Effect of selected fungicides on Brown spot disease of rice caused by *Helminthosporium oryzae*

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Abstract— *The in-vitro test of selected fungicides against brown spot disease incidence of rice and development of a disease prediction model base on weather variable was conducted during two Kharif seasons from 2014-2015 to 2015-2016. Results revealed that among the selected fungicides treatment lowest per cent disease incidence was found in Propiconazole in both the cropping season (2014-15) and (2015-16) with minimum mean per cent disease index (PDI) value bcd (7.76) and (7.03) with per cent disease control of 72.39 and 73.09 respectively over the control, followed by Propineb (PDI) value bcd (8.6) and (7.23) with per cent disease control of (69.40) and 73.09 respectively of the two cropping seasons. Among the fungicides treatment highest disease incidence was found in Thiophanate with maximum mean per cent disease index (PDI) value bcd (17.03) and (14.98) with per cent disease that control of 39.41 and 42.67 respectively in both the cropping seasons. It was also found disease intensity was higher during the first cropping season (2014-15) as indicated by higher mean per cent disease index (PDI) value abcd (12.5**) whereas in the following cropping season (2015-16) with lower value of (PDI) value abcd (11.18**).*

Keywords— Brown spot, Helminthosporium oryzae, disease index, Fungicides, Rice, Fungal Diseases.

I. INTRODUCTION

Proper evaluation of fungicides available in the market is required to identify the efficacy of a particular chemical against the target pest which will avoid economic losses as most chemicals are costly. Its indiscriminate use has serious effect on natural environment and is a global issue that needs to address through judicious application system. Brown spot disease of rice caused by *Heminthosporium oryzae* (Breda de Haan) is a major fungal disease which has been reported to occur in all rice growing countries including Japan, China, Burma, Sri Lanka, Bangladesh, Iran, Africa, South America, Russia, North America, Philipines, Saudi Arabia, Australia, Malaysia and Thailand (Ou, 1985; Khalili, *et al*. 2012). In India the disease was known to occur in all rice growing states but more severe in dry and direct seeded rice in the state of Bihar, Chhatisgarh, Madhya Pradesh, Orissa, Assam, Jharkhand and West Bengal (Gangopadhyay, 1983; Ou, 1985; Sunder, *et al*., 2014). This particular disease has been reported to cause enormous losses in grain yield upto 90% particularly when leaf spotting phase assumes epiphytotic proportions as observed in great Bengal famine in 1942 (Ghose *et al*. 1960) and in general can cause yield loss upto 45% when no protection was given.

II. METHODOLOGY

2.1 In-vivo test

Field trial was carried out in the experimental plot of Department of Plant Pathology, Allahabad School of Agriculture, SHUATS, Allahabad, U.P. for two consecutive cropping seasons of kharif (2014-15) and (2015-16) by using a susceptible Manipur Paddy cultivar *viz.*, Daramphou. Field layout was made in Randomized Block Design (RBD) with plot size (2x3) sq. m. 25 days old seedlings was transplanted with spacing 20 cm (row x row) and 15 cm (plant x plant) with 2-3 seedlings/hill. Five fungicides *viz.*, Thiophanate, Carbendazim, Myclobutanil, Propineb, Propiconazole at 1000ppm was sprayed at 10 days intervals from 48, 58 and 68 days after transplantation of the paddy and when prominent disease symptoms start appearing. Periodical monitoring on fixed plot was performed for obtaining real time data for rice brown spot disease incidence and severity in experimental plots. Observation was made one day ahead of each time of the treatment application and final observation was taken at 10 days after the final or third spray. For measuring disease progress 5 plants

per plot was tagged inside the field borders and one in the centre and top three leaves were taken into consideration in each time of disease rating during observation and data was systematically recorded and maintained as per the standard procedure.

