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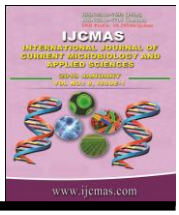

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Influence of Different Chemical Fungicides against Rice Brown Leaf Spot Disease Caused by *Bipolaris oryzae*

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A B S T R A C T

Brown leaf spot of Rice, caused by *Bipolaris oryzae L* is one of the major rice diseases occurring in World and Nepal. A field experiment to evaluate the efficacy of different chemical fungicides against brown leaf spot of rice was conducted at the farmer's field in Galkot municipality ward no.4. The six different fungicides that were compared with control treatment were Propaconazole, Hexaconazole, Teuboconazole, Carbendazim, Mancozeb allocated in Randomized Completely Block Design (RCBD) and replicated for three times. Application of propiconazole showed the lower AUDPC value (415.7) and highest grain yield (4.277 t/ha) followed by Kyoto (464.3) and SAAF (513.7) as compared to control. From this result, it was concluded that propiconazole can be used to reduce the disease severity and for higher economic yield.

Introduction

Rice (*Oryza sativa*) is one of the most important cereal crops of Nepal (Karki *et al.*, 2018). Rice covers 15, 52,469 ha of total cultivated land, with the production of 52, 30,327 mt. and the productivity of 3.37 t ha^{-1} in Nepal (MoAD, 2073/74).

Brown spot, a devastating disease, caused by *Bipolaris oryzae L.* is the most important biotic constraint of rice production occurring in almost all the rice growing land in the World. The fungal diseases of rice reduce the yield drastically causing significant loss as resulted in the Bengal famine in 1942, when approximately two million people died from starvation (Agrios, 2005). The pathogen after infection shows the symptoms on the leaves, panicles, glumes, and grain causing first as small, circular, and dark brown to purple-brown spots and fully developed lesions are circular to oval with a light brown to gray center, surrounded by a reddish-brown margin and ultimately killing the leaf (Manandhar *et al.*, 2016).

Temperature, relative humidity and amount of rainfall during the crop season influence the development (Dhaliwal, 2018). The management of the brown spot can be done mainly through resistant varieties, chemicals, biological, cultural, etc. Disease control by foliar spray with bio-agents is not enough for management of disease. Application of fungicides for the control of brown spot is the most effective management option effective and widely recommended methods of disease control (Biswas *et al.*, 2008). Fungicides, such as iprodione, propiconazole, azoxystrobin, and carbendazim are effective in management of brown spot disease (Mandal and Jha, 2008). The objective of the study was mainly focused on identifying the efficacy of different chemical fungicides and suggests the farmers of mid-hill effective fungicide to check the Brown spot disease.

Materials and Methods

The experiment was carried out at Farmer's field in Galkot Municipality ward no. 3 from July 2 to November 24, 2018. The site is located about 45 km south-west from Headquarter of Baglung district, Nepal. The experimental site lies at an altitude of 1216 masl, between 28^0 12'57" N latitude and 83^0 25' E longitude.

Field Layout

The experiment was conducted in completely Randomized Block design (RCBD) consisting of 7 treatments (Table 1) with 3 replication for each treatment. Each replication was separated by 1m alley and the space between the each treatment was 0.5 m. Each individual plot size was 2 m^2 and the net cultivated area was 42 m^2. The row to row and plant to plant distances was maintained as 20cm x 20cm such that 10 plants were maintained in each row and total 100 plants in each plot.

Field preparation and transplanting

Rice variety named as Khumal 9, a long duration variety, was selected for the experiment. Seedlings were raised on the same field of local farmer. Line sowing was practiced for the seedling raising. The main filed was thoroughly ploughed, leveled and puddled. Experimental set up was done. The light irrigation was provided to the seedlings before transplanting. The 21 days old seedlings were transplanted on main filed according to the experimental design. At the time of land preparation, FYM @ 5 ton/ha and half dose of Nitrogen (N) and full doses of Phosphorus (P) and Potassium (K) with the recommended doses of 120:60:40 NPK/ha were applied. Top dressing of remaining half doses of N, irrigation, weeding and hoeing was done as per the requirement.

Application of treatments

The fungicides were sprayed after each disease scoring on the same day at noon as per the respective treatments with the help of Hand Sprayer.

Disease assessment

Disease identification

Disease identification was done by visual method at the experimental site and microscopic confirmation was done at the Plant Pathology Laboratory, Agriculture and Forestry University by examining the infected leaves under compound microscope.

Disease scoring

Disease scoring was started in the field just after the appearance of the brown spot symptoms in the plot and done. Total five scoring were done in the naturally infested block at the interval of 7 days. First scoring

was done at 85 DAT followed by 92, 99, 106 and 114 DAT respectively. Disease scoring was assessed visually as foliage damage percent in all the observations using 0-9 scale (Manandhar *et al.*, 2016).

