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INTEGRATED MANAGEMENT OF SEED BORNE PATHOGENIC FUNGI OF BRRI 29 RICE VARIETY

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Key words: Integrated management, Pathogenic fungi, BRRI 29 rice variety, Bangladesh

Abstract

A pot experiment was conducted with the single and combined doses of fungicides, plant extracts and antagonist for the management of nine rice pathogens. A total of 13 treatments including controls with or without inocula of the pathogen were tested. Amongst all the treatments only T6 (Bavistin + *Azadirachta indica* + *Trichoderma harzianum*) showed highest percentage of seed germination and seedling vigor index of seeds inoculated with *Alternaria alternata* , *Aspergillus flavus*, *Curvularia lunata* and *Pestalotiopsis guepinii*. Next to T6, T10 (Bavistin + Tall + *Azadirachta indica* + *Citrus medica*) showed promising result against *Drechslera oryzae*, *Fusarium moniliforme*, *Microdochium oryzae* and *Sarocladium oryzae*. T3 treatment (*Azadirachta indica*) showed highest percentage of seed germination and seedling vigor index in case of seeds inoculated with *Fusarium solani*. Amongst all treatments the integrated use of Bavistin, *A. indica* and *T. harzianum* showed the better performance for growth reduction of test pathogens and increased germination of seeds.

Introduction

Rice is the staple food of Bangladesh and there are many constraints responsible for low yield of rice in Bangladesh. The extremely seed borne pathogens *viz*. *Bipolaris oryzae* (Breda de Haan) Shoem. *Fusarium moniliforme* Sheldon, *Pyricularia oryzae* Cavara, *Rhizoctonia solani* Kuhn, *Sarocladium oryzae* (Sawada) W. Gams. and D. Hawks, *Sclerotium oryzae* (Catt.) R.A. Krause and R.K. Webster, *Microdochium oryzae* (Hashloka and Yokogi) Sam. and Hal., *Curvularia lunata* (Wakker) Boedijn etc. are associated with seed infection of rice causes yield reduction, quality deterioration and germination failure[1-3]. These diseases are very common in many parts of South East Asia and considerable losses in rice production. Grain spotting or discoloration causes both quantitative and qualitative losses in rice[4]. In Bangladesh, 43 diseases are known to occur on the rice crop and among these 36 are seed borne, of which 14 are of major importance[5]. Of all the seed borne diseases of rice, 22 are caused by fungi[6]. Approximately 2.5 million tons of rice worth more than Tk.12000 million is lost annually due to diseases caused by seed borne pathogens[7].

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Fungal pathogens have becoming an increasing problem for rice cultivation in Bangladesh. Relative humidity and high temperature during plant growth favor development of seed borne disease. This disease is a major constraint in obtaining potential yield from the modern rice varieties. Therefore emphasis should be paid on other alternative management options. Chemical control is very common for controlling of the disease but it causes hazard to human health and environment. However, to keep the environment chemical–free, dependence on chemicals should be reduced as far as possible.

Lots of researches have been done on rice grain pathogens and its management[8-18]. But information on integrated management of rice seed borne pathogens is insufficient[19-24]. By keeping in view the above mentioned facts, an integrated programme was aimed to control rice seed borne pathogens. The present study was undertaken to screen out some fungicides, plant extracts and antagonist for the integrated management of rice pathogens and their impact on yield and yield contributing factors of rice.

Materials and Methods

The experiment was conducted in a completely randomized design with three replications in the earthen pot of Botanical garden, University of Dhaka, to assess the single and combined doses of fungicides, plant extracts and antagonist for the management of nine rice pathogens. A total of 13 treatments including controls with or without inocula of the pathogens were tested. The experiment was designed in a randomized block design with 3 replications. Pot soil was prepared by mixing sandy loam soil and decomposed organic fertilizer at the ratio 4:1. The plastic pots (20 cm diameter) were filled with 2 kg soil which was treated with formalin. A high yielding susceptible rice variety BRRI 29 was selected for this study[25].

