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To studies about use of different fungicides against leaf and neck blast disease of rice (*Oryza sativa* L.) under field conditions

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Abstract
Rice (*Oryza sativa* L.) is an important Kharif cereal crop of Satna district. The productivity of Rice is greatly reduced due to heavy infestation of blast disease at vegetative growth stage of crop. Blast Disease is a serious disease of Rice that reduces the yield of Rice by 15-20%. Rice blast caused by *Pyricularia grisea* Sacc. is the important disease of rice and different fungicides against this disease were evaluated in Deendayal Research institute Krishi Vigyan Kendra, Satna M.P. A susceptible Rice cultivar 'MTU 1010' was planted in randomized block design (RBD) and fungicides *viz.,* Pyraclostrobin 10% CS (0.25%), Tebuconazole 25.9% EC @ (0.2%), Hexaconazole 5% SC (0.2%) and Hexaconazole 4% + Zineb 68% WP (0.2%) were sprayed thrice at weekly interval starting from the booting stage. All these fungicides were found to be effective in controlling leaf and neck blast disease as compare to control. Among them, Pyraclostrobin 10% CS (0.25%) was found to be the most effective with least leaf blast disease severity (6.23%), neck blast incidence (8.97%), and highest percentage disease control (87.08% and 79.62% in leaf blast and neck blast, respectively) and higher grain yield (4.23 t/ha), followed by Tebuconazole 25.9% EC @ (0.2%), Hexaconazole 5% SC (0.2%) and Hexaconazole 4% + Zineb 68% WP (0.2%) fungicide could be used to control rice blast at weekly interval starting from the booting stage for three times.

Keywords: Rice, *Oryza sativa*, leaf blast, severity, neck blast, disease incidence, percent and grain yield

Introduction
Rice (*Oryza sativa* L.) is the most important cereal crop of the world and is consumed by 50% population worldwide (Luo *et al*., 1998) [5]. It had been affected by many serious diseases, including blast which was caused by ascomycete fungus *Pyricularia grisea* Sacc., (Telemorph: *Magnaporthe grisea*) (Correll *et al*., 2000) [2]. The fungus can infects most parts of the plant, but the most damaging phase of the disease is the nodal or panicle infection (Ou, 1985) [9]. The disease either kills the host plant or prevents seed development when pathogen infects on neck or panicle. In epidemics result in a complete loss of seedlings in the seed bed (Manandhar, 1984; Chaudhary and Sah, 1997) [6, 1].

Blast is a serious and recurrent problem in all rice growing regions of the world (Kapoor and Katoch, 2014) [4] and in tropical region, especially in India the disease is a serious threat to rice crop (Sireesha, 2013) [12]. Blast is a major contributor to the yield gap and in this era of rapidly increasing world population, limitations to increase cultivated land and non-availability of water for irrigation, reducing the loss due to blast can prove to be a critical component towards mitigating the world food security (Sharma *et al*., 2012) [11].

Rice blast is one of the most destructive diseases in rice fields. Depending on cultivar susceptibility, environmental conditions and management system, it causes yield losses up to 100%. Planting of resistant varieties, application of fungicides, and manipulation of planting times, fertilizers and irrigations are the most usual approaches for the management of Rice blast disease (Naidu and Reddy, 1989) [8]. Among several methods developed for the control of the disease (Mariappan *et al*., 1995) [7], chemical control has been widely practiced in many countries. Seed treatments with systemic fungicides and foliar sprays with those fungicides had been demonstrated to be effective in minimizing blast disease (Manandhar, 1984) [6]. Present study was undertaken to appraise the field efficacy of different fungicide against Leaf blast and Neck blast disease of paddy under field conditions.

Materials and Methods

A field experiment was conducted at Deendayal Research Institute Krishi Vigyan Kendra, Satna, M. P. Rice nursery of susceptible cultivar 'MTU 1010" was sown in the month of June, 2018. The experiment was laid out in randomized block design (RBD) with three replications. Each replication was separated by 1 m and there were seven blocks in each replication which were separated by 0.5 m. 26 days old seedlings were transplanted to the main field.

