COMPARATIVE EFFICACY OF BAU-BIOFUNGICIDE AND SOME CHEMICAL FUNGICIDES IN CONTROLLING LEAF BLAST AND BROWN SPOT OF RICE

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ABSTRACT

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Efficacy of BAU-Biofungicide, a product of *Trichoderma harzianum*, Contaf 5EC (Hexaconazole), Bavistin DF (Carbendazim), Tilt 250EC (Propiconazole), Dithane M45 (Mancozeb) and Companion (Mancozeb+ Carbendazim) were evaluated for the management of some foliar diseases of rice under field condition. Leaf blast and brown spot incidence and disease severity were lowest in plots sprayed with BAU-Biofungicide. The maximum number of effective tillers/hill (21.96) was recorded in plots sprayed with BAU-Biofungicide followed by Bavistin DF (21.05). The highest number of primary branches/panicle (16.36) was recorded in plots sprayed with Companion and the highest weight of grain/panicle (g) was recorded in BAU-Biofungicide (43.93) followed by Tilt 250EC (41.73). Among all treatments *Trichoderma* based BAU-Biofungicide showed enhanced effect for controlling blast and brown spot of rice as well as increasing rice yield.

Keywords: BAU-Biofungicide, *Trichoderma harzianum*, disease incidence and disease severity, Rice.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the important food crops of Gramineae family and staple food crop in Bangladesh. In Bangladesh, about 15.04 million acres of cropped areas are under cultivation (BBS 2014), where rice grown in 1051.37 hectares of land and produces 2,326 metric tons of grains in Aus season, 5530.43 hectares of land and produces 13,023 metric tons in Aman season and 4790.67 hectares of land produces 19,007 metric tons in Boro season (BBS 2014). In Bangladesh an average yield of rice is 3.01 t/ha that is lower compared to that of China (6.9 t/ha), India (3.7 t/ha) and Indonesia (3.4 t/ha) (FAO 2014). In spite of the soil and climate of Bangladesh being favourable for rice cultivation throughout the year, there are many constraints responsible for low yield of rice in Bangladesh. Among these, disease is a major threat to its production (Ou1985). There are 12 major diseases of rice reported during rice cultivation in Bangladesh (BRRI 2014). Out of these, some foliar diseases of rice viz. blast, brown spot, narrow brown leaf spot and bacterial leaf blight cause 12-13% average yield loss (BRRI 2014). Among the diseases, Blast is a destructive foliar disease and may cause considerable yield loss (6-7) % of rice every year in Bangladesh (Khan *et al*. 2015).

In the last decades, a number of chemical fungicides with different mode of action and targets have been applied to reduce the losses caused by the diseases. The most common foliar diseases of rice are being controlled specially by fungicides application in field condition (Prosad *et al.* 2015). The use of large amount of fungicides can effectively control most of the crop diseases and decrease the crop production loss. Chemical fungicides are effective in controlling rice diseases but are important reasons for environmental hazards by breaking down natural ecosystem or by killing beneficial soil microbs etc. (Pal *et al*. 2015).

Besides chemical fungicides, biological control is one of the best options which have been emphasized to combat the problem. The use of biocontrol means may help in avoiding environmental pollution. It may be economically beneficial to our farmers as well as, it may increase the production of rice (Prajapati *et al*. 2011). BAU-Biofungicide is a *Trichoderma* based biocontrol agent which is used to protect crops from different diseases. BAU-Biofungicide protects seeds in soil from huge number of soil borne as well as seed borne fungi (Hossain and Sultana 2011). *Trichoderma harzianum* and *Pseudomonas fluorescens* in talc and oil based formulations were found to be effective against brown spot diseases caused by *Helminthosporium oryzae* of rice under field condition in India (Biswas 2012). Considering the above facts the present study was undertaken to study the comparative efficacy of BAU-Biofungicide with some chemical fungicides in controlling leaf blast and brown spot of rice.

MATERIALS AND METHODS

The experiment was conducted in the field laboratory of the Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh. BRRI dhan 50, known as "Banglamoti" a high yielding and aromatic rice variety grown in Boro season was used. The seedlings were transplanted at the age of 15 days with spacing of 25cm×15cm in the experimental field. Seven treatments viz. BAU-Biofungicide (2%), a product of *Trichoderma harzianum*, Contaf 5EC (Hexaconazole, 1ml/L), Bavistin DF (Carbendazim, 1g/L), Tilt 250EC (Propiconazole, 2ml/L), Dithane M45 (Mancozeb, 4.5g/L), Companion (Mancozeb+ Carbendazim, 2g/L) including untreated control were included in the experiment. The experiment was done following Randomised Complete Block Design (RCBD) with three replications, where each plot was 10 m^2 (5m x 2m).