The treatments and their combinations were : T1 = Bavistin, T2 = Tall, T3 = *Azadirachta indica*, T4 = *Citrus medica* T5 = *Trichoderma harzianum*, T6 = Bavistin + *Azadirachta indica* + *Trichoderma harzianum* T7 = Bavistin + *Citrus medica* + *Trichoderma harzianum*, T8 = Tall + *Azadirachta indica* + *Trichoderma harzianum*, T9 = Tall + *Citrus medica* + *Trichoderma harzianum*, T10 = Bavistin +Tall + *Azadirachta indica* + *Citrus medica,* T11 = Bavistin +Tall + *Azadirachta indica* + *Citrus medica* + *Trichoderma harzianum* , T12 = Control (with inocula), T13 = Control (without inocula). Seeds were suspended with the inocula suspension of test pathogens for 1 hour and treated with the above mentioned treatments for 2 hours. Then the seeds were sowing in plastic pots. Treatments were applied at 10 days intervals. Data were recorded after 15, 20, 25 days of germination. Twenty five days old seedlings of BRRI 29 variety were uprooted carefully to avoid root injury. The shoot and root length were taken separately against all tested pathogens. The percentage of germination and mortality was also recorded.

The experiment was performed twice. Data on different parameters were analyzed following computer package MSTAT-C and means were compared using Duncans Multiple Range Test (DMRT).The data were collected and evaluated by analysis of variance (ANOVA) by using STAR statistical program.

Results and Discussion

Effects of different treatments with fungicides, leaf extracts and antagonist on seed quality parameters of BRRI 29 rice variety against *Alternaria alternata, Aspergillus flavus*, *Curvularia lunata, Drechslera oryzae, Fusarium moniliforme*, *Fusarium solani, Microdochium oryzae, Pestalotiopsis guepinii* and *Sarocladium oryzae* are presented in Tables 1-3 and Fig 1.

Combined effect of fungicides, plant extracts and antagonist on seed quality parameters of BRRI 29 rice variety against *Alternaria alternata, Aspergillus flavus* and *Curvularia lunata*

Due to combined effect of different treatments with fungicides, leaf extracts and antagonist on seed quality parameters of BRRI 29 rice variety against *A. alternata, A. flavus* and *C. lunata,*T6 (Bavistin +*A. indica* + *T. harzianum*) treatment showed highest percentage of seed germination (87, 83 and 83%) and seedling vigor index (1496.4, 1517 and 1596.92), respectively. Amongst 13 treatments T10 (Bavistin + Tall + *A. indica* + *C. medica*) was next to T6, and T11 (Bavistin + Tall + *A. indica* + *C. medica*+ *T. harzianum*) showed promising result, respectively (Table 1). In case of root length, shoot length and mortality of seedlings, significant differences were observed due to different treatments against *A. alternata, A. flavus* and *C. lunata* (Table 1).

Combined effect of fungicides, plant extracts and antagonist on seed quality parameters of BRRI 29 rice variety against *Drechslera oryzae, Fusarium moniliforme* and *Fusarium solani*

Inoculated seeds with *D. oryzae* and *F. moniliforme* showed highest per cent (74 and75%) of seed germination and seedling vigor index (1281.6 and 1144), respectively due to combined effect of T10 (Bavistin+Tall+*A. indica*+*C. medica*) treatment. Next to T10, T11 (Bavistin+Tall+ *A. indica*+*C. medica*+*T. harzianum*) showed better result which was followed by T6 (Bavistin+*A. indica*+*T. harzianum*). Seeds inoculated with *F. solani* showed highest per cent of seed germination (81%) and seedling vigor index (1360.8) due to T3 (*A. indica)* treatment followed by T8 (Tall+*A. indica*+*T. harzianum*) and T6 (Bavistin+*A. indica*+*T. harzianum*) treatments. Different treatments did not make any significant difference in root and shoot lengths and also mortality of seedlings against *D. oryzae, F. moniliforme* and *F. solani* (Table 2).