The rating of the disease severity was done by using disease scoring scale of 0-4, based on percentage number of leaves showing symptoms according to Kalloo and Banerjee (2000) [where, 0=No symptoms observed, 1=1-25 % leaf area affected, 2=26-50 % leaf area affected, 3=51-75% leaf area affected and 4=75% and above leaf area affected]. Disease rating was recorded and the percent disease severity was worked out subsequently at every 10 days interval of the growth stage of the crop by following formula (Mc Kinny, 1923).

$$\text{PDI}\ (\%) = \frac{\text{Summation of numerical ratings}}{\text{Total number of leaves observed} \times \text{Maximum rating grade}} \times 100 \quad (1)$$

III. RESULTS AND DISCUSSION

The results obtained during the course of investigation are presented in the following tables (1 and 2) and figures (1 and 2).

TABLE 1
SELECTED FUNGICIDES AND PER CENT DISEASE INCIDENCE OF BROWN SPOT OF RICE DURING FIRST CROPPING SEASON (2014-15)

Sl. No.	Treatment	PDI					
		BS* a	AFS* b	ASS* c	ATS* d	Mean (bcd)	% Control
1.	T_0 (Control)	8.2	22.43	29.15	32.76	28.11	-
2.	T_1 (Thiophanate)	7.8	12.01	18.17	20.91	17.03	39.41
3.	T_2 (Myclobutanil)	9.16	6.96	11.83	11.69	10.16	63.52
4.	T_3 (Carbendazim)	8.6	6.91	15.01	13.33	11.75	58.19
5.	T_4 (Propineb)	8.2	4.69	10.72	10.39	8.6	69.40
6.	T_5 (Propiconazole)	7.8	4.44	9.92	8.94	7.76	72.39
	Mean (abcd)	8.29	9.57	15.80	16.33	12.50**	-
	S.Ed (±)	1.7	0.43	0.21	0.22	0.71	1.9
	CD (0.05%)	2.03 (NS)	0.61	0.29	0.32	0.40	5.60

Mean value of four replication
BS-before spray, AFS-after first spray, ASS-after second spray, ATS-after third spray,
bcd-mean PDI value three observation after the spray
abcd-mean PDI value of four observation** NS-non significant

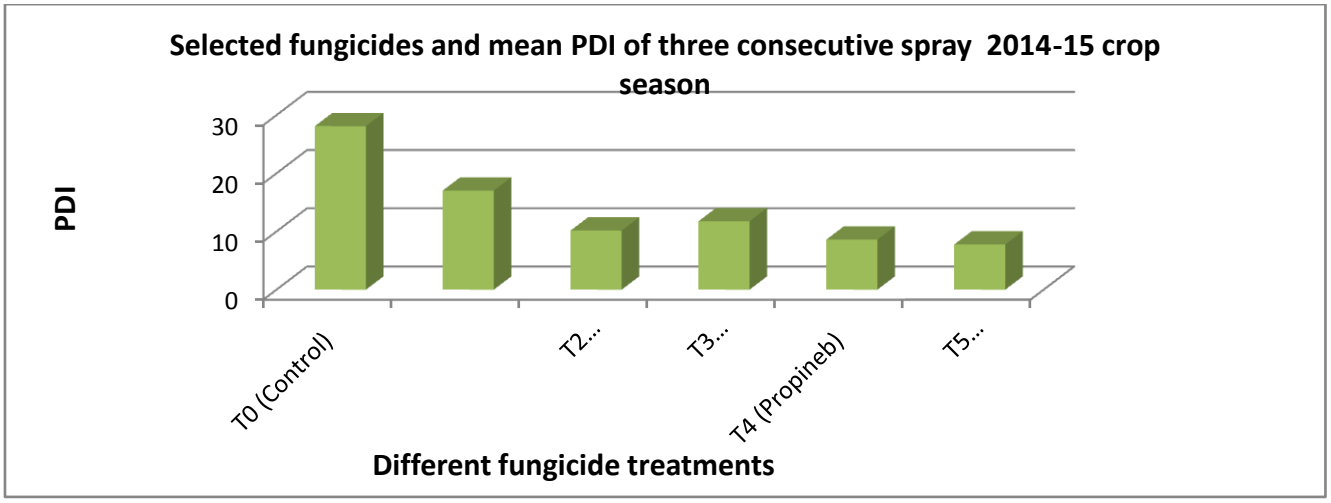

FIGURE 1: Selected Fungicides and mean PDI of three consecutive spray (2014-15)

The data presented on Table 1 is the per cent disease incidence of brown spot disease of rice and the selected fungicides at three consecutive schedule of spray at 48, 58 and 68 days and subsequent observation taken at 10 days interval *i.e*. 47, 57, 67 and 77 days after transplanting of the first cropping season (2014-15).

