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Research Article

ECO-FRIENDLY MANAGEMENT OF RICE DISEASES

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Abstract

Comparative efficacy of BAU-Biofungicide (2%), a product of *Trichoderma harzianum*, Garlic (*Allium sativum*) clove extract (5%), Allamanda (*Allamanda cathartica*) leaf extract (5%), Bion (25ppm), Amistar (0.1%) and Tilt 250EC (0.1%) were evaluated for eco-friendly management of diseases of rice cv. BRRI Dhan-49 under field and laboratory conditions from July,2013 to March,2014. The field experiment was carried out following Randomised Complete Block Design and the laboratory experiments were done following Completely Randomized Design. Brown spot, Narrow brown leaf spot, Bacterial leaf blight and Sheath blight were recorded in the field. The lowest incidence of brown spot and narrow brown leaf spot was observed in plots treated with BAU-Biofungicide and that of bacterial leaf blight was observed in plots sprayed with Allamanda leaf extract. In case of sheath blight, the lowest incidence was observed in BAU-Biofungicide sprayed plots. The highest grain yield (3680.34kg/ha) was recorded in plots sprayed with BAU-Biofungicide which is 40.56% higher over control. The highest seed germination (%) was recorded when seeds were treated with Garlic clove extract (89.29%) followed by BAU-Biofungicide (87.30%). The prevalence of seed-borne fungi was investigated by blotter method. The identified seed-borne fungal species were *Bipolaris oryzae, Fusarium oxysporum, Fusarium moniliforme, Curvularia lunata, Aspergillus niger* and *Aspergillus flavus*. Maximum reduction of seed-borne infection of pathogens was obtained by treating seeds with BAU-Biofungicide (2% of seed weight).

Kew-words: BAU; Biofungicide; Plant extract; Rice disease

Introduction

Rice (*Oryza sativa* L.) is the most important food for over two billion people in Asia and for hundreds of million in Africa and Latin America. To feed the ever increasing population of these regions the world's annual rice production must be increased from the present 560 to 750 million tonnes by 2020 (Saranraj *et al.* 2013). Rice ranked first position by production during the year 2012-2013 among all the cereals in Bangladesh (BBS, 2013). At present the total area and production of rice in Bangladesh is about 11.65 million hectares and 34.00 million metric tons, respectively (BBS, 2013). Among reasons of low yield of rice, diseases pose a major threat to its production (Ou, 1985). As many as 43 diseases are reported on rice in Bangladesh (Fakir, 2000). Rice is suffering from brown spot to a great extent. It caused Bengal famine in 1943 (Padamanabhan, 1973). Bacterial leaf blight is a destructive systemic disease and may cause an average 20-30% yield loss (0u. 1985). Sheath blight has been also documented to be one of the major and destructive diseases of rice occurring in Bangladesh (Miah *et al*. 1985; Shahjahan *et al*. 1987). The common diseases of rice are being controlled specially by sowing of seed treated with fungicides and fungicide application in the field that break down the natural ecological balance. The use of eco-friendly management practices may help in avoiding environmental pollution as well as increase the production of rice. Considering the above facts the present study was undertaken to find out the efficacy of different eco-friendly management practices of rice diseases for successful crop production.

Materials and methods

The field experiment was carried out in the field laboratory of the Department of Plant Pathology, Bangladesh Agricultural University (BAU), Mymensingh and laboratory experiments were conducted in the Eco-friendly Plant Disease Management laboratory of the Department of Plant Pathology and Seed Pathology Centre, BAU, Mymensingh during the period from July, 2013 to March, 2014. BRRI dhan 49, a high yielding rice variety was used as test crop. The field experiment was carried out in Randomized Complete Block Design with 3 replications. The unit plot size was 10 m^2 (5m×2m). Normal agronomic practices and fertilization were used for the study as per recommended dose of Fertilizer Recommendation Guide (BARC, 2012). BAU-Biofungicide (2%), Garlic clove extract (5%), Allamanda leaf extract (5%), Bion (25ppm), Amistar (0.1%) and Tilt 250EC (0.1%) were applied as foliar spray for 3 times with 10 days interval at 65, 75 and 85 DAT, respectively. Only water was sprayed in case of control plots. Data were recorded on Brown spot, narrow brown leaf spot, Bacterial leaf blight (BLB) and Sheath blight at 70, 80 and 90 DAT, respectively. The disease incidence was calculated following Ansari (1995).