Prepared BAU-Biofungicide collected from Eco-friendly Plant Disease Management Lab. of the Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh was used @ 20g/L. The chemical fungicides were collected from the local market and used as per dose mentioned above.

BAU-Biofungicide and chemicals were sprayed in the experimental plots as per treatments. Spraying was done for 3 times with 15 days interval before ten days of data collection at 60, 75 and 90 Days After Transplanting (DAT). Number of leaves/plant, number of infected leaves/plant, disease incidence and severity were recorded. The disease incidence was calculated by following formula of Ansari (1995) and the disease severity was calculated by following formula of Sharma (2010).

The recorded data on different parameters were subjected to statistical analysis by using MSTAT-C and WASP softwares to find out the significance of variation resulting from experimental treatments. The difference between the treatment means were judged by Duncan's Multiple Range Test (DMRT) following Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Effect of BAU-Biofungicide and chemical fungicides on No. of infected leaves/plant was differed significantly among the different treatments (Table 1). The highest number of infected leaves/plant was recorded in Companion (6.96) followed by control (6.56) and the minimum number of infected leaves/plant was recorded in Dithane M45 (3.85) preceded by BAU-Biofungicide (4.53) at 60 DAT. At 75 DAT the highest number of infected leaves/plant was recorded in Contaf (7.43) and the lowest total number of infected leaves/plant was recorded in Dithane M45 (5.70). At 90 DAT the highest number of infected leaves/plant was recorded in control (10.40) and the lowest number of infected leaves/plant was recorded in Contaf 5EC (5.45). Raju and Hossain (2015) reported lowest leaf infection of rice disease in plots treated with BAU-Biofungicide. Contaf 5EC/Hexaconazole (Johnson *et al.*, 2013; Lore *et al*, 2007), Tilt 25^0EC/Propiconazole (Lore *et al.* 2007), Dithane M45/Mancozeb (Hajano *et al*. 2012*)* were reported to control leaf infection of rice.

The disease incidence (%) of leaf blast was significantly influenced by the treatments and ranged from 10.90% to 6.31% at 60 DAT, where the highest disease incidence (%) was recorded in control (10.90%) and the lowest disease incidence (%) was recorded in plots sprayed with BAU-Biofungicide (6.31%). At 75 DAT, the maximum leaf blast disease incidence (%) was found in control plot (19.21%) and the minimum disease incidence (%) was recorded in plots sprayed with BAU-Biofungicide (10.73%). At 90 DAT, the highest disease incidence (%) was recorded in control (29.70%) followed by Contaf 5EC (28.23%). The lowest disease incidence (%) was recorded in plots sprayed with BAU-Biofungicide (15.33%) as shown in Table 2. The highest disease severity (%) was recorded in control (21.90%) followed by Bavistin DF (16.78%) and the lowest disease severity (%) was recorded in plots sprayed with BAU-Biofungicide (6.78%) at 60 DAT. At 75 DAT, the disease severity of leaf blast was also significantly affected by the treatments. The disease severity (%) ranged from 16.47% to 47.28% where the maximum disease severity (%) was found in control plot (47.28%) and the minimum disease severity (%) was recorded in plots sprayed with BAU-Biofungicide (16.47%). At 90 DAT, the highest disease severity (%) was recorded in control (51.75%) and the lowest disease severity (%) was recorded in plots sprayed with BAU-Biofungicide (23.72%) (Table 2). Thus, *Trichoderma* based BAU-Biofungicide was effective to control leaf blast of rice. Hajano *et al*. (2012) found in a in-vitro study that *Trichoderma* was effective to reduce rice blast pathogen, *Pyricularia oryzae*.