The whole field was surrounded by one row of highly susceptible cultivar MTU 1010 and also there is a row between two replications to provide the uniform source of inocolum. The plot size for each treatment was 9 m2 (3 m × 3 m) with 15 rows in each plot and plant to plant and row to row distance was 20 cm. Fertilizer was applied @ 120:60:40 kg NPK/ha through urea (46% N), DAP (18% N and 46% P2O5) and MOP (60% K2O). One third dose of Nitrogen, full dose of Phosphorus and Potash were applied before final land preparation as basal dose. Remaining dose of N was applied in two split doses at active tillering stage and panicle initiation. Zinc Sulphate (commercial product) was applied @ 25 kg/ha at final land preparation. Herbicide Bispyribac sodium 10% SC @ 200 ml/ha of water was sprayed 20 DAT for controlling weeds. Twice spraying of Indoxacarb 14.5% SC @ 375 ml per ha + Imidacloprid 17.8% SL @ 250 ml/ha was done before milking stage to control rice gundhi bug and stem borer. There were five treatments including four fungicides and one control (No spray). The fungicides *viz*., Pyraclostrobin 10% CS (0.25%), Tebuconazole 25.9% EC @ (0.2%), Hexaconazole 5% SC (0.2%) and Hexaconazole 4% + Zineb 68% WP (0.2%) were sprayed thrice at weekly interval starting from the booting stage. The data on leaf blast severity were collected from randomly selected 25 plants from each plot, one week after the last application of fungicides by using 0-9 disease rating scale given by International Rice Research Institute (IRRI, 1996) as shown in Table 1 and then converting into

Percent disease by using the following formula

$$\text{Disease\%} = \frac{\text{Sum of score x 100}}{\text{Number of observation X Highest number in rating scale}}$$

The neck blast incidence was recorded one week before harvesting by examining all the tillers in 25 randomly selected hills per plot. By counting the infected and healthy panicles in each hill, percentage neck blast incidence was determined. The grain yield was recorded from individual plots. The percent disease control was calculated by using formula given by Abbotts, (1925) percentage reduction = C – T/C × 100, where, C is the population of control and T is the population of treated plots. The data on yield was recorded at maturity by manual harvesting with the help of sickle from whole plots.

Table 1: Rice blast (leaf blast and neck blast) disease rating scale

Scale	Description	Host Behavior
0	No lesion observed	Highly Resistant
1	Small brown specks of pin point size	Resistant
2	Small roundish to slightly elongated, necrotic gray spots, about 1-2 mm in diameter with a distinct brown margin. Lesions are mostly found on the lower leaves	Moderately Resistant
3	Lesion type same as in 2, but significant number of lesions on the upper leaves	Moderately Resistant
4	Typical susceptible blast lesions, 3 mm or longer infecting less than 4% of leaf area	Moderately Susceptible
5	Typical susceptible blast lesions of 3mm or longer infecting 4-10% of the leaf area	Moderately Susceptible
6	Typical susceptible blast lesions of 3 mm or longer infecting 11-25% of the leaf area	Susceptible
7	Typical susceptible blast lesions of 3 mm or longer infecting 26-50% of the leaf area	Susceptible
8	Typical susceptible blast lesions of 3 mm or longer infecting 51-75% of the leaf area many leaves are dead	Highly Susceptible
9	Typical susceptible blast lesions of 3 mm or longer infecting more than 75% leaf area affected	Highly Susceptible

Result and discussion

Different fungicides were evaluated to control leaf and neck blast disease under field conditions and their ultimate effect on grain yield was given in the Table 2. The table shows the leaf blast severity, neck blast incidence, percentage disease control and grain yield from various fungicidal treatments. During the experiment leaf blast severity was found to be significantly less in all treated plots over control one. The result shows that after the application of various fungicides as foliar spray, Pyraclostrobin 10% CS (0.25%), was found most effective treatment showing significantly less leaf blast disease severity (6.23%) as compare to others. A range of 59.98 to 87.08% disease control was noticed from various fungicides.