The severity of the diseases was recorded following Standard Evaluation System for Rice (IRRI, 2002). All data were analyzed for evaluating test of significance. After harvesting the field plots, the rice seeds of individual plots were stored separately in small-sized white colored cotton bags at room temperature until use for further study. These stored seeds were used for the laboratory experiments. The seeds were inspected visually and grouped into different categories for the presence of any distinct disease symptom or any other physiological abnormalities. Seeds were then treated with BAU-Biofungicide (2%), Garlic clove extract (5%), Allamanda leaf extract (5%), Bion (25ppm), Amistar (0.1%) and Tilt 250EC (0.1%). For seed treatment, required amount of each seed sample was dipped in each treatment solution for overnight. Then the solutions were drained out and the treated seeds were dried on blotting papers for 6 hours. A set of control was maintained by dipping the seeds in sterile water. To detect the seed borne pathogens associated with the seeds in seed samples the Blotter method was used by following ISTA rules for seed testing (ISTA, 1996). In this method, three layers of blotting paper (Whatman filter no.1) were soaked in sterilized water and placed at the bottom of 9 cm dia plastic petridish and thereafter 25 seeds were plated. The seeds in the petridishes were incubated in the incubation chamber at 20 ± 2 °C under alternating cycles of 12 hours near ultraviolet light and darkness for 7 days. Seed germination was recorded at 7 days after incubation and expressed in percentage. Each individual incubated seed was observed under stereomicroscope at 16x and 25x magnifications in order to record the incidence of seed borne fungi. Most of the associated pathogens were detected by observing their growth characters on the incubated seeds on blotter paper following the keys outlines by Ramnath *et al*. (1970) and Khan (1975).

Results and Discussion

The lowest brown spot incidence was observed in plots sprayed with BAU-Biofungicide (8.88%, 9.88% and 10.00% at 70, 80 and 90 DAT, respectively) (Table 1). These findings are similar to the observation of Joshi *et al.* (2007) who evaluated the efficacy of *Trichoderma harzianum* and *Pseudomonas fluorescens* in talc- and oil-based formulations against brown spot of rice cultivars PR 116 and Basmati rice 386 under field conditions in India during 2005. The lowest incidence of narrow brown leaf spot was observed in plots treated with BAU-Biofungicide (6.00%, 6.33% and 8.37% at 70, 80 and 90 DAT, respectively). These findings are supported by Reyes *et al.* (2007) who reported that *Trichoderma harzianum* has good potentialities for the control of narrow brown leaf spot of rice. The lowest incidence of bacterial leaf blight was observed in plots sprayed with Allamanda leaf extract (2.50%, 2.66% and 2.85% at 70, 80 and 90 DAT, respectively). These findings are in accordance with the findings of Mostafa (2004). They reported that leaf extract of Allamanda was best in reducing the incidence of bacterial and viral diseases of rice. In case of sheath blight, the lowest incidence was observed in BAU-Biofungicide sprayed plots (11.33%, 13.73% and 15.00% at 70, 80 and 90 DAT, respectively). This finding can be correlated with the work of Rahman (2007) who carried out an experiment to find out the effectiveness of *Trichoderma* spp. for controlling sheath blight of rice. *Trichoderma harzianum* significantly reduced the pathogen of sheath blight of rice. This is similar to the findings of Reyes *et al.* (2007) and Khan and Sinha (2005).