Results revealed that before the treatment was applied there was no significance difference among the treatment and between non treatment control plots concerning disease incidences. However, observation taken at 9 days after the first treatment found per cent disease incidence was lowest in Propiconazole (4.44) followed by Propineb (4.69), Myclobutanil (6.96) and highest incidence was observed in Thiophanate and Carbendzim treatment with per cent disease incidence of (12.01) and (6.91) respectively over the untreated control (22.43). However, all fungicides treatment was found significantly different among themselves as compared to untreated control. Similarly in the following second and third treatment on each time of observation taken at 9 days after the treatment application. It was observed that per cent disease incidence (PDI) was always found lowest in treatment with Propiconazole followed by Propineb and Myclobutanil and maximum disease incidence was observed in Thiophanate and Carbendazim. It is also evident from the mean PDI value of treatment (bcd) that lowest per cent disease index was found in Propiconazole (7.76) with per cent disease control (72.39) followed by Propineb (8.6) and Myclobutanil (10.16) with per cent control (69.40) and (63.52) respectively over control whereas maximum per cent disease index was found in Thiophanate (17.03) and Carbendazim (11.75) with per cent disease control of (39.41) and (58.19) respectively over the untreated control. However, in all cases all fungicides treatment was found significantly different among themselves as compared to untreated control (Fig.1).

TABLE 2
SELECTED FUNGICIDES AND PER CENT DISEASE INCIDENCE OF BROWN SPOT OF RICE DURING SECOND CROPPING SEASON (2015-16)

Sl. No.	Treatment	PDI					
		BS* a	AFS* b	ASS* c	ATS* d	Mean (bcd)	% control
1.	T_0 Control	9.16	20.68	26.42	31.29	**26.13**	-
2.	T_1 Thiophanate	8.32	9.21	16.36	19.37	14.98	42.67
3.	T_2 Myclobutanil	8.36	5.94	7.59	9.04	7.52	71.22
4.	T_3 Carbendazim	7.64	6.91	12.55	11.1	10.18	61.04
5.	T_4 Propineb	7.65	4.70	8.31	8.70	7.23	73.09
6.	T_5 Propiconazole	8.12	4.23	8.76	8.12	7.03	73.09
	Mean (abcd)	8.20	8.61	13.33	14.60	11.18**	-
	S.Ed (±)	1.32	0.17	0.22	0.19	0.19	0.75
	CD(0.05%)	3.04 (NS)	0.51	0.68	0.57	0.58	2.32

Mean value of four replication
BS-before spray, AFS-after first spray, ASS-after second spray, ATS- after third spray,
bcd- Mean PDI value three observation after spray
abcd- mean PDI value of four observation**
NS - Non significance

The data presented on Table 2 is the percent disease incidence of brown spot disease of rice and the selected fungicides at three consecutive schedule of spray at 48, 58 and 68 days and subsequent observation taken at 10 days interval *i.e*. 47, 57, 67 and 77 days after transplanting of the first cropping season (2015-16).

