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EFFECT OF SELECTED SOIL AMENDMENTS ON SEED GERMINATION, SEEDLING GROWTH AND CONTROL OF DAMPING OFF OF CHILI SEEDLINGS

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ABSTRACT

Soil amendments with sand, ash, sawdust, cowdung, poultry refuse, neem compost, vermicompost and control were evaluated for seed germination, seedling growth and control of damping off disease of chili. Soil application of poultry refuse (T_6), neem compost (T_7) and vermicompost (T_1) showed better performance in controlling damping off of seedlings as well as increased seed germination and influenced growth characters of chili seedlings. The highest seedling population 78.00% at 12 DAS, 82.67% at 15 DAS and 90.33% at 18 DAS were recorded under the treatment Poultry refuse (T_6), where seed germination was increased 43.57%, 24.63% and 34.82% over control, respectively. Poultry refuse reduced the damping off incidence by 100% at 20 DAS, 94.12% at 25 DAS and 89.46% at 30 DAS over control. Seedlings growth characters like shoot length, root length, seedling height, fresh shoot weight, fresh root weight and fresh seedling weight of chili were also enhanced by the application of poultry refuse. Application of neem compost and vermicompost also showed promising effect against damping off disease and also enhanced seed germination and growth characters of chili seedlings.

Key words: Soil amendments, seed germination, seedling growth, control, damping off, chili

INTRODUCTION

Chili (*Capsicum annuum* L.) is one of the important spice crop in the world as well as in Bangladesh under the family Solanaceae having nutritive value especially rich in vitamin C. In Bangladesh the total area of chili cultivation is 65000 hectares, where 23417 ha in kharif season and 41583 ha in rabi season with total production of 52000 MT and average yield 0.08 MT in 2004-2005 (Anon., 2006). Such yield is very low compared to other chili growing countries of the world. There are many factors responsible for the low yield of chili in our country. Among them fungal diseases play a vital role. Chili is known to suffer from as many as 83 different diseases, of which more than 40 