Combined effect of fungicides, plant extracts and antagonist on seed quality parameters of BRRI 29 rice variety against *Microdochium oryzae, Pestalotiopsis guepinii* and *Sarocladium oryzae*

Seeds inoculated with *M. oryzae* and *S. oryzae* showed highest per cent of germination due to combined effect of T10 (Bavistin+Tall+*Azadirachta indica*+*C. medica*) which showed highest per cent (82 and 84%) of seed grrmination and seedling vigor index (1590.8 and1546.4), respectively amongst 13 treatments. Next to T10, T11 (Bavistin+Tall+*A.indica*+*C. medica*+*T. harzianum*) and T6 (Bavistin+*A. indica*+*T.harzianum*) showed promising result in both the cases. Seeds inoculated with *P. guepinii* showed highest per cent (85%) germination and seedling vigor index (1487.5) due to combined effect of T6 (Bavistin+*A. indica*+*T. harzianum*) treatment followed by T10 and T11 treatments, respectively (Table 3). There was no significant difference in the length of root and shoot, and mortality of seedlings due to different treatments against *M.oryzae* and *S. oryzae.* However, slight difference was noticed in case of the lengths of root and shoot along with the mortality of seedlings against *P. guepinii* due to different treatments (Table 3).

The results of this investigation showed similarity with the findings of Hossain and Mia[19], Ashrafuzzaman *et al*.[20], Islam and Monjil[21], Gohel and Chauhan[22] and Balgade and Gaikwad[23]. Hossain and Mia[19] observed two foliar sprays with Aimcozim, Bavistin, Shincar and Tilt at 0.1% and two top dressing of MP with 40kg/ha caused significant reduction of tiller infection of sheath blight disease. They also reported that tilt was the best fungicide for controlling the disease. Ashrafuzzaman *et al*.[20] reported the integrated management of sheath blight of aman rice through different combinations of treatment including controls with or without inocula of the pathogen. Severity increased with the increasing maturity of rice plants under all the treatments. The development was significantly least in plants treated with combined doses. The highest yield of rice was recorded in plants with the combined doses. Islam and Monjil[21] detected complete inhibition of sheath blight pathogen when treated with four indigenous medicinal plant extracts *i.e.* tulsi, nishinda, thankuni and biskatali and also reported germination failure due to fungal infection.

Islam and Monjil[22] observed number of infected tillers per hill and the lowest was found in seeds treated with propiconazole and biskatali (*Polygonum hydropiper*) extracts. Another three plants reduced tiller infection compared to control. They also reported highest vigor index in Jute seedlings raised from prewashed seeds treated with garlic and Know in which resulted significant reduction of seed borne fungal population.

Gohel and Chauhan[23] observed the efficacy of fungicides, bio-agent (*Pseudomonas flourescens*) and botanicals (neem, tulshi leaves extracts) for the management of rice blast pathogen and then reported the combined use of these reduced the pathogen and

Table 1. Effects of different treatments with fungicides, leaf extracts and antagonist on seed quality parameters of BRRI 29 rice variety against *Alternaria alternata, Aspergillus flavus* and *Curvularia lunata*.

Treatments	Seed quality parameters against test pathogens														
	Alternaria alternate					*Aspergillus flavus*					*Curvularia lunata*				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
T1	79 c	8.00 dc	2.9 cd	13.0 cd	1256.1 cd	78 cd	10.25 bc	2.90 e	13.0 cd	1240.2 cd	69 def	8.33 d	3.08 de	13.2ab	1123.32 cd
T2	80 c	9.00 c	3.50 a	12.5 de	1280 cd	76 d	8.10 de	3.50 bc	12.5 d	1232 d	65 def	9.09 c	3.2 cde	13.0 cd	1053 bcd
T3	80 c	8.33 d	3.0 bcd	13.0 cd	1280 cd	81 ab	9.87 bcd	3.20 cde	13.0 cd	1312.2 c	72 cde	8.01d	2.50d	14.0 b	1188 bcd
T4	74 e	7.69 ef	3.1 bcd	12.0 e	1117.4 e	72 e	12.5 a	3.00 de	13.5 bcd	1188 d	64 f	9.37 c	2.60c	13.0 cd	998.4 de
T5	72 f	7.84 e	2.90 cd	12.0 e	1072.8 e	62 f	9.67 bcd	3.25 cd	14.0 abc	1069.5 e	62 f	7.69 e	3.25 cd	15.0 ab	1131.5 cd
T6	**87 a**	9.00 c	3.2 abc	14.0 ab	**1496.4 a**	**83 a**	10.97 ab	3.28 cd	15.0 a	**1517a**	**83 a**	9.30 c	3.24 cd	16.0 a	**1596.92 a**
T7	79 c	8.00 de	3.3 ab	13.3 bcd	1311.4 ab	81 ab	11.11 ab	3.25 cd	14.5 ab	1437.75 ab	72 cde	11.11 a	3.25 cd	14.0 b	1242 bc
T8	77 d	7.40 f	2.80 d	13.8 abc	1278.2 cd	79 bc	10.12 bc	3.80 ab	14.0 abc	1406.2 b	75 bcd	10.66 b	3.01 d	15.0 ab	1350.75 ab
T9	75 e	5.60 g	3.0 bcd	13.9 abc	1267.5cd	77 cd	9.09 cd	3.90 a	14.2 abc	1393.7 b	75 bcd	10.81 b	3.50 bc	14.5 ab	1350 ab
T10	81 b	9.70 b	2.60 d	14.0 ab	1344 ab	82 a	7.31 e	3.40 c	14.5 ab	1467.8 ab	82 ab	11.63 a	3.80 ab	13.0 cd	1377.6 ab
T11	80 c	8.77 c	2.50 d	14.0 ab	1320 ab	81 ab	9.87 bcd	3.50 bc	14.0 abc	1417.5 ab	80 abc	10.01 b	3.90 b	13.0 cd	1352 ab
T12	70 g	10.2 a	2.90 cd	13.0 cd	1113 e	70 e	8.97 cde	3.40 c	14.0 abc	1218 d	54 g	9.25 c	3.40 c	12.9 d	880.2 e
T13	74 e	7.69 ef	3.0 bcd	13.8 abc	1243.2 d	72 e	8.75 cde	3.50 bc	13.5 bcd	1224 d	64 f	8.25 d	4.25 a	13.75 c	1152 cde
CV%	1.43	2.58	6.67	3.82	4.36	1.77	9.58	5.37	5.01	3.62	4.69	17.12	13.10	11.07	9.27