The lowest brown spot severity was found in plots sprayed with Garlic clove extract (12.32%, 13.76% and 14.09% at 70, 80 and 90 DAT, respectively) (Table 2). These findings are in agreement with that of Ahmed (2002) who reported that Neem and Garlic extracts were effective against *Bipolaris oryzae* at 1:1 dilution. The lowest severity of narrow brown leaf spot was found in BAU-Biofungicide sprayed plots (9.51%, 9.86% and 10.31% at 70, 80 and 90 DAT, respectively). These findings are similar to the observation of Khan and Sinha (2007) who found that *Trichoderma harzianum* was found best in managing narrow brown leaf spot, compared to other commercial formulations of bioagents, giving 48.1% reduction in disease severity. The lowest bacterial leaf blight severity (%) was also found in plots sprayed with BAU-Biofungicide (15.77%, 16.10% and 16.44% at 70, 80 and 90 DAT, respectively). Tang *et al.* (2001) supported this finding. They evaluated the biological control efficiency of *Trichoderma* spp. against the bacterial leaf blight pathogen, *Xanthomonas oryzae*. The lowest severity of sheath blight was found in BAU-Biofungicide (4.27%, 7.70% and 9.84% at 70, 80 and 90 DAT, respectively). These findings are in accordance with the findings of Tewari and Rajbir (2005). They observed that, foliar spray of *Trichoderma harzianum* was superior showing significantly reduced sheath blight severity (40.82%) compared to other treatments.

BAU-Biofungicide shown best performance in case of maximum panicle length (21.76 cm), maximum no. of panicle/hill (13.27), highest total no. of grains/panicle (114.12), highest weight of grains/panicle (2.73g) and maximum weight of grains/hill (17.29g), respectively (Table 3). The highest weight of 100 grains (2.37g) was observed in Tilt 250EC sprayed plots. The highest grain yield was observed in case of BAU-Biofungicide (3680.34 kg/ha) which is 40.56% higher over control. These findings are in accordance with the findings of Khan and Sinha (2005). They reported that foliar spray of *Trichoderma harzianum* was most effective in increasing grain yield of rice (20.25-23.13%).

Table 1: Comparative efficacy of different treatments on incidence (%) of different diseases of rice cv. BRRI dhan 49 at 70, 80 and 90 DAT, respectively

Treatments	Disease incidence (%)											
	Brown spot			Narrow brown leaf spot			Bacterial leaf blight			Sheath blight		
	70 DAT	80 DAT	90 DAT	70 DAT	80 DAT	90 DAT	70 DAT	80 DAT	90 DAT	70 DAT	80 DAT	90 DAT
BAU-Biofungicide	8.88 g	9.88 b	10.00 b	6.00 b	6.33 b	8.37 b	2.99 bc	3.13 d	3.40 d	11.33 d	13.73	15.00
Garlic (clove extract)	9.29 f	10.00 ab	10.67 ab	7.83 ab	8.00 ab	9.49 ab	3.49 abc	3.57 c	3.80 c	15.15 c	15.65	16.51
Allamanda (leaf extract)	10.00 e	10.30 ab	10.46 b	8.33 ab	9.54 ab	12.00 ab	2.50 c	2.66 e	2.85 e	18.89 b	18.97	19.92
Bion	11.00 c	11.20 ab	11.44 ab	7.01 b	8.13 ab	10.93 ab	3.08 bc	3.31 d	3.90 c	19.20 b	19.28	20.23
Amistar	12.20 b	12.24 ab	13.30 ab	8.40 ab	9.62 ab	12.70 ab	4.10 ab	4.22 b	4.27 b	21.56 a	21.86	22.50
Tilt 250EC	10.56 d	10.60 ab	11.08 ab	6.44 b	7.77 ab	11.24 ab	4.63 a	4.75 a	4.78 a	18.63 b	20.00	21.00
Control	12.97 a	13.40 a	14.00 a	9.60 a	12.74 a	13.74 a	4.71 a	4.87 a	4.94 a	23.30 a	23.70	24.40
Level of significance	**	**	**	**	**	**	**	**	**	**	NS	NS