Maximum percent disease control was recorded from Pyraclostrobin 10% CS (0.25%), followed by Tebuconazole 25.9% EC @ (0.2%), was also found to be effective in controlling rice neck blast (8.97% disease incidence) and a range of 43.18 to 79.62% disease control was recorded from various treatments. The leaf blast severity and neck blast incidence covered significant reduction in yield (control 2.71 t/ha). Grain yield from various treatments shows that yield was significantly higher in Pyraclostrobin 10% CS (4.23 t/ha) and it increases up to 56.09% grain yield over the control one. Our results are in conformity with those of Sood and Kapoor, (1997) [13], Prabhu *et al*., (2003) [10] and Usman Ghazanfar *et al*., (2009) as they reported fungicides application increases the Rice yield. D. Pramesh *et al*., (2016) [3] Pyraclostrobin 100 g/l CS (Seltima 100 g/l CS) was evaluated for its bio-efficacy against rice leaf blast disease under field condition. The test fungicide, Pyraclostrobin 100 g/l CS was found effective against leaf blast disease which recorded least percent disease index (PDI) of 14.20 and 16.48 @ 75 g a.i./ha and @ 100 g a.i./ha, respectively.

Researchers from around the world also found similar results while testing the various fungicides, like Varie *et al*., (1993) [15] used eight fungicide for rice blast management and treated the seed with Hexaconazole 4% + Zineb 68% WP @ 2 g/kg seed proved effective after 40 days of sowing. Sood and Kapoor, 1997 [13] evaluated 7 fungicides against leaf and neck blast of rice at recommended rates at booting and heading stage and found that Pyraclostrobin 10% CS was the most effective. It reduces leaf and neck blast by 89.2% and 97.5%, respectively and increases the yield by 43.3% as compared with control (No spray).

Table 2: Effect of different fungicides for the control of blast and grain yield of Rice

S. No.	Treatment	Leaf blast disease incidence percent	percent disease control	Neck blast disase incidence percent	percent disease control	Grain yield	Percent Increase yield over control
1	Pyraclostrobin 10% CS (0.25%)	6.23	87.08	8.97	79.62	4.23	56.09
2	Tebuconazole 25.9% EC (0.2%)	18.17	62.33	22.00	50	3.22	18.82
3	Hexaconazole 5% SC (0.2%)	15.20	68.48	18.33	58.34	3.50	29.15
4	Hexaconazole 4% + Zineb 68% WP (0.2%)	17.10	64.54	21.33	51.52	3.40	25.46
5	Control	48.23	--	44.0	-	2.71	-

Conclusion

The trial on management of Rice blast disease by use of different fungicides at Deendayal Research Institute Krishi Vigyan Kendra, Satna (M.P.) revealed that fungicides can effectively control the Rice blast disease and among them Pyraclostrobin 10% CS (0.25%), was found to be the most effective one with least leaf blast disease severity (6.23%) and neck blast incidence (8.97%). Also, maximum disease control (87.08% and 79.62%) and highest grain yield (4.23 t/ha) were recorded from Pyraclostrobin 10% CS (0.25%). So, it is recommended to use this fungicide against Rice leaf and neck blast disease thrice at weekly interval starting from booting stage to have effective control and highest grain yield.