0 = No disease on plant
1 = Less than 1% leaf area infected
2 = 1-3% of leaf area infected
3 = 4-5% of leaf area infected
4 = 6-10% of leaf area infected
5 = 11-15% of leaf area infected
6 = 16-25% of leaf area infected
7 = 26-50% of leaf area infected
8 = 51-75% of leaf area infected
9 = More than 76% of leaf area infected

Area under disease progress curve (AUDPC)

The area under disease progress curve (AUDPC) is used to summarize the progress of disease severity. The AUDPC was estimated using the following formula (Campbell and Madden, 1990).

$$AUDPC = \sum_{i=1}^{n-1} (Y_{i+1} + Y_i)\ 0.5\ (T_{i+1} - T_i)$$

Where
Y_i = late blight disease severity % on the i^{th} date
T_i = date on which the disease was scored
n = numbers of dates on which disease was scored

Statistical analysis

The entry of recorded data was done using MS-excel 2007 program. The data were processed to fit into GenStat Fifteenth edition Version 15.1.0.8035 software for analysis. DMRT was done at 5% level of significance for mean comparison.

Results and Discussion

The seven different chemical fungicides were tested against the brown spot disease of the rice. The Area Under disease progressive curve (AUDPC) value was calculated on the basis of the disease severity recorded in different dates 85 DAT, 92 DAT, 99DAT, 106 DAT and 113 DAT (Table 2**)**. Significantly lowest AUDPC value was observed in the field treated with the Propicanazole (415.7) which was statistically par with Azoxystrobin + Tebuconazole. (464.3) and followed by Carbendazim+ Mancozeb (464.3). The plot with control treatment showed the maximum AUDPC value (723.4). Gupta *et al.*, 2013 found the reduction of disease severity with the application of Propicanazole to 08.24%.

The disease severity of brown spot was insignificant difference among the treatments during first two scoring D85and D92. But third, fourth and fifth disease severity scoring showed the significant different among the treatments. The application of propicaonazole significantly reduced the disease severity followed by Kyoto, SAAF, Hexaconazole, Carbendazim and Mancozeb.

Test weight and grain yield

Maximum test weight (12.68) and grain yield (4.277 t/ha) was obtained from propiconazole followed by Azoxystrobin + Tebuconazole (12.62) and (4.120 t/ha) respectively. So, Propiconazole and Tebuconazole + Azoxystrobin appeared as the efficient ones against brown leaf spot among all chemical fungicides in the field (Table 3). The application of SAAF, Hexaconazole, Cabendazim and Mancozeb resulted in average grain yield of 3.847 t/ha, 3.377 t/ha, 3.470 t/ha and 3.333 t/ha respectively as compared to control (2.793 t/ha).

Table.1 Treatments of experiment with notations

Trade Name	Generic Name	Notations
Built	Propicanazole 25% EC	T1
Bavistin	Carbendazim 50% WP	T2
Dithan M-45	Mancozeb 75% WP	T3
Cryzol	Hexaconazole 5% SC	T4
SAAF	Carbendazim 63% + Mancozeb 12% WP	T5
Kyoto	Azoxystrobin 11% + Tebuconazole 18.30% SC	T6
	Control	T7

Table.2 Mean disease severity value of rice at different DAT treated with different chemical fungicides in field at Baglung, Nepal

Treatments	D85	D92	D99	D106	D113
Propicanazole	8.72^{ab}	12.76^{a}	16.96^{a}	16.70^{a}	12.99^{a}
Carbendazim	10.23^{ab}	16.88^{ab}	20.35^{b}	21.79^{bc}	22.26^{cd}
Mancozeb	9.43^{ab}	16.02^{ab}	19.68^{b}	23.30^{c}	24.35^{d}
Hexaconazole	10.39^{ab}	15.30^{ab}	22.00^{b}	20.71^{abc}	19.13^{bc}
Carbendazim + Mancozeb	9.13^{ab}	14.85^{ab}	21.68^{b}	20.20^{abc}	17.36^{b}
Azoxystrobin + Tebuconazole	7.613^{a}	15.96^{ab}	20.25^{ab}	18.30^{ab}	15.74^{ab}
Control	11.68^{b}	19.40^{b}	25.11^{c}	30.94^{d}	$38,39^{e}$
Mean	9.600	15.74	20.72	21.71	21.41
F value	NS	NS	*	**	**
SeM(±)	1.350	2.036	1. 166	1.912	1.605
LSD (0.05)	2.941	4.436	2.541	4.166	3.497
CV (%)	17.2	15.8	6.9	10.8	9.2