Results revealed that before the treatment was applied there was no significance among the treatment and non treatment control plots concerning disease incidences. However, observation taken at 9 days after first spray recorded that per cent disease incidence was lowest in Propiconazole (4.23) followed by Propineb (4.70), Myclobutanil (5.94) and highest incidence was observed in Thiophanate and Carbendzim treatment with per cent disease incidence of (9.21) and (6.91) respectively over the untreated control (20.68). However, all fungicides treatment was found significantly different among themselves as compared to untreated control. Similarly in the following second and third treatment taken at 9 days after the

treatment application it was observed that per cent disease incidence (PDI) was always found lowest in treatment with Propiconazole followed by Propineb and Myclobutanil and maximum disease incidence was observed in Thiophanate and Carbendazim. It is also evident from the mean PDI value of treatment (bcd) that lowest per cent disease index was found in Propiconazole (7.03) with per cent disease control (73.09) followed by Propineb (7.23) and Myclobutanil (7.52) with per cent control (73.09) and (71.22) respectively over control whereas maximum mean per cent disease index value bcd was found in Thiophanate (14.98) and Carbendazim (10.18) with per cent disease control of (42.67) and (61.04) respectively over the untreated control. However, in all cases all fungicides treatment was found significantly different among themselves as compared to untreated control (Fig.2).

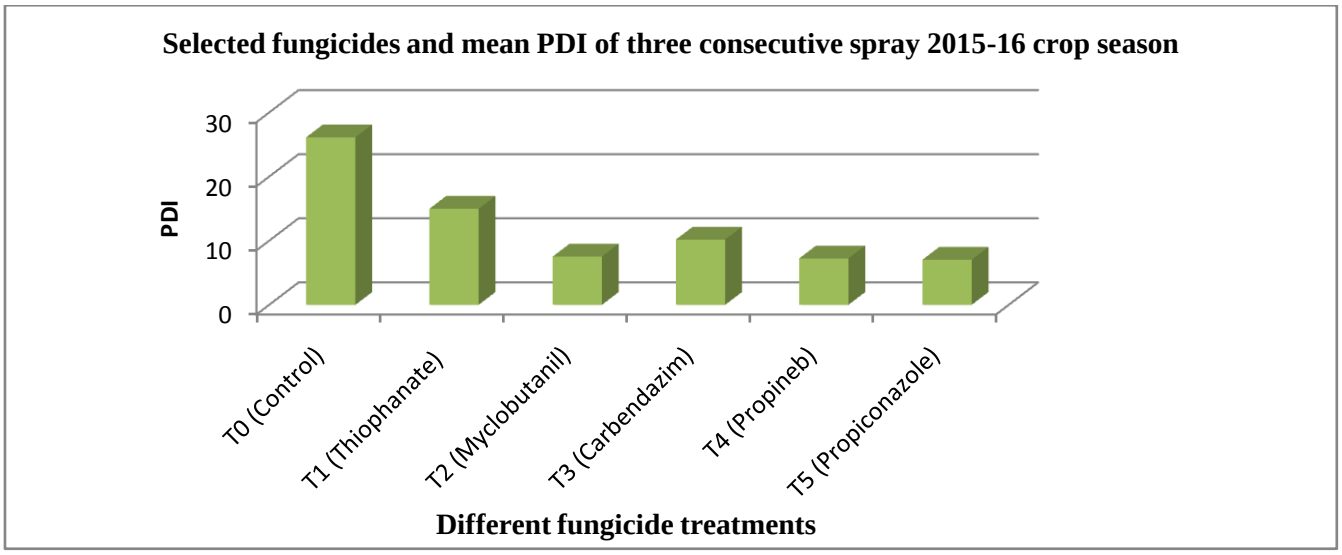

FIGURE 2: Selected Fungicides and mean PDI of three consecutive spray (2015-16)

The analysis of the above results of the two crop seasons (2014-15) and (2015-16) of *in-vivo* test revealed that all selected fungicides significantly inhibit the disease incidence in all the three schedule of spray. However, among the treatments highest significant per cent reduction of brown spot disease incidence was recorded in Propiconazole followed by Propineb, Myclobutanil, Carbendazim and Thiophanate respectively. Our present finding are in corroborate with that of Percich (1989) who reported that foliar application with Propiconazole was found to have better results in management of brown spot disease of rice. Pannu *et al*. (2003) also reported that application of Propiconazole was found most effective against brown spot disease. Moletti *et al*. (1996) reported that application of Iprodione and Propiconazole was most effective against brown spot disease whereas Celmer *et al*. (2007) reported that Trifloxystrobin + Propiconazole can effectively control the brown spot diseases of rice. Kumar and Rai (2008) also reported that application of Antracol or Propineb and RIL-FA 200SC can effectively reduce brown spot incidence of rice. Sunder *et al*. (2005, 2010) reported that spraying of Hexaconazole and Propiconazole at early booting stage considerably reduced both leaf spot and stalk rot phase of brown spot disease of rice. The data shows that disease severity was more during first cropping season 2014-15 as revealed by higher mean PDI value of four observation abcd (12.50**) whereas in the second cropping seasons 2015-15 lower mean PDI value of four observation abcd (11.18**) recorded.

