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Evaluation of newer fungicides against neck blast disease of rice under field condition in south-eastern Rajasthan

Yadav DL*, Manoj Kumar, Sharma KM and Pratap Singh

Agricultural Research Station, Kota
Agriculture University, Kota, Rajasthan, India
*Corresponding author email: dlaau21@gmail.com

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Abstract

Neck blast is considered as the most destructive phase of the blast disease in rice under south-eastern Rajasthan. Eight new generation fungicides *viz*., Tebuconazole, Difenconazole Propiconazole , Hexaconazole Azoxystrobin , Azoxystrobin + Tebuconazole , Azoxystrobin Mancozeb Trifloxystrobin +Tebuconazole were evaluated under field conditions during Kharif 2021. Result revealed that the combination of Trifloxystrobin (25%) + Tebuconazole (50 WG @ 0.4g/lit) gave minimum disease intensity (3.2%) and maximum disease control (80.8%) with higher yield (4482.3 kg/ha) which was at par with Propiconazole with a grain yield of 4400.0 kg/ha.

Keywords: Neck blast, Pyricularia, Trifloxystrobin 25%+Tebuconazole 50 WG, Difenconazole 25%, Propiconazole 25 % EC and Azoxystrobin 23% SC.

Introduction

Rice is one of the most important food crops that feeds more than 60 per cent population of India. India is one of the leading producers of rice in the world. Rice is the basic food crop and being a tropical species, it flourishes comfortably in a hot and humid climate. Rice is mainly grown in rain-fed areas that receive heavy rainfall. Rice blast disease caused by *Magnaporthe oryzae* (anamorph: *Pyricularia oryzae*) is the most serious constraint in all the rice ecosystems of the country. The fungus *P. oryzae* attacks at all stages of the crop and symptoms appear on leaves and nodes (Seebold *et al.,* 2004). Neck region of panicle develops a black colour and shrivels completely / partially, grain set inhibited, panicle breaks at the neck and hangs. Rice blast is by far the most important disease of rice. It is found wherever rice is grown and it is always a threat. Failures of entire rice crops have resulted directly from rice blast epidemics (Long *et al.,* 2001). The symptoms are more severe in case of neck blast that is characterized by the infection at the panicle base and its rotting (Bonman *et al.,* 1989).

Neck blast is considered as the most destructive phase of the disease and can occur without being preceded by severe leaf blast. (Zhu *et al.,* 2005). Yield reduction by neck blast infection is twice as severe as leaf blast (Hwang *et al.,* 1987). Heavy yield losses have been reported in many rice growing countries. For example, 75 percent grain loss may occur in India (Padmanabhan, 1965). Okhovot (1989) obtained maximum control of neck blast with Tricyclazole. Saikia (1991) found that the fungicides, Edifenphos, Thiophanate methyl and Carbendazim reduced leaf and neck blast infections by 7.5-80.8 and 60.5-64.5 per cent, respectively. Hence, continuous efforts are required to identify effective and safe molecules to manage this disease. The present study was, therefore, undertaken to evaluate new molecules effective against neck blast and their influence on rice yield.

Materials and Methods

The experiment was conducted at Agricultural Research Station, Agriculture University, Kota during *kharif* 2021 to evaluate the efficacy of various new fungicides against neck blast of rice under

field conditions. The experiment was laid out in a Randomized Block Design (RBD) with three replications and nine treatments. Variety PB-1121 was sown in 20 m^2 plot at 20 cm row to row distance. Crop was raised as per the recommended package of practices of the zone and irrigation was given as and when required. Fungicides were sprayed twice using a hand operated knapsack sprayer fitted with hollow cone nozzle and water volume of 500 lit/ha was maintained. First spraying was given just after the appearance of the disease and second was given 14 days after the first spray. Observations related to diseases were recorded 15 days after first application (at 15 days) and second 15 days after second application (at 30 days). One random tiller from each of the ten hills in each field was assessed for the neck blast incidence and expressed as per cent.

Calculation of Per Cent Disease intensity (PDI)

These grades are then utilized for the calculation of PDI by using the following formula of Wheeler (1969).

$$\text{Per cent Disease intensity (PDI)} = \frac{\text{Sum of individual rating}}{\text{No. of panicle examined}} \times \frac{100}{\text{Max. Disease rating}}$$

Yield assessment: The rice grains were harvested and weighed plot wise; the average seed yield per treatment was recorded and then calculated in to Kg/ha and statistically analyzed.

Neck blast disease scoring was done as suggested by Goto and Yamanaka, (1968); Mackill and Bonman, (1992) and Hayashi and Fukuta (2009).

Table 1. Neck blast disease rating scale

Neck blast score	Score description
0	No visible lesions or lesions only on few pedicles
1	Lesions on several pedicels or secondary branches
3	Lesions on a few primary branches or the middle part of panicle axis
5	Lesions partially around the base (node) or the uppermost internodes or the lower part of the panicle axis near the base
7	Lesion completely around the panicle base or uppermost internodes or panicle axis near the base with more than 30% of filled grains
9	Lesion completely around the panicle base or uppermost internodes or the panicle axis near the base with less than 30% of filled grains

Results and Discussion

In the present experiment, all applied fungicides were found significantly superior in reducing the disease severity as compared to check against neck blast disease of rice during *Kharif* 2021. Minimum disease intensity (3.2%) and maximum disease control (80.8%) was observed with foliar spray of fungicide combination Trifloxystrobin 25%+Tebuconazole 50 WG @ 0.4g/lit which was at par with Propiconazole 25 % EC @ 1ml/lit (PDI 4.1% & PDC 75.4%). Next best treatment was the combination of Azoxystrobin 11% + Tebuconazole 18.3% SC @ 1.5 ml/lit which recorded disease intensity *i.e.* 4.6% with 72.4% disease control. Minimum disease control (47.9%) was recorded under fungicide spray of Hexaconazole @ 5% SC as compared to other foliar spray of fungicides. However, maximum disease intensity (16.7%) was recorded in untreated plot (**Table 2**).

