

Comparative Efficacy of Different Chemical Treatments for Paddy Blast, Brown Leaf Spot and Bacterial Leaf Blight Diseases in Rice (*Oryza Sativa* L.)

Halima Qudsia, Muhammad Akhter, Awais Riaz, Zulqarnain Haider* and Abid Mahmood

Rice Research Institute, Kala Shah Kaku, Lahore, Pakistan

*Corresponding author: Zulqarnain Haider, Rice Research Institute, Kala Shah Kaku, Lahore, Pakistan, E-mail: z.haider.breeder@gmail.com

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Abstract

Paddy blast, brown leaf spot and bacterial leaf blight of rice are the most devastating diseases of rice worldwide causing serious threats to food security. For the purpose field trials were conducted for the evaluation of different available fungicides at Rice Research Institute, Kala Shah Kaku during season of 2016. Application of different fungicide to control the disease and their effect on paddy yield under field condition were studied. The results showed that fungicide application not only controlled the disease but also improved the paddy yield as compared to control. In this study, Amistar Top 325 SC performed best to control the Paddy blast that leaf to high yield. In the case of Brown leaf spot, application of Switch DF 80 WG revealed the lowest incidence of disease along with highest protection value. Similarly, Nativo was most effective to control the Bacterial Leaf Blight incidence. Conclusively, these chemical can be used to control the studied bacterial and fungal diseases for high paddy yield.

Keywords: Comparative efficacy; Chemical treatments; Rice; Paddy blast; Bacterial leaf blight; Brown leaf spot

Introduction

Rice (*Oryza sativa* L.) is considered as queen of the cereals because it is one of the most important crops of the world feeding about half of the world's population [1]. In Pakistan, rice is the third major crop grown after Wheat and Cotton. Rice covered 2748 thousand hectares area in Pakistan yielding 6811 thousand tonnes. Rice is an excellent food source, low in fat and high in starchy carbohydrate. It contains vitamins and minerals and provides an excellent source of vitamin E, vitamin B (thiamin, niacin) and potassium. Basmati rice varieties of Pakistan are very famous around the world because of its specific aroma but unfortunately these varieties are also susceptible to many rice diseases such as paddy blast, bacterial leaf blight and brown leaf spot of rice.

Among other biotic and abiotic factors, the major rice diseases that are responsible for quality reduction and yield losses include rice blast caused by *Pyricularia oryzae* which attacks all above ground parts of the plant, causing eye-shaped lesions on leaves with whitish to gray centers and red to brownish borders, brown discoloration on panicle neck that breaks and panicles often fall over, nodes also show brown lesions, dry up and break off. Brown leaf spot (*Helminthosporium oryzae*) appears on leaves as typical oval spots, about the size and shape of sesame seeds. These spots are uniform and evenly distributed over the leaf surface. They are brown, with grey or whitish centers surrounded by a reddish brown margin when fully developed. Bacterial leaf blight (*Xanthomonas oryzae* pv. *oryzae*) cause water-soaked to yellowish stripes on leaf blades or starting at leaf tips then later increase in length and width with a wavy margin and these lesions turn yellow to white as the disease advances.

Many management strategies can be adopted to combat these diseases, including, cultivation of resistant varieties, improved cultural

practices, biological control and application of fungicides. Due to changing environmental conditions, pathogens also change themselves breaking the host resistance thus making the host susceptible against the particular disease. Cultural practices alone cannot give the proper disease control. Biological control is not practicable for larger fields. Chemicals are the important tool for controlling rice diseases. Judicious use of chemicals offers efficient and quick control of diseases resulting in higher yield and enhanced quality of the commodity. Many chemicals are recommended to control the rice diseases in Pakistan. To evaluate the efficiency of different fungicides/chemicals in the field their formulations were used against rice blast, brown leaf spot and bacterial leaf blight in the present study. The objective of the study was to evaluate best performing fungicides/chemicals for recommendations to rice growers.

Materials and Methods

Field trials were conducted for the evaluation of different fungicides at Rice Research Institute, Kala Shah Kaku during Kharif season of 2016. Rice nursery (35 days old) was transplanted in well prepared puddled field. Randomized Complete Block Design (RCBD) was used in the experiments with three replications and 2 m × 6 m plots size dimensions. Applied fertilizer was NPK@150:85:00 (Kg/ha). For paddy blast disease susceptible variety C622 was used as check. The crop was inoculated with highly blast infected leaves of rice. Test fungicides were sprayed at late booting stage and 4-5 days after panicle emergence. Data regarding blast incidence and paddy yield was recorded following the scale IRRRI [2].