The disease incidence (%) of brown spot of rice was significantly influenced by different treatments and ranged from 5.47% to 10.30%, where the highest disease incidence (%) was recorded in control (10.30%) and the lowest disease incidence (%) was recorded in plots sprayed with BAU-Biofungicide (5.47%). At 75 DAT, the maximum disease incidence (%) was found in control plot (26.55%) followed by Companion (14.23%). The minimum disease

incidence (%) was recorded in plots sprayed with BAU-Biofungicide (11.01%). At 90 DAT, the highest disease incidence (%) was recorded in control (37.00%) and the lowest disease incidence (%) was recorded in plots sprayed with BAU-Biofungicide (12.69%) (Table 3). The disease severity (%) ranged from 17.37% to 28.46%, where the highest disease severity (%) was recorded in control (28.46%) and the lowest disease severity (%) was recorded in plots sprayed with BAU-Biofungicide (17.37%) preceded by Companion (19.20%). At 75 DAT, the disease severity (%) ranged from 21.22% to 47.09% where the maximum disease severity (%) was found in control plot (47.09%) followed by Companion (40.10%) and Dithane M45 (35.38%). The minimum disease severity (%) was recorded in plots sprayed with BAU-Biofungicide (21.22%). At 90 DAT, the mean disease severity (%) was also significantly influenced by the treatments the highest disease severity (%) was recorded in control (58.92%) followed by Tilt 250 (51.55%). The lowest disease severity (%) was recorded in plots sprayed with BAU-Biofungicide (26.54%). This findings are similar to the observation of Joshi *et al.* (2007) who evaluated the efficacy of *Trichoderma harzianum* in talc- and oil-based formulations against brown spot (caused by *Helminthosporium oryzae*) of rice cultivars PR 116 and Basmati rice 386 under field conditions in India during 2005. Sharma *et al.* (2015) found that seed treatment with *Trichoderma harzianum* was most effective against brown spot intensity. Ahmed (2002) observed that *Trichoderma* solution spraying was effective against *Bipolaris oryzae* at field condition. Raju and Hossain (2015) reported that the lowest disease incidence and severity of leaf blast, brown spot, and narrow brown leaf spot were observed in field condition spraying with BAU-Biofungicide.

The number of tillers/hill was significantly affected by the treatments (Table 4). The total number of tillers/hill ranged from 13.00 to 18.90, where the maximum number of tillers/hill was recorded in plots sprayed with Companion (18.90) and the minimum number of tillers/hill was recorded in Contaf 5EC (13.00). The maximum number of effective tillers/hill were recorded in plots sprayed with BAU-Biofungicide (21.96). The minimum number of effective tillers/hill were recorded in control (12.61) preceded by Dithane M45 (18.29). The total number of panicle length (cm) ranged from 18.83 to 25.60, where the highest plant height was recorded in Bavistin DF (25.60) followed by Companion (24.30). The lowest plant height was found in Contaf (18.83). The total number of primary branches/panicle ranged from 10.42 to 16.36, where the maximum number of primary branches/panicle was recorded in plots sprayed with companion (16.36) followed by Bavistin DF (14.76) and Tilt 250EC (13.16). The minimum number of primary branches/panicle was recorded in control (10.42). Significant differences were found among the weights of grain/panicle (g). The total weight of grain/panicle (g) ranged from 31.73 to 43.93, where the highest weight of grain/panicle (g) was recorded in BAU-Biofungicide (43.93) followed by Tilt 250EC (41.73). The lowest weight of grain/panicle (g) was found in Contaf 5EC (31.73) preceded By Dithane M45 (38.63).

These results, in conjunction with the present study provide evidences that BAU-Biofungicide is an effective biocontrol means for controlling blast and brown spot of rice as well as increasing rice yield.

Table 1. Effect of BAU-Biofungicide and chemical fungicides on No. of infected leaves/ plant

Treatment	Number of infected leaves/ plant		
	60 DAT	75 DAT	90 DAT
$T_{1=}$ BAU-Biofungicide	4.53 cd	6.23 bc	5.73 c
$T_{2=}$ Contaf 5EC	5.66 abc	7.43 a	5.45 c
T_3= Bavistin DF	5.16 bcd	5.80 c	7.00 bc
T_4= Tilt 250EC	6.00 abc	5.96 bc	5.94 c
T_5= Dithane M45	3.85 d	5.70 c	7.63 b
T_6= Companion	6.96 a	6.90 ab	5.66 c
T_7= Control	6.56 ab	6.30 bc	10.40 a
Level of significance	*	*	**
CV (%)	12.23	8.79	13.62

DAT = Day After Transplanting, Data were subjected to ANOVA. *P < 0.05, *P < 0.01. Similar letter(s) in a column did not differed significantly at 5% level by DMRT