T1: Bavistin, T2: Tall, T3: *Azadirachta indica*, T4: *Citrus medica*, T5: *Trichoderma harzianum*, T6: Bavistin + *Azadirachta indica* + *Trichoderma harzianum*, T7: Bavistin + *Citrus medica* + *Trichoderma harzianum*, T8: Tall + *Azadirachta indica* + *Trichoderma harzianum*, T9: Tall + *Citrus medica* + *Trichoderma harzianum*, T10: Bavistin + Tall + *Azadirachta indica* + *Citrus medica*, T11: Bavistin + Tall + *Azadirachta indica* + *Citrus medica* + *Trichoderma harzianum*, T12: Control with inocula and T13: Control without inocula; A: % germination, B: % mortality, C: Root length (cm), D: Shoot length (cm) and E: Seedling vigor index.

Values within the same column with a common letter (s) do not differ significantly at 5% level by DMRT.

Table 2. Effects of different treatments with fungicides, leaf extracts and antagonist on seed quality parameters of BRRI 29 rice variety *Drechslera oryzae*, *Fusarium moniliforme* and *Fusarium solani*.

Treatments	Seed quality parameters against test pathogens														
	Drechslera oryzae					*Fusarium moniliforme*					*Fusarium solani*				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
T1	72 b	8.33	3.92	11.25	1092.22 de	72 b	9.09	3.1	10.5	979.2 de	70 de	10.01	3.2	13	1134 b
T2	72 b	8.09	3.30	12.5	1137.6 b	70 a	11.76	3.26	10.15	938.6 efg	70 de	11.43	3.6	12.9	1155 b
T3	65 e	8.33	3.64	9.88	878.8 h	70 b	14.29	3.5	10.15	924 ef	**81 a**	9.88	3.5	13.3	**1360.8 a**
T4	60 i	11.25	2.95	11.25	852.0 h	67 c	10.44	2.9	10.25	815.3 gh	75 bc	10.66	2.8	12.2	1125 b
T5	62 h	12.0	3.20	12.0	942.4 g	62 d	12.9	3.01	10.5	837 h	65 f	12.31	2.8	12.5	994.5 cd
T6	73 a	10.5	3.18	12.5	1144.5 b	73 b	11.11	3.5	11.4	1087.7 ab	78 ab	10.26	3.2	11.75	1166.1 b
T7	64 ef	9.50	3.15	10.25	857.6 h	70 b	11.42	3.5	12	1085 ab	77 ab	10.39	3.01	12.1	1162.7 b
T8	68 d	8.50	3.10	13.25	1111.8 cd	72 a	10.66	3.00	11.25	1026b	79 ab	10.13	3.3	11.5	1169.2 b
T9	63 fg	12.25	3.30	13.55	1061.55 c	72 b	11.11	3.6	10.5	1015.2 cd	70 de	11.43	3.01	12	1050 c
T10	**74 a**	13.25	3.80	14.0	**1281.6 a**	**75 a**	10.66	3.7	11.5	**1140 a**	66 ef	12.12	2.99	11.5	950.4 d
T11	70 c	14.0	3.90	13.88	1181.6 ab	74 a	10.81	3.9	11.4	1132 a	68 def	11.76	3.2	12.2	1047.2 c
T12	65 e	12.0	4.15	11.25	1001 f	62 d	12.9	3.25	9.3	778.1 I	56 g	14.28	2.9	10.5	750.4 e
T13	70 c	10.5	3.90	11.5	1078 de	68 c	11.42	3.3	10.01	904 fg	72 cd	11.11	3.5	12.2	1130.4 b
CV%	0.006	.0083	.0048	.0072	0.9224	1.72	3.52	.001	.056	0.9828	3.53	16.98	16.53	8.06	6.51