Table.3 AUDPC value, test weight and grain yield of rice treated with different chemical fungicides in field at Baglung, Nepal

Treatments	AUDPC Value	Test weight	Grain Yield
Propiconazole	415.7^{a}	12.68^{c}	4.277^{c}
Carbendazim	539.0^{c}	12.00^{bc}	3.333^{ab}
Mancozeb	544.1^{c}	10.23^{a}	3.377^{ab}
Hexaconazole	532.9^{c}	12.04^{bc}	3.470^{abc}
Carbendazim + Mancozeb	513.7^{bc}	12.35^{c}	3.847^{bc}
Azoxystobin + Tebuconazole	464.3^{ab}	12.62^{bc}	4.120^{bc}
Control	723.4^{d}	$11. 13^{ab}$	2.793^{a}
Mean	533.3	11.87	3.602
F value	**	*	*
SEM(±)	28.90	0.616	0.3653
LSD(0.05)	62.97	1.342	0.7959
Cv(%)	6.6	6.4	12.4

Figure.1 Relationship between AUDPC value and economic yield of rice treated with different chemical fungicides in field at Baglung, Nepal

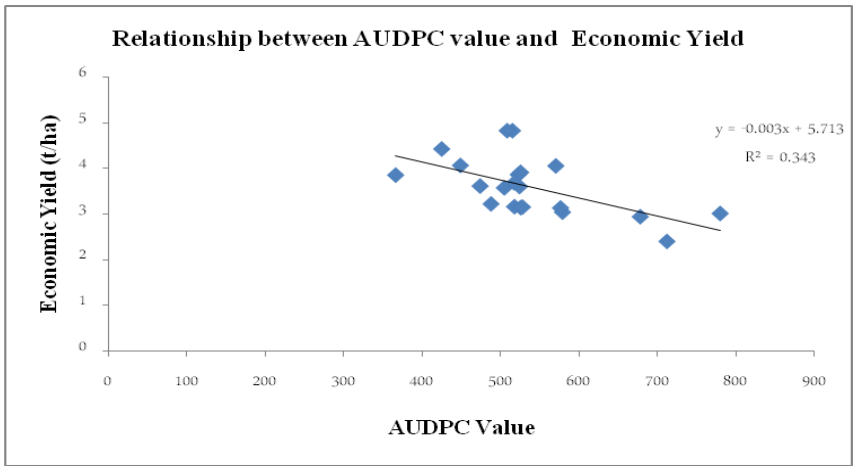
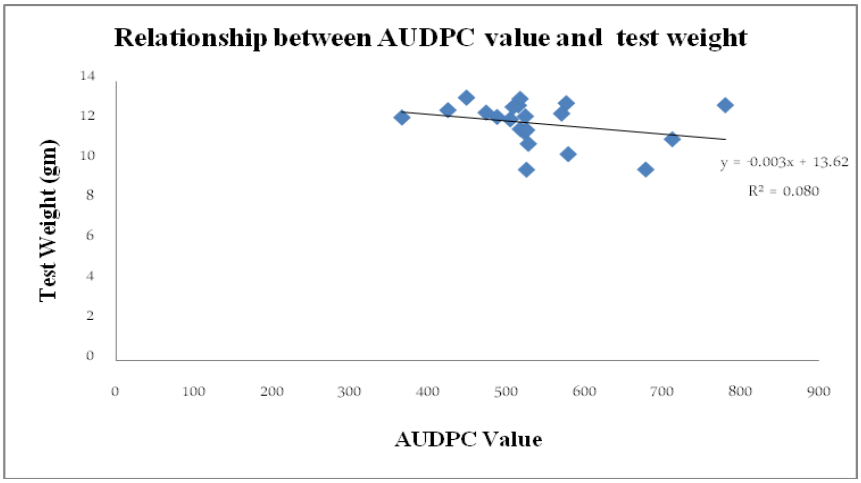


Figure.2 Relationship between AUDPC Value and test weight of rice treated with different chemical fungicides in field at Baglung, Nepal



Correlation and regression analysis

There was significant negative correlation between AUDPC Value and grain yield (R^2 = 0.343) and test weight (R^2 = 0.080) (Figure 1). The AUDPC Value contributes approximately 34.3% variation in the grain yield and remaining 65.7% variation due to variables other than AUDPC. Similarly about 8% variation in test weight of grains was due to AUDPC value (Figure 2) and remaining portion due to other factors. According to the linear equation, per unit increase in AUDPC value, test weight decreased by 0.003 times.

In conclusion the efficacy evaluation of different chemical fungicides available in the market against brown leaf spot disease of rice showed that application of propiconazole for management of brown spot in field was most effective in both reducing the diseases severity and economic yield than other tested fungicides. So, propiconazole was recommended for the farmers.

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