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EFFECT OF FERMENTED TEA EXTRACT IN CONTROLLING BROWN SPOT AND NARROW BROWN SPOT OF RICE

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Abstract

Compost tea, Tilt 250 EC and Bavistin 50 WP were evaluated for controlling brown spot and narrow brown spot diseases of rice in the field laboratory of the Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh during the period from July to December, 2011. Significant effect of different treatments was observed on the severity of brown spot and narrow brown spot of rice as compared to control. The results evidently showed the lowest brown spot severity in T_4 (Tilt 250 EC applied as foliar spray) which was statistically similar to T_3 (Compost tea as soil drenching) while the highest severity was recorded in untreated control plot at booting and ripening stage. But narrow brown spot severity was lowest in T_4 (Tilt 250 EC as foliar spray) which was similar to T_5 (Tilt 250 EC as soil drenching), T_6 (Bavistin 50 WP as foliar spray) and highest severity was found in T_2 (Compost tea as foliar spray) which was statistically similar to T_1 (control), T_3 (Compost tea as soil drenching), T_7 (Bavistin 50 WP as soil drenching) at booting stage. But at ripening stage the highest severity was found in T_1 (control) and the lowest severity was found in T_4 (Tilt 250 EC as foliar spray) which was statistically similar to T_5 (Tilt 250 EC as soil drenching). However, soil drenching and foliar application of compost tea performed better as compared to control in reducing the severity of brown spot. But compost tea as foliar spray increased the narrow brown spot disease. Significant effect of the treatments was observed on growth and yield contributing characters except panicle length. Foliar and soil application of Tilt and soil application of compost tea showed better performance in increasing growth and yield contributing characters as compared to all other treatments.

Keywords: Compost tea, brown spot, narrow brown spot, rice

Introduction

Rice (O*ryza sativa* L.) is one of the staple food crops of world especially in south east asia and at the same time it attains the second position on cereal road map of world after wheat. Approximately 90% rice is produced and consumed in Asia (Salim *et al.*, 2003). It is the staple food of Bangladesh, but yield of this crop is comparatively lower than that of even neighboring countries. At present the total annual rice production in the country is approximately 34.7097 million metric

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tons and the average yield is around 2.876 mt ha^{-1} (BBS, 2016) while the world's total production is 497.8 million tons (FAO, 2016).

The rice production is seriously affected by diseases over its entire growth period. Diseases can affect both productivity and grain quality as well (Santos *et al*., 2009). Out of 31 rice diseases, 10 are considered as major diseases (Miah *et al*., 1985; Shahjahan *et al*., 1987). Among the diseases, brown spot (*Bipolaris oryzae*) and narrow brown spot (*Cercospora oryzae*) cause substantial loss to rice both in quality and quantity in the present ecosystem in Bangladesh. Rice is suffering from brown spot disease to a great extent and caused Bengal famine in 1943 (Padamanabhan, 1973). Brown spot caused an estimated loss of 4.58-29% in grain weight and 11.0-37.3% reduction in germination of rice in Panjab (Bedi *et al.*, 1960). Narrow brown spot cause a great loss both in the storage and field. Besides *Cercospora oryzae*, the causal agent of narrow brown spot reduced the seed viability of rice (Arunyarat *et al.*, 1981).

The common diseases of rice are being controlled specially by spraying fungicides that cause environmental pollution. The indiscriminate use of chemicals for controlling diseases of crop plants resulted environmental pollution and health hazards. The costly chemicals are being imported from abroad and farmers have to pay a high price. Moreover, huge amount of foreign currency is needed to purchase plant protecting chemicals. As an alternate means of avoiding these limitations, biological agents may be used for combating the diseases with the aim of increasing crop production. The biological control of pathogen offers environmentally safe, durable and cost effective alternatives to chemical compounds (Papavizas and Lumsden, 1980).