T1: Bavistin, T2: Tall, T3: *Azadirachta indica*, T4: *Citrus medica*, T5: *Trichoderma harzianum*, T6: Bavistin + *Azadirachta indica* + *Trichoderma harzianum*, T7: Bavistin + *Citrus medica* + *Trichoderma harzianum*, T8: Tall + *Azadirachta indica* + *Trichoderma harzianum*, T9: Tall + *Citrus medica* + *Trichoderma harzianum*, T10: Bavistin + Tall + *Azadirachta indica* + *Citrus medica*, T11: Bavistin + Tall + A*zadirachta indica* + *Citrus medica* + *Trichoderma harzianum*, T12: Control with inocula and T13: Control without inocula; A: % germination, B: % mortality, C: Root length (cm), D: Shoot length (cm) and E: Seedling vigor index

Values within the same column with a common letter (s) do not differ significantly at 5% level by DMRT.

Table 3. Effects of different treatments with fungicides, leaf extracts and antagonists on seed quality parameters of BRRI 29 rice variety *Microdochium oryzae, Pestalotiopsis guepinii* and *Sarocladium oryzae*.

Treatments	Seed quality parameters against test pathogens.														
	Microdochium oryzae					*Pestalotiopsis guepinii*					*Sarocladium oryzae*				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
T1	69 e	11.59 c	4.2	14.5	1290.3 d	64 f	12.5 ab	3.2 abc	12.5 bc	1004.8 c	72 de	11.11	3.5	16.5 a	1440 abc
T2	64 f	12.5 b	4.1	15	1222.4 e	68 e	11.76 c	3.5 a	13 abc	1122 d	78abc	10.25	4.01	15.5 ab	1521.78 ab
T3	71 c	11.26 c	4.3	15.5	1405.8 c	80 a	11.62 c	2.99 bcd	14 a	1359.2 abc	81 ab	9.88	4.1	14.6 bc	1514.7 a
T4	62 g	12.90 b	4.01	15.25	1194.12 e	65 f	12.3 b	3.01bcd	12.5 bc	1008.15 c	74 cde	10.81	3.8	14.3 bc	1339.4 abc
T5	61 g	13.11 a	3.9	14.5	1122.4 f	60 g	13.33 a	2.8 d	12.0 c	888 f	78 abcd	10.26	3.9	14.5 bc	1435.2 abc
T6	81 a	9.75 f	4.14	15.4	1582.6 a	**85 a**	11.76 c	3.5 a	14.0 a	**1487.5 a**	82 ab	9.76	4.2	14.6 bc	1541.6 a
T7	81 ab	9.87 f	4.1	14.2	1482.3 b	78 d	10.26 d	3.25 abc	13.5 ab	1306.5 c	73 cde	10.96	3.7	13.9 c	1284.8 cde
T8	78 bc	10.26 d	3.9	14.5	1435.2 bc	80 cd	12.5 ab	3.2 abc	14.0 a	1376 abc	76 bcde	10.53	3.6	13.8 c	1322.4 bcd
T9	75 c	10.66 d	3.8	14.8	1395 c	82 bc	12.2 b	3.3 ab	13 abc	1336.6 bc	79 abc	10.13	3.94	14 c	1417.26 abc
T10	**82 a**	9.88 e	3.9	15.5	**1590.8 a**	85 a	11.76 c	3.3 ab	13.5 ab	1428 ab	**84 a**	9.52	4.01	14.4 bc	**1546.44 a**
T11	80 b	10.00 e	4.01	15.5	1560.8 a	84 ab	11.9 bc	3.2 abc	13.4 ab	1394.4 abc	79 abc	10.13	3.8	14.3 bc	1429.9 abc
T12	58 h	13.79 a	3.2	14.5	1026.6 g	52 h	9.61 e	2.9 cd	12.0 c	774.8 g	64 f	12.5	3.5	14.5 bc	1152 e
T13	60 g	13.33 a	3.8	15	1128 f	60g	11.76 c	3.01 bcd	13.5 ab	990 ef	70 ef	11.43	3.7	13.8 c	1225 de
CV%	1.53	0.895	0.764	1.02	1.38	1.79	9.58	3.89	2.68	2.02	3.53	18.98	16.53	8.06	6.51