IV. CONCLUSION

Chemical indiscriminate use need to be addressed through proper screening and evaluation and its judicious application practices need to be advocated at the highest level by the end users or the farming community. In our present investigation among the selected fungicides, Propiconazole and Propineb at 1000ppm applied at 48 days after the paddy transplantation and consecutive two sprays at 10 intervals was found most effective against brown spot disease of rice and its severity.

REFERENCES

[1] Celmer, A., Madalosso, M.G., Debortoli, M.P., Navarini,L and Balardin, R.S (2007) Chemical control of irrigated rice diseases. *Pesquisa Agropecuaria Brasilleira*. 42: 901-904.

[2] Chattopadhyay, C., Meena, P.D., Godika, S., Yadav, M.S., Meena, R.L. and Bhunia, C.K (2005) Garlic bulb extracts a better choice than chemical fungicides in managing oilseed crop diseases. *J. Mycol. Pl. Pathol*. 35: 574-575.

[3] Dasgupta, M.K and Chattopadhyay, S.B (1977) Effect of different doses of N and P on the susceptibility of rice to brown spot caused by *Helminthosporium oryzae*. *Z. Pftanzenkrankh. Pftlanzensch*. 84**:** 276-285

[4] Gangopadhyay, S (1983) Current concepts on Fungal Diseases of Rice. Today and Tomorrow's Printers & Publishers, New Delhi, 349.

[5] Ghose, R.L.M., Ghatge, M.B and Subramanian, V (1960) Rice in India (revised edn.), New Delhi, ICAR, 474.

[6] Khalili, E., Sadravi, M., Naeimi, S. and Khosravi,V (2012) Biological control of rice brown spot with native isolates of three *Trichoderma* species. *Braz. J. Microbiol*. 43**:** 297-305

[7] Kumar, S. and Rai, B (2008) Evaluation of new fungicides and biopesticides against brown spot of rice. *Indian Agriculturist* 52:117-119

[8] Mc Kinney, H.H (1923) A new system of grading plant diseases. *J. Agric. Res.,* 26: 195-218.

[9] Molletti, M., Giudici, M.L and Villa, B (1996) Rice Akiochi brown spot disease in Italy: agronomic and chemical control. *Informators Fitopathologico*. 46**:** 41-46.

[10] Ou, S.H (1985). Rice diseases 2nd edn. CMI, Kew, England, 370.

[11] Pannu,P.P.S., Mandeep Kaur and Chahal, S.S (2003) Evaluation of different fungicides against *Helminthosporium oryzae* in vitro and in-vivo conditions. *J.Mycol.Pl.Pathol*. 33: 473.

[12] Percich, J.A (1989) Comparison of Propiconazole rates for control of fungal brown spot of wild rice by *Bipolaris oryzae* in the growth chamber. *Plant Dis.* 73**:** 588-589.

[13] Scherm, H. and Yang, X. B (1995) Inter-annual variations in wheat rust development in China and the United States in relation to the El Nino/Southern Oscillation. *Phytopathology*, 85: 970-976.

[14] Singh, C., Singh P and Singh R (2008) Modern Techniques of Raising Field Crops, Second Edn. 68-73.

[15] Singh, R. K., Singh, C. V and Shukla, V. D (2005) Phosphorus nutrition reduces brown spot incidence in rainfed upland rice. *International Rice Research Notes* 30(2): 31–32.