For brown leaf spot management commercially grown Super Basmati was used as susceptible check variety. Inoculation was done with *Helminthosporium oryzae* from field infected leaves. The application of the various fungicides was sprayed at late boot and early flowering stages of plant development. For bacterial leaf blight (BLB) susceptible variety Basmati 2000 was transplanted as check for field

trials. Inoculation was done with freshly prepared (soaking of infected leaves in distilled water) inoculum of *Xanthomonas oryzae* pv *oryzae*. Test chemicals were sprayed at booting stage and repeated after 10 days. Data regarding BLB incidence was recorded two weeks after second spray following the scale devised by IRRI [2]. Control plots were sprayed with water only. An average disease index on a scale of 1-5 (1=no leaf lesions, 2=25%, 3=50%, 4=75%, and 5=100% of leaf area covered with lesions) was determined.

All plots were hand harvested 25 days after the last fungicide application and or maturity of each plot. A standardized inner square of 1 m × 1 m was hand harvested for the determination of paddy yield. The data was then statistically analyzed and tested at 5% level of significance to interpret the treatment differences Least Significant Difference (LSD) was applied.

Results and Discussions

Paddy blast (PB)

In paddy blast, application of fungicide effected the significant at $P \leq 0.05$ (LSD 5.251) as compared to untreated plot (Table 1). With the

application of Amistar Top 325 SC had protection value of 82.62% along with 11% disease incidence level. On the other hand, Kocide 3000 52.4 WG application showed the least effective protection 64.21 % in managing the disease as compared to control. Similarly, Dorazole 50 EC, Score 250 EC and Nativo 75 WG were also effective in reducing the disease incidence (15%, 15.3% and 16% respectively). It was followed by the Dora 10 WG in controlling the disease incidence level (21.3%) with protection level 66.36% as compared to control treatment. In accordance to yield, highest yield (4.68 t/ha) was observed with the application of Amistar Top 325 SC followed by the Nativo 75 WG (4.33 t/ha) and Dora 10 WG (t/ha) as compared to control (1.83 t/ha) condition. These result showed that application of different fungicide improved the paddy yield as compared to control. Different researchers also reported the level of disease incidence under control and fungicide application [3]. The result of this study also contributed in fungicide formulation which helped out to control the disease incidence and improved the paddy yield. Rohilla et al. reported that evolution of different chemical to control paddy blast vary with location and climatic condition [4].

Treatments (Trade Name)	Generic Names	Dose/acre	Blast incidence (%)	Protection value (%)	Yield t/ha
Amistar Top 325 SC	Azoxystrobin +Difenconazonle	200 mL	11 ^c	82.63	4.68 ^a
Nativo 75 WG	Tebuconazole+Trifloxystrobin	65 g	16 ^c	74.73	4.33 ^{ab}
Dora 10 WG	Difenconazole	300 g	21.3 ^b	66.36	3.83 ^{bc}
Dorazole 50 EC	Difenconazole+Propiconazole	125 mL	15 ^c	76.31	3.68 ^c
Score 250 EC	Difenconazole	125 mL	15.3 ^c	75.84	2.93 ^d
Kocide 3000 52.4 WG	Copper hydroxide	250 g	22.66 ^b	64.21	3.33 ^{cd}
Control	Water	-	63.33 ^a	-	1.83 ^e
	LSD value		5.251		0.223

Table 1: Comparative efficacy of different chemical treatments for paddy blast (PB) disease in rice (*Oryza Sativa L.*).

Brown leaf spot (BLS)

In this study, different fungicides were evaluated to control the rice brown leaf spot and their effect on paddy yield. The results showed that after the application of six fungicides to control the brown leaf spot were significantly ($P \leq 0.05$) as compared to Control that showed the 61.33% of disease incidence (Table 2). The fungicide Switch DF 80 WF showed the best result with 10% disease incidence. Similarly the Amistar Top 325 SC, Kumulus DF 80 WG, Nativo 75 WG and Score 250 EC showed the intermediate result and the disease incidence reported were 14.66%, 15.33%, 15.66% and 17.66% respectively. The Kocide 3000 52.4 WG was least effective to control the brown leaf spot and had 22.33% disease incidence. Similarly, different research had conducted studies regarding the efficacy of fungicide like Dubey evaluated the eight fungicides to control the brown leaf spot and found the Topsin M+indofil M-45 was effective among of all these [5]. Haq et

al. conducted a laboratory experiment to identify the effective fungicide (Derosal, Trimiltox, Dithane M-45, Sunlet, Bayeltan, Acrobat and Captan) that controlled the mycelial growth of brown leaf spot [6]. They found that Captan and Acrobat were the most effective fungicide compared to others. Furthermore, the application of fungicide not only controls the disease but also improve the grain yield. The effect of fungicide on paddy yield was given in table 2. The result showed that maximum average grain yield (4.75 t/ha) increased after the application of Switch DF 80 WG. The application of Score 250 EC, Amistar Top 325 SC and Kumulus DF 80 WG resulted in average grain yield of 4.08 t/ha, 3.75 t/ha and 3.58 t/ha respectively as compared to control (2.08 t/ha). These results are also in conformity with those of Tirmali et al. that the application of fungicide improved the paddy yield [7].