Figures in a column with same letter(s) do not differ significantly.
** Significant at 1% level of significance, NS= Non significant

Table 2: Comparative efficacy of different treatments on severity (%) of different diseases of rice cv. BRRI dhan 49 at 70, 80 and 90 DAT, respectively

Treatments	Disease severity (%)											
	Brown spot			Narrow brown leaf spot			Bacterial leaf blight			Sheath blight		
	70 DAT	80 DAT	90 DAT	70 DAT	80 DAT	90 DAT	70 DAT	80 DAT	90 DAT	70 DAT	80 DAT	90 DAT
BAU-Biofungicide	13.93 f	14.51 f	14.87 e	9.51 f	9.86 f	10.31 f	15.77 g	16.10 g	16.44 g	4.27 b	7.70 b	9.84
Garlic (clove extract)	13.32 g	13.76 f	14.09 e	11.40 e	11.75 e	12.22 e	23.89 d	23.93 d	24.23 d	6.66 ab	9.96 ab	11.00
Allamanda (leaf extract)	16.59 d	16.93 d	17.26 d	16.91 b	16.98 b	16.98 b	18.39 f	18.70 f	19.24 f	6.00 ab	9.34 ab	11.80
Bion	21.55 b	21.91 b	22.58 b	13.27 d	13.80 d	14.13 d	27.14 c	27.65 c	27.99 c	7.33 a	10.73 a	12.78
Amistar	19.78 c	20.11 c	20.44 c	14.61 c	14.78 c	15.48 c	30.13 b	30.65 b	31.01 b	7.87 a	11.00 a	13.44
Tilt 250EC	15.39 e	15.73 e	16.41 d	9.70 f	9.92 f	10.39 f	19.62 e	19.94 e	20.61 e	5.80 ab	9.04 ab	11.89
Control	23.61 a	23.93 a	23.99 a	19.79 a	19.91 a	20.75 a	37.44 a	37.81 a	38.54 a	7.88 a	10.90 a	15.20
Level of significance	**	**	**	**	**	**	**	**	**	**	**	NS

Figures in a column with same letter(s) do not differ significantly.
** Significant at 1% level of significance, NS= Non significant

Table 3: Comparative efficacy of different treatments on yield components and grain yield of rice cv. BRRI dhan 49

Treatments	Panice length (cm)	Number of panicle/hill	Number of grains/ panicle	Weight of grains/ Panicle (g)	Weight of Grains/ hill (g)	Weight of 100 grains (g)	Grain yield (kg/ha)	% increase of grain yield over control
BAU-Biofungicide	21.76	13.27 a	114.12 a	2.73 a	17.29 a	2.29 ab	3680.34 a	40.56
Garlic (clove extract)	19.83	12.77 b	108.75 b	2.45 b	16.91 bc	2.28 ab	3395.51 c	29.68
Allamanda (leaf extract)	19.83	11.33 d	103.90 c	2.32 c	16.64 c	2.00 cd	3584.89 b	36.92
Bion	19.63	10.37 f	100.02 d	2.17 d	15.74 d	2.14 bc	3369.46 c	28.69
Amistar	19.93	10.74 e	99.82 d	1.99 e	14.87 e	1.97 cd	3310.70 d	26.44
Tilt 250EC	20.26	12.41 c	113.70 a	2.13 d	17.11 ab	2.37 a	2986.49 e	14.06
Control	18.87	9.76 g	97.87 e	1.99 e	14.37 f	1.93 d	2618.30 f	
Level of significance	NS	**	**	**	**	**	**	

Figures in a column with same letter(s) do not differ significantly.
** Significant at 1% level of significance, NS= Non significant

Table 4: Comparative efficacy of different treatments on % of different categories of grains/panicle of rice cv. BRRI dhan 49