Composts are known to suppress plant diseases through a combination of physiochemical and biological characteristics. Physiochemical characteristics i.e. any physical or chemical aspects of composts that reduce disease severity by directly or indirectly affecting the pathogen or host capacity for growth due to the effect of nutrient level, organic matter, moisture, pH, and other factors. Recently, Compost tea has been defined simply as liquid extract from compost material that may contain organic and inorganic soluble nutrients and a large number of organisms including bacteria, fungi, protozoa and nematodes (Rou, 2003). Thus using compost tea instead of solid compost application to the soil may be the best use of technology to improve crop productivity and crop health. Therefore, the present study was undertaken to evaluate the efficacy of compost tea in controlling brown spot and narrow brown spot of rice as compared to other chemicals and also its effect on plant growth, yield and yield contributing characters of rice.

Materials and Methods

The experiment was conducted at the Field Laboratory, Department of Plant Pathology, Bangladesh Agricultural University (BAU), Mymensingh during the period from 21 August 2011 to 12 December 2011. A high yielding cultivar of

rice 'BR14' was selected for this study. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. Distances between the blocks and between the plots were 50cm and 25cm, respectively. The size of unit plot was 2m×1.5m. A total of seven treatments were used, viz. T_1 (Control no spray), T_2 (Compost tea as foliar spray), T_3 (Compost tea as soil drenching), T_4 (Tilt 250 EC as foliar spray), T_5 (Tilt 250 EC as soil drenching), T_6 (Bavistin 50 WP as foliar spray) and T_7 (Bavistin 50 WP as soil drenching). The land used for seed bed was marshy and no fertilizers were applied. Clean and mature seeds were soaked in tap water for 24 hours and incubated 48 hours for germination before sowing in the seed bed. The germinated seeds were sown uniformly in the seed bed.

Preparation of Compost tea

Compost tea was obtained by mixing compost with tap water at a ratio of 1:5(w/v) followed by fermentation for one week. It was stirred once in every day and allowed to ferment in the Nethouse, Seed Pathology Centre, BAU, Mymensingh at 25°C. After 7 days, the solution was filtered through cheese cloth. The prepared compost tea was ready for application with ordinary sprayers.

Application of fertilizer and manures

The chemical fertilizers were applied in the field as per recommended dose of Bangladesh Rice Research Institute (BRRI). TSP, MoP, Gypsum and Zinc sulphate except urea were applied (all plots) at the time of final land preparation. Urea was applied in equal splits at 15, 30 and 45 days after transplanting. Organic amendments with cowdung (10 ton/ha), Neem oil cake (150 kg/ha) and Mustard oil cake (133 kg/ha) were also accomplished at the time of final land preparation.

Transplanting of rice seedling in experimental plots

After preparing the land, 32 days old seedlings of BR 14 were uprooted carefully to avoid root injury. The seedlings were transplanted in the experimental plots using three seedlings/hill. Plant to plant and row to row spacing were 15cm and 20cm, respectively. In case of missing hill necessary gap filling was done at 10 days after transplanting. Weeding was done twice.

Recording of Diseases Severity in the Field

Data were recorded visually by observing the symptoms at booting and ripening stages. Four leaves from the top of the plant were considered for grading the severity of diseases. Five plants in each plot were randomly selected for recording the disease severity and the selected plants were tagged. The severity of two diseases viz. brown spot and narrow brown spot were recorded (0-9 scale) following Standard Evaluation System for Rice (IRRI, 1980). The grading scale for brown spot of rice was 0 = No incidence, 1 = Less than 1% area affected, 2 =

1-3% areas affected, 3 = 4-5% areas affected, 4 = 6-10% areas affected, 5 = 11-15% areas affected, 6 = 16-25% areas affected, 7 = 26-50% areas affected, 8 = 51-75% areas affected and 9 = 76-100% areas affected. The grading scale for narrow brown spot of rice was 0 = No incidence, 1 = Less than 1% area affected, 3= 1-5% areas affected, 5= 5-25% areas affected, 7 = 26-50% areas affected and 9= 51-100% areas affected

Data Collection on growth and yield and Analysis

The data were collected on the growth and yield parameters of rice. These data were analyzed statistically and the treatment means were compared by Duncan's Multiple Range Test (DMRT).