Treatments (Trade Name)	Generic Names	Dose/acre	Brown Leaf Spot incidence (%)	Protection value (%)	Yield t/ha
Amistar Top 325 SC	Azoxystrobin+Difenconazonle	200 mL	14.66 ^c	76.09	3.75 ^b
Kumulus DF 80 WG	Sulfur	800 g	15.33 ^c	75	3.58 ^b
Nativo 75 WG	Tebuconazole+Trifloxystrobin	65 g	15.66 ^c	74.46	2.33 ^{cd}
Switch DF 80 WG	Sulfur	800 g	10 ^d	83.69	4.75 ^a
Kocide 3000 52.4 WG	Copper hydroxide	250 g	22.33 ^b	63.59	2.75 ^c
Score 250 EC	Difenconazole	125 mL	17.66 ^c	71.2	4.08 ^b
Control	Water	-	61.33 ^a	-	2.08 ^d
	LSD Value		4.576		0.254

Table 2: Comparative efficacy of different chemicals treatments against brown leaf spot (BLS) disease in rice (*Oryza Sativa L.*).

Bacterial leaf blight (BLB)

In past, BLB is mostly controlled by application of Bordeaux mixture or combination of mercury and copper. However several antibiotics and their derivate compound have been used to control the BLB efficiently. In this study, six different chemical and their effect on paddy yield were evaluated and compared. The result showed that all the treatments were significantly different ($P \leq 0.05$) from the control. The Nativo 75 WG showed better control of BLB incidence (9.3%) along with highest yield (5.43 t/ha). It followed by the Score 250 EC, Copper Oxchloride had 10.33 and 12.33% disease incidence along with protection value of 86.34 and 83.7%, respectively. The Switch 3000 52.4 WG was least effective in controlling BLB incidence (19.33%) as

compared to control (75.66%) and had lowest paddy yield (2.75 t/ha) among all studied chemicals (Table 3). Mustafa et al. also observed the same results and further confirmed by this study. Their results showed that Nativo was most effective to control BLB then others [8]. Moreover, Khan et al. also showed that application of Vigran blue and Copper Oxchloride in foliar form were the most effective to control the BLB incidence [9]. Similarly, Chaudhary et al. evaluated the three bactericide (Streptomycin@0.50 kg/ha, Copper Oxchloride 50%@1.25 kg/ha and Oxytetracycline@0.75 L/h) and their combination [10]. Their results showed that Bordeaux was most effective, economical and had broad spectrum mode of control over the disease incidence as compared to antibiotics and Copper Oxchloride.

Treatments (Trade Name)	Generic Names	Dose/acre	BLB incidence (%)	Protection value (%)	Yield t/ha
Dorazole 50 EC	Difenconazole+Propiconazole	125 mL	13.33 ^c	82.38	4.00 ^b
Score 250 EC	Difenconazole	125 mL	10.33 ^{cd}	86.34	4.25 ^b
Copper Oxchloride	Copper Oxchloride	300 g	12.33 ^{cd}	83.7	3.75 ^b
Kocide 3000 52.4 WG	Copper hydroxide	250 g	19.33 ^b	74.45	2.75 ^c
Switch DF 80 WG	Sulfur	800 g	18 ^b	76.2	4.50 ^b
Nativo 75 WG	Tebuconazole+Trifloxystrobin	65 g	9.3 ^d	87.71	5.43 ^a
Control	Water	-	75.66 ^a	-	2.33 ^c
	LSD Value		3.876		0.307

Table 3: Comparative efficacy of different chemical treatments for bacterial leaf blight (BLB) disease in rice (*Oryza Sativa L.*).

Conclusion

Efficacy of different fungicides in controlling paddy blast, bacterial leaf blight and brown leaf spot were investigated along with their effects on maintaining paddy yield under field condition. The results showed that fungicide application not only controlled the disease better but also resulted in better paddy yield as compared to control condition. In this study, Amistar Top 325 SC performed best to control the Paddy blast that leaf to high yield among all the studied chemicals.

In the case of Brown leaf spot, application of Switch DF 80 WG revealed the lowest incidence of disease along with highest protection value. Similarly, Nativo was most effective to control the BLB incidence among all the studied fungicides. Conclusively, these chemicals may be recommended and used to control these three diseases for sustainable and high paddy yield.

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