Treatments	% of different categories of grains/panicle					
	Filled grains	**Diseased filled grains**	**Healthy filled grains**	**Chaffy grains**	**Diseased chaffy grains**	**Healthy chaffy grains**
BAU-Biofungicide	79.38 a	44.00	35.38 c	20.62 f	15.62	5.00 c
Garlic (clove extract)	74.54 d	39.75	34.79 d	25.46 d	21.26	4.19 d
Allamanda (leaf extract)	73.85 c	31.65	42.19 a	26.15 b	18.16	7.99 a
Bion	74.71 e	43.24	31.47 f	25.29 e	21.62	3.67 e
Amistar	71.52 f	38.89	33.62 e	28.48 b	24.21	4.28 de
Tilt 250EC	75.79 b	36.60	39.18 b	24.21 c	18.26	5.96 b
Control	68.82 g	38.73	30.08 g	31.18 a	28.32	2.85 f
Level of significance	**	NS	**	**	NS	**

Figures in a column with same letter(s) do not differ significantly.
** Significant at 1% level of significance, NS= Non significant

Table 5: Efficacy of different treatments on seed-borne infections of rice cv. BRRI dhan 49

Treatments	% seed germination	% increase of seed germination over control	% pathogen infection after seed treatment					
			Bipolaris oryzae	***Fusarium oxysporum***	***Fusarium moniliforme***	***Curvularia lunata***	***Aspergillus niger***	***Aspergillus flavus***
BAU-Biofungicide	87.30 b	18.84	5.80 f	2.72 g	1.94 f	1.19 f	0.90 e	1.77 e
Garlic (clove extract)	89.29 a	21.55	8.96 d	7.76 d	3.76 e	2.64 d	1.49 d	2.58 cd
Allamanda (leaf extract)	84.15 c	14.55	11.66 c	11.01 c	7.83 c	3.46 c	2.29 c	2.96 c
Bion	80.44 d	9.50	15.02 b	15.70 b	8.66 b	4.53 b	2.97 b	3.77 b
Amistar	78.18 e	6.42	8.92 d	5.78 e	5.79 d	2.02 de	1.17 de	1.28 f
Tilt 250EC	77.30 f	5.23	7.83 e	3.63 f	3.10 e	1.89 ef	1.93 c	2.14 de
Control	73.46 g		17.19 a	19.37 a	13.35 a	10.96 a	5.73 a	10.37 a
Level of significance	**		**	**	**	**	**	**

Figures in a column with same letter(s) do not differ significantly.
** Significant at 1% level of significance

BAU-Biofungicide shown best performance in terms of highest % filled grains (79.38%), lowest chaffy grains (20.62%), and lowest diseased chaffy grains (15.62%) (Table 4). The minimum % diseased filled grains (31.65%), maximum % healthy filled grains (42.19%) and highest % healthy chaffy grains (7.99%) were observed in Allamanda leaf extract.

The highest seed germination (%) was recorded when seeds were treated with Garlic clove extract (89.29%) which is 21.55% higher over control (Table 5). This finding is supported by the work of Ahmed et al. (2013) who reported that Garlic extract (1:1) was best for successful reduction of seed-borne infection which increased seed germination up to 68.39% over control. BAU-Biofungicide shown best performance in terms of lowest % seed-borne infection after seed treatment of Bipolaris oryzae (5.80%), Fusarium oxysporum (2.72%), Fusarium moniliforme (1.94%), Curvularia lunata (1.19%) and Aspergillus niger (0.90%). The minimum % seed-borne infection of Aspergillus flavus (1.28%) was observed in case of Amistar, which is closely followed by BAU-Biofungicide.

Conclusion

The present experiments were conducted for one season (Aman season) with a single rice cultivar. Hence, it is difficult to draw a sound conclusion on the efficacy of BAU-Biofungicide, Garlic clove extract, Allamanda leaf extract, Bion, Amistar and Tilt 250EC for eco-friendly management practices in controlling rice diseases to obtain higher grain yield. Therefore, this study need to be carried out under different agro-ecological zones in the country. However, farmers can be advised to use BAU-Biofungicide for seed treatment and field spray to fulfil the requirement of eco-friendly management practices of rice diseases for successful crop production with an increase in yield.