Results and Discussion

Severity of Brown spot

At booting stage highest severity (6.67%) was recorded in T_1 (control) and lowest severity (2.47%) was in T_4 (Tilt as foliar spray) which was almost similar to T_3 (Compost tea as soil drenching) (Table 1). Similarly, at ripening stage, highest severity (66%) was found in T_1 (control) and lowest severity (13.87%) was observed in T_4 (Tilt as foliar spray). Lower severity (26.27%) was recorded in T_3 (Compost tea as soil drenching) (Table 1).

Table 1. Effect of compost tea on severity of brown spot in rice at booting stage and ripening stage

Treatments	Disease severity (%) of brown spot of rice	
	Booting stage	Ripening stage
T_1 =Control	6.67	66.00
T_2=Compost tea(foliar spray)	5.67	45.00
T_3=Compost tea (Soil drenching)	3.00	26.27
T_4= Tilt(Foliar spray)	2.47	13.87
T_5= Tilt (Soil drenching)	5.53	34.13
T_6 =Bavistin (Foliar spray)	6.27	28.70
T_7= Bavistin (soil drenching)	5.87	39.60

Severity of Narrow Brown spot

In booting stage the highest severity (4.60%) was found in T_2 (Compost tea as soil drenching) and higher severity (4.53%) was found in T_1 (control) and lowest severity (1.40%) was found in T_4 (Tilt as foliar spray) (Table 2). Besides, highest severity (63.37%) was found in T_1 (control) at ripening stage and lowest severity (16.30%) in T_4 (Tilt as foliar spray) which was almost similar to T_5 (Tilt as soil drenching) (Table 2).

Table 2. Effect of compost tea on severity of narrow brown spot in rice at booting stage and ripening stage

Treatments	Disease severity (%) of narrow brown spot of rice	
	Booting stage	Ripening stage
T_1 =Control	4.53	63.37
T_2=Compost tea (foliar spray)	4.60	45.07
T_3=Compost tea (Soil drenching)	3.73	32.00
T_4= Tilt(Foliar spray)	1.40	16.30
T_5= Tilt (Soil drenching)	2.00	16.80
T_6 =Bavistin (Foliar spray)	2.00	24.67
T_7= Bavistin (soil drenching)	3.53	41.73

Number of tiller and hill

The highest number of tillers per plant (16.93) was recorded in case of foliar application of Tilt (T_4) which was statistically similar to T_2, T_3, and T_5. The lowest number of tillers (13.93) was found in Bavistin soil drenched (T_7) plot (Table 3). The maximum number of hills per plot (26.33) was recorded due to foliar application of Compost tea (T_2), while minimum number of hills (20.33) was found in Bavistin soil drenched (T_7) plot (Table 3).

Table 3. Effect of compost tea on growth and yield contributing characters in rice cv. BR14

Treatments	No. of tiller/plant	Hill number/ plot	Plant height (cm)	Panicle length (cm)	Grain number/ ear	Chaffy grain number/ear
T_1 =Control	14.60b	23.00bc	92.10c	20.00	123.89c	64.89a
T_2=Compost tea(foliar spray)	16.27a	26.33a	100.78abc	21.83	131.67c	46.67bc
T_3=Compost tea (Soil drenching)	16.07a	23.33b	102.83abc	20.87	142.78ab	40.22d
T_4= Tilt(Foliar spray)	16.93a	23.00bc	106.72ab	21.05	151.89a	34.00e
T_5= Tilt (Soil drenching)	16.67a	22.67bc	111.92a	20.89	134.11bc	43.89cd
T_6 =Bavistin (Foliar spray)	14.33b	24.00ab	102.30abc	21.14	129.44c	49.67b
T_7= Bavistin (soil drenching)	13.93b	20.33c	99.27bc	21.00	126.33c	50.12b
LSD at 5%	1.99	2.09	7.52	-	12.91	5.39
CV (%)	7.20%	5.07%	4.14%	7.87%	5.40%	6.43%
Level of sig.	*	**	**	NS	**	**

* = Significant at 5% level of probability, ** = Significant at 1% level of probability, NS = Not significant

Plant height and panicle length

The highest plant height (111.92) was recorded by soil drenching of Tilt (T_5) and lowest plant height (92.1) was found in control treatment (T_1) (Table 3). There was no significant variation in case of panicle length and it ranged from 20 to 21.83cm.