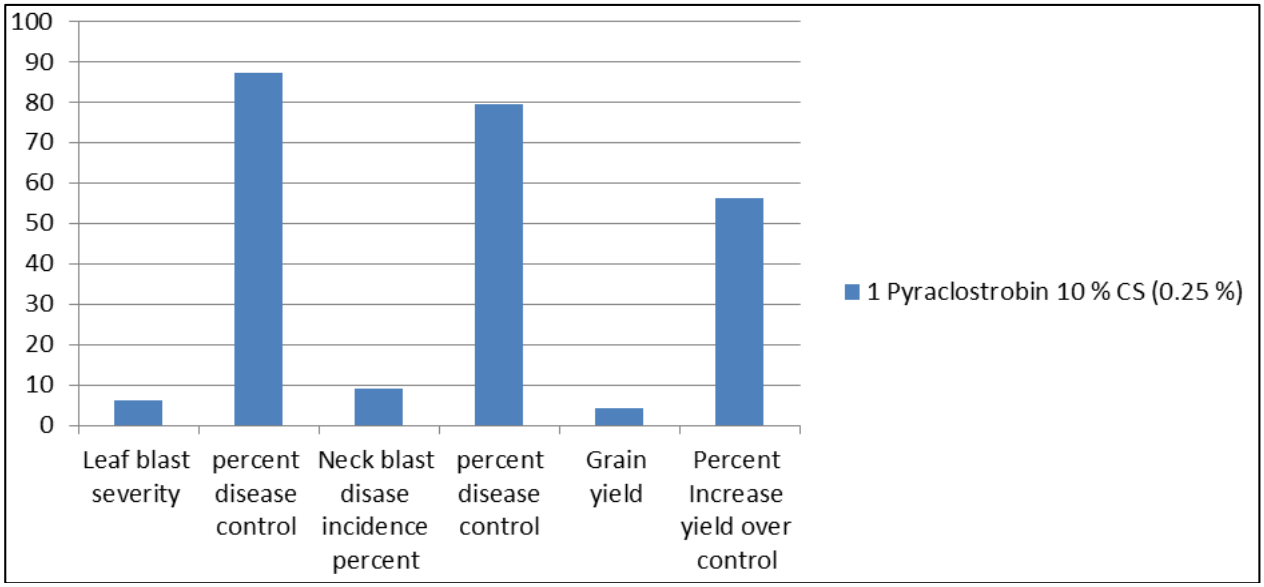

Fig 1: Pyraclostrobin 10% CS (0.25%)

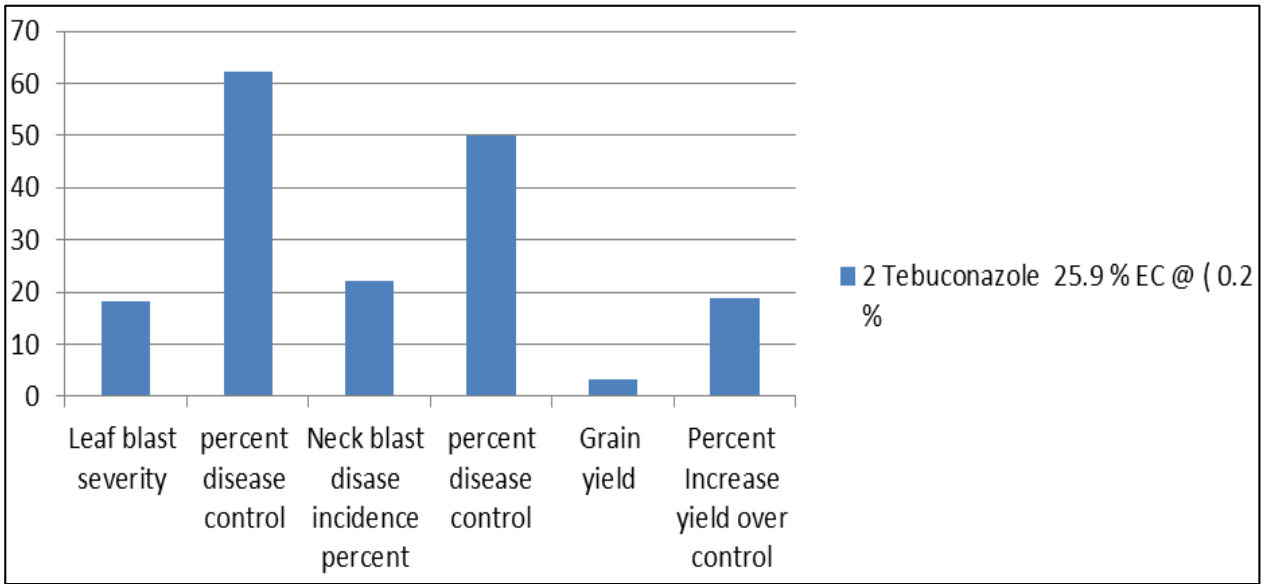

Fig 2: Tebuconazole 25.9% EC (0.2%)