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References

Ahmed M, Hossain I, Hassan K and Dash CK (2013) Efficacy of Different Plant Extract on Reducing Seed Borne Infection and Increasing Germination of Collected Rice Seed Sample. *Universal Journal of Plant Science*. **3**: 66-73.

Ahmed MF (2002) Efficacy of some fungicides and plant extracts against *Biploris oryzae*. M.S. Thesis, Dept. of Plant Pathology, BAU, Mymensingh, pp. 1-82.

Ansari MM (1995) Control of sheath blight of rice by plant extracts. *Indian Phytopathol*. **3**: 268-270.

BBS (2013) Statistical pocket book Bangladesh. Bangladesh Bureau of Statistics, Stat. Div., Minis. Plan. Govt. People's Repub. Bangladesh. pp. 207.

IRRI (2002) Standard Evaluation System for Rice (SES), **6**: 12.

ISTA (1996) International Rules of Seed Testing Association. In. Proc. Int. Seed Test. Assoc. pp. 19-41.

Joshi N, Brar KS, Pannu PP and Singh P (2007) Field efficacy of fungal and bacterial antagonists against brown spot of rice. *Journal of Biological Control*. **21**: 159-162.

Khan AA and Sinha AP (2007) Biocontrol potential of *Trichoderma* species against sheath blight of rice. *Indian Phytopathol*. **60**: 208-213.

Khan S (1975) Effect of seed treatments on brown spot disease and their influence on rice seedling. *Madras Agricultural Journal*. **75**: 57-58.

Miah SA, Shahjahan AKM., Hossain MA and Sharma NR (1985) Survey of rice diseases in Bangladesh: Tropical Pest Management. **31**: 208-213. DOI: 10.1080/09670878509370984

Mostafa M (2004) Effect of some plant extracts on viral disease of tomato. M.S. thesis, Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh, pp. 1-56.

Ou SH (1985) Rice diseases. 2nd edition. Commonwealth Mycological Institute, Kew, Surrey. England, pp: 198.

Padmanabhan SY (1973) The Great Bengal famine. A Review of Plant Pathology, **11**: 11-24.

Rahman Z (2007) Biological control of sheath blight of rice using antagonistics *Trichoderma*. M.S. Thesis. Dept. of Plant Pathology, Bangladesh Agricultural University, Mymensingh, pp. 1-58.

Ramnath, Mathur SB. and Neergaard P (1970) Seed borne fungi of mungbean from India and their significance. Proc. Int. Seed Test. Association, **35**: 225-241.

Reyes R, Rodriguez TG, Pupo AD, Alarcon L and Limonta, Y (2007) *In vitro* effecacy of *Trichoderma harzianum* for biocontrol of *Rhizoctonia solani* and *Pyricularia grisea* isolated from rice crop *(Oryza saliva* L.). Fitosanidad **11**: 29-33.

Saranraj P, Sivasakthivelan P and Sivasakthi S (2013) Prevalence and production of plant growth promoting substance by *Pseudomonas fluorescens* isolated from paddy rhizosphere soil of Cuddalore district, Tamil Nadu, India. *African Journal of Basic and Applied Sciences*. **5**: 95-101.

Shahjahan AKM, Duve T and Bonman JM (1987) Climate and rice disease in weather and rice. IRRI, Los Banon, Lequa, Philippines. pp. 125-128.

Tang J, Tian B, LingXia M, Ping W and Hong C (2001) Biocontrol of *Rhizoclonia solani* with *Trichoderma* spp. CRRN. Chinese Rice Research Newsletter. **9**: 8.

Tewari L and Rajbir S (2005) Biological control of sheath blight of rice by *Tridoderma harzianum. Indian Phytopathol*. **58**: 35-40.