Number of grains and yield

Maximum number of grains per panicle (151.89) was recorded in case of foliar application of Tilt (T_4) the minimum number of grains (123.89) was in control treatment (T_1) which was statistically similar to T_2, T_6, and T_7 (Table 3). On the other hand, maximum number of chaffy grains (64.89) was found in control treatment (T_1) and minimum number of chaffy grains (34) was recorded in case of foliar application of Tilt (T_4) (Table 3). The grain yield of rice varied significantly among the treatments. The highest grain weight (7.67 t/ha) was found in T_4 which was followed by T_3 (7.34 t/ha) and the lowest (6.17 t/ha) was found in T_1, T_2, T_6 and T_7 treatments (Table 4).

Table 4. Effect of compost tea on grain yield in rice cv. BR14

Treatments	Grain yield (t/ha)
T_1 =Control	6.17d
T_2=Compost tea (foliar spray)	6.17d
T_3=Compost tea (Soil drenching)	7.37b
T_4= Tilt (Foliar spray)	7.67a
T_5= Tilt (Soil drenching)	6.83c
T_6 =Bavistin (Foliar spray)	6.17d
T_7= Bavistin (soil drenching)	6.17d
LSD at 5%	16.26
CV (%)	1.38%

Spraying of Tilt showed lowest severity of brown spot and narrow brown spot disease at both booting stage and ripening stage that was supported by the findings of Percich and Huot (1989). Soil drenching of compost tea reduced brown spot disease because after application it works rapidly at the time of sporulation of fungus and thus inhibit the sporulation process. So fungus cannot cause brown spot disease severely. The results supported by Zinati (2005) who showed use of compost resulted suppression of root rot disease caused by *Phytophthora*, where mechanism like antibiosis, competition, hyperparasitism and induced resistance worked. Wickramaarachchi *et al.* (2003) reported disease reduction by applying compost extract. Ryan *et al*. (2005) reported the use of aerated water extracts or tea from compost to control foliar diseases. Kelley (2004) studied the efficacy of aerated compost tea for plant disease control. Aldahmani (2005) reported that compost-amended substrates offered the potential for management of diseases caused by soil borne as well as foliar plant pathogens.

Organic manures have been reported to have some positive impact in reducing the incidence and severity of many diseases of some economically important crop plants (Aryantha *et al*., 2000; Nelson *et al*., 2002; Shaikh and Ghaffar, 2004; Ben Jenana *et al*., 2009; Saadi *et al*., 2010; Pane *et al*., 2011; Ahmed *et al*., 2012).

Compost tea enhanced the growth and yield parameters of rice. Foliar and soil application of compost tea and Tilt showed better performance in increasing growth and yield as compared to all other treatments. Goerlach (1996) reported that the application of Tilt reduced diseases and increased grain yield by up to 1400 pound/acre and milling yield by 12%. Compost tea enhanced the grain weight significantly. This result was supported by Ngakou *et al.* (2012). Merill *et al.* (1998) reported that organic teas increased vigour and hardness on the plant by providing both micronutrients and the organic chelating agents. The increased yield and protein content were also reported in potato when plants were grown in the soil applied composted animal manure (Srikumar and Ockerman, 1990) and composted plant material added to soil was also observed for increasing yield in sweet potato (Preston, 1990; Floyd *et al.*, 1988). Significant increase in tomato yield was also reported with compost amendment (Cheuk, 2005). Besides, significant yield increase in eggplant was observed as a result of disease suppressiveness and growth promoting effect of compost (Paplomatas, 2005).

Conclusion

Soil drenching of compost tea might be used as an alternative environment friendly means to control brown spot of rice. Soil and foliar application of compost tea contributed positively towards increasing growth, yield and yield contributing characters of rice. But compost tea as foliar spray enhanced the narrow brown spot disease. Further investigations are required to draw any conclusion on the use of compost tea in controlling narrow brown spot of rice.

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