentheses indicate the arc sin transformed value

2. Treatment means with letter in common are not significant by Duncan's new multiple range test (DNMRT) at 5% level of significance within a column

CONCLUSION

It should be concluded that out of total 7 fungicides recommended by Central Insecticides Board and Registration Committee for grain discolouration were evaluated against the disease. Tebuconazole 50% + trifloxystrobin 25% WG and tricyclozole 20.4% w/w + azoxystrobin 6.8% w/w SC were found to be the best fungicides to manage the disease showing the least per cent panicle discolouration *i.e* 9.80% and 11.11% respectively. Tebuconazole 50% + trifloxystrobin 25% WG, tricyclozole 20.4% w/w + azoxystrobin 6.8% and picoxystrobin 7.05% + propiconazole 11.7% SC were showing least per cent spikelet discolouration 8.83%, 9.90% and 11.77%, respectively. Grain yield and straw yield were also highest under tebuconazole 50% + trifloxystrobin 25% WG (7704 and 9251 kg/ha, respectively).

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References

Anonymous (2021). *Agriculture Statistics at a Glance*. Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmer Welfare, Ministry of Agriculture and Farmer Welfare, Govt. of India, pp. 44. Retrieved from- https://eands.dacnet.nic.in/PDF/

Arshad, I., Khan, J., Naz, S., Khan, S. and Akram, M. (2009). Grain discolouration disease complex: a new threat for rice crop and its management. Pakistan Journal of Phytopathology, 21, 31–36.

Baite, M. S., Raghu, S., Prabhukarthikeyan, S. R., Keerthana, U., Jambhulkar, N. N. and Rath, P. C. (2020). Disease incidence and yield loss in rice due to grain discolouration. Journal of Plant Diseases and Protection, 127 (1), 9-13.

Ghose, R. L. M., Ghatge, M. B. and Subramanyam, V. (1960). *Rice in India*, second ed. ICAR, New Delhi, pp. 474.

Goswami, S. K. and Thind, T. S. (2018). Efficacy of fungicides against grain discoloration of rice under natural conditions. Indian Phytopathology, 71 (3), 453-455.

Halgekar, N. Y. and Giri, G. K. (2015). Detection of seed borne fungi of rice. Environment and Ecology, 33 (4), 1599-1603.

Kheroda, L. and Chhetry, G. K. N. (2008). Fungi associated with discoloured rice grains and their effect on germination. Journal of Mycopathological Research, 46 (1), 125-126.

Kumar, P. V., Naaiik, R. B., Rajkumar, B. V., Swetha, M., Bhavyamanjari, M., Lakshmi, D. V. and Padmaveni, C. (2020). Management of disease complex inducing grain discolouration in rice crop in northern Telangana zone of the state. Journal of Entomology and Zoology Studies, 8 (1), 197-199.

Mustafa, A. and Mohsan, M. (2017). Mycoflora associated with grain discolouration of common rice *(Oryza sativa L.)* cultivars and their management. International Journal of Advanced Research in Biological Sciences, 4 (4), 1-5.

Ou, S.H., (1985). *Rice Diseases*, (second ed.) Commonwealth Mycological Institute, Kew, Surrey, England, UK, pp. 380.

Pal, R. and Mandal, D. (2021). Chemical Management of Grain Discolouration Disease of Rice. *Pesticide Research Journal*, *33*(1), 25-29.

Persaud, R., Persaud, M., Saravanakumar, D. and Homenauth, O. (2020). Identification of causal agent and management of grain discolouration in rice. Journal of Plant Diseases and Protection, *127*(2), 183-196.

Phat, C. T., Duong, N. T. and Du, L. T. (2005). Influence of grain discolouration to seed quality. Omonrice, 13, 139-144.

Sumangala, K., Patil, M. B., Nargund, V. B., Arun, S., Prashanti, S. and Uma, K. (2010). Status and distribution of paddy grain discolouration in North Eastern Karnataka. Karnataka Journal of Agricultural Sciences, 23, 804-805.

ISSN (Print) 2321-8614 & ISSN (Online) 2454-2318
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Tullis, E. C. (1936). Fungi isolated from discoloured rice kernels. Technical Bulletin No. 540, United States Department of Agriculture Washington, 24, 11-14.