Maximum yield (4482.3 kg/ha) was recorded in foliar spray of combination Trifloxystrobin 25%+Tebuconazole 50 WG @ 0.4g/lit which was at par with Propiconazole 25 % EC @ 1ml/lit (4400.0kg/ha), Azoxystrobin 11% + Tebuconazole 18.3% SC @ 1.5 ml/lit (4340.0kg/ha) and Azoxystrobin 8.3%+ Mancozeb 66.7% WG @ 2.5gm/lit. (4240.0 kg/ha), while, minimum yield was recorded in control plot (3846.7 kg/ha.). Maximum cost benefit ratio was recorded with application of Propiconazole 25 % EC @ 1ml/lit.

Present findings are in accordance with Narayanswamy *et al.,* (2009) who reported that application of tebuconazole 50 % + trifloxystrobin 25 % (WG) was found most effective in controlling leaf blast as it controlled the disease up to the extent of 84 per cent compared to control. Mohan *et al.,* (2011) and Nirmalkar *et al.,* (2017) reported that, tebuconazole 50 % + trifloxystrobin 25 % (WG) and tebuconazole 25.9 % (EC) were found most effective against the leaf and neck blast of paddy. The strobilurin fungicides interfere with spore germination and germ tube development, absorbed into the leaf tissue and move in a translaminar manner (Sauter *et al*., 1999). However, the triazole fungicides are sterol inhibitors that interfere with sterol biosynthesis in fungal membranes and are absorbed into the leaf tissue (Tsuda *et al*., 2004).

Table 2. Bio-efficacy of new generation fungicides against neck blast and yield of rice

Treatments	Dose/ lit. water	Percent disease intensity	Per cent disease control	Yield kg /ha
T1: Tebuconazole 250 EC	0.5 ml/lit.	6.6	60.5	4021.7
T2: Difenconazole 25% EC	0.5 ml/lit.	6.3	62.3	4126.7
T3: Propiconazole 25 % EC	1 ml/lit.	4.1	75.4	4400.0
T4: Hexaconazole 5 SC	2 ml/lit.	8.7	47.9	3900.0
T5: Azoxystrobin 23% SC	1ml/lit.	8.5	49.1	4083.3
T6: Azoxystrobin 11% + Tebuconazole 18.3% SC	1.5 ml/lit.	4.6	72.4	4340.0
T7: Azoxystrobin 8.3%+ Mancozeb 66.7% WG	2.5gm/lit.	6.5	61.1	4240.0
T8: Trifloxystrobin 25%+Tebuconazole 50 WG	0.4g/lit	3.2	80.8	4482.3
T9: Control		16.7	--	3846.7
S. Em. ±		0.59	--	120.2
CD at 5 %		1.24	--	254.9

Table 3. Economics of treatments for the management of neck blast in paddy cultivation

Treatments details	Cost of cultivation (Rs/ha)	Cost of treatments (Rs/ha)	Cost of inputs (Rs/ha)	Yield kg /ha	Income (Rs./ha)	Net return (Rs/ha)	BC Ratio
T1: Tebuconazole 250 EC @ 0.5 ml/lit.	45000	1339	46339	4021.7	108586	62247	1.34
T2: Difenconazole 25% EC @ 0.5 ml/lit.	45000	2500	47500	4126.7	111421	63921	1.35
T3: Propiconazole 25 % EC @ 1 ml/lit.	45000	1200	46200	4400.0	118800	72600	1.57
T4: Hexaconazole 5 SC @ 2 ml/lit.	45000	1390	46390	3900.0	105300	58910	1.27
T5: Azoxystrobin 23% SC @ 1ml/lit.	45000	6670	51670	4083.3	110249	58579	1.13
T6: Azoxystrobin 11% + Tebuconazole 18.3% SC @ 1.5 ml/lit.	45000	4800	49800	4340.0	117180	67380	1.35
T7: Azoxystrobin 8.3%+ Mancozeb 66.7% WG @ 2.5gm/lit.	45000	3250	48250	4240.0	114480	66230	1.37
T8: Trifloxystrobin 25%+Tebuconazole 50 WG @ 0.4g/lit	45000	3148	48148	4482.3	121022	72874	1.51
T9: Control	45000	--	45000	3846.7	103861	58861	1.31

Conclusions

Among the eight fungicides tested under field conditions, the fungicides Trifloxystrobin 25%+Tebuconazole 50 WG @ 0.4g/lit and Propiconazole 25 % EC @ 1ml/litre were found to be the most effective against neck blast disease with great reduction in the per cent disease intensity and getting higher grain yield. Maximum cost benefit ratio was recorded with application of Propiconazole 25 % EC @ 1ml/lit followed by Trifloxystrobin 25%+Tebuconazole 50 WG @ 0.4g/lit.

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Conflict of interests

The authors declare no conflict of interest.

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