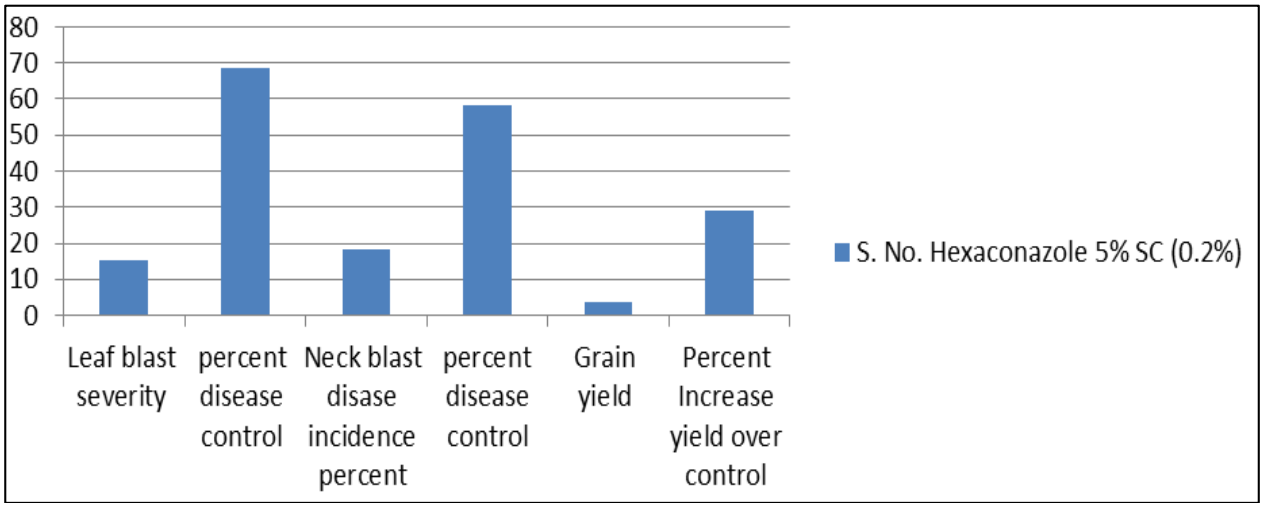

Fig 3: Hexaconazole 5% SC (0.2%)

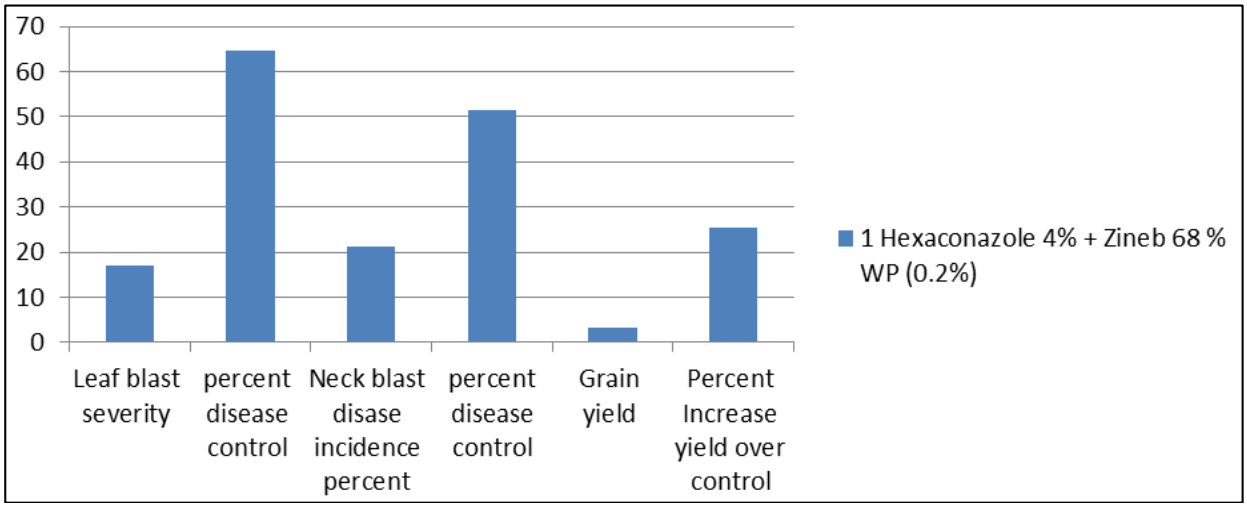

Fig 4: Hexaconazole 4% + Zineb 68% WP (0.2%)

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