Table 2. Effect of BAU-Biofungicide and some chemical fungicides on disease incidence and disease severity of leaf blast of rice

Treatment	60 DAT		75 DAT		90 DAT	
	Disease incidence (%)	Disease severity (%)	Disease incidence (%)	Disease severity (%)	Disease incidence (%)	Disease severity (%)
$T_{1=}$ BAU-Biofungicide	6.31 c	6.78 e	10.73 c	16.06 e	15.33 e	23.72 e
$T_{2=}$ Contaf 5EC	7.38 bc	12.26 cd	17.25 ab	21.47 cd	28.23 ab	28.63 d
T_3= Bavistin DF	6.78 bc	16.78 b	15.22 b	36.71 b	26.00 ab	40.47 c
T_4= Tilt 250EC	7.35 bc	10.55 cd	16.22 ab	25.08 c	22.61 cd	31.49 d
T_5= Dithane M45	8.08 bc	14.14 bc	17.00 ab	45.46 a	20.38 d	46.44 b
T_6= Companion	8.63 b	7.72 e	14.56 b	19.15 de	25.34 bc	40.06 c
T_7= Control	10.90 a	21.90 a	19.21 a	47.28 a	29.70 a	51.75 a
Level of significance	*	**	**	**	**	**

DAT = Day After Transplanting, Data were subjected to ANOVA. *P < 0.05, *P < 0.01. Similar letter(s) in a column did not differed significantly at 5% level by DMRT

Table 3. Effect of BAU-Biofungicide and some chemical fungicides on disease incidence and disease severity of Brown spot of rice

Treatment	60 DAT		75 DAT		90 DAT	
	Disease incidence (%)	Disease severity (%)	Disease incidence (%)	Disease severity (%)	Disease incidence (%)	Disease severity (%)
$T_{1=}$ BAU-Biofungicide	5.47 c	17.37 d	11.01 c	21.22 e	12.69 d	26.54 e
$T_{2=}$ Contaf 5EC	6.70 bc	19.87 cd	11.11 bc	34.74 c	14.03 d	40.23 d
T_3= Bavistin DF	6.78 bc	22.45 bc	14.35 b	24.56 e	19.79 c	48.03 c
T_4= Tilt 250EC	5.81 c	26.48 ab	12.42 bc	29.68 d	18.56 c	51.55 a
T_5= Dithane M45	5.70 c	22.83 bc	14.24 bc	35.38 c	28.69 b	41.33 d
T_6= Companion	8.33 ab	19.20 cd	14.23 bc	40.10 b	19.67 c	49.99 bc
T_7= Control	10.30 a	28.46 a	26.55 a	47.09 a	37.00 a	58.92 b
Level of significance	**	**	**	**	**	**

DAT = Day After Transplanting, Data were subjected to ANOVA. *P < 0.05, *P < 0.01. Similar letter(s) in a column did not differed significantly at 5% level by DMRT

Table 4. Efficacy of BAU-Biofungicide and chemical fungicides on No. of tillers/hill, No. of effective tillers/hill, panicle length, No. of primary branches/panicle and weight of grain/panicle of rice

Treatments	**No. of tillers/ hill**	**No. of effective tillers/ hill**	**Panicle length (cm)**	**No. of primary branches/ panicle**	**Weight of grain/panicle (g)**
$T_{1=}$ BAU-Biofungicide	16.00 ab	21.96 a	19.26 cd	12.10 cd	43.93 a
$T_{2=}$ Contaf 5EC	13.00 b	18.63 c	18.83 d	12.66 bcd	31.73 d
T_3= Bavistin DF	18.63 a	21.05 ab	25.60 a	14.76 ab	39.16 bc
T_4= Tilt 250EC	17.30 a	19.70 abc	21.56 bcd	13.16 bc	41.73 ab
T_5= Dithane M45	18.10 a	18.29 c	22.30 b	12.73 bcd	38.63 c
T_6= Companion	18.90 a	18.50 bc	24.30 ab	16.36 a	39.10 bc
T_7= Control	15.96 ab	12.61 d	21.66 bc	10.42 d	38.06 c
Level of significance	*	**	**	**	**

DAT = Day After Transplanting, Data were subjected to ANOVA. *P < 0.05, *P < 0.01. Similar letter(s) in a column did not differed significantly at 5% level by DMRT

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