T1: Bavistin, T2: Tall, T3: *Azadirachta indica*, T4: *Citrus medica*, T5: *Trichoderma harzianum*, T6: Bavistin + *Azadirachta indica* + *Trichoderma harzianum*, T7: Bavistin + *Citrus medica* + *Trichoderma harzianum*, T8: Tall + *Azadirachta indica* + *Trichoderma harzianum*, T9: Tall + *Citrus medica* + *Trichoderma harzianum*, T10: Bavistin + Tall + *Azadirachta indica* + *Citrus medica*, T11: Bavistin + Tall + *Azadirachta indica* + *Citrus medica* + *Trichoderma harzianum*, T12: Control with inocula and T13: Control without inocula; A: % germination, B: % mortality, C: Root length (cm), D: Shoot length (cm) and E: Seedling vigor index.

Values within the same column with a common letter (s) do not differ significantly at 5% level by DMRT.

Fig. 1. Combined effects of treatments with fungicides, plant extracts and antagonist.

T1. Bavistin, T2. Tall and T3. *Azadirachta indica,* T4. *Citrus medica*, T5. *Trichoderma harzianum*, T6. Bavistin + *Azadirachta indica* + *Trichoderma harzianum*, T7. Bavistin + *Citrus medica* + *Trichoderma harzianum,* T8. Tall + *Azadirachta indica* + *Trichoderma harzianum,* T9. Tall + *Citrus medica* + *Trichoderma harzianum*, T10. Bavistin + Tall + *Azadirachta indica* + *Citrus medica,* T11. Bavistin + Tall + *Azadirachta indica* + *Citrus medica* + *Trichoderma harzianum*, T12. Control with inocula, T13. Control without inocula

increased yield parameters. Balgade and Gaikwad[24] observed the integrated management of blast of rice through seed treatment with benomyl (0,3%) followed by *Pseudomonas fluorescens* (0.5%) and cultural practices (CP) like soil application of rice husk ash (RHA) at sowing on raised beds (1kg /m2) with soil application of rice straw (2 tons/ha) at transplanting. But highest disease reduction were recorded in the combination of seed treatment and cultural practices with three sprays of propiconazole.

Almost all the treatments were effective against test pathogens and showed the maximum germination of seedlings in comparison to control. The highest germination and seedling vigor index was recorded in inoculated seeds with *A. alternata, A. flavus , C. lunata* and *P. guepinii* grown in pots where the integrated doses of Bavistin *, A. indica* and *T. harzianum* (`T6) were applied followed by seeds grown in pots amended with the integrated doses of Bavistin, Tall, *A. indica* and *T. harzianum* (T10). But in case of inoculated seeds with *D. oryzae, F. moniliforme, M. oryzae* and *S. oryzae* showed maximum germination due to combined effect of T10 treatment followed by T6 treatment. Only *A. indica* (T3 treatment) treated seeds showed highest germination and seedling vigor index against *F. solani.*

Considering the overall performance of the treatments, the combined use of Bavistin, *A. indica* and *T. harzianum* showed better performance for the reduction of test pathogens and increased germination considerably.The present investigation revealed that the integrated treatment T6 (Bavistin+*A. indica*+*T. harzianum*) might be useful for the management of rice pathogens and increasing germination of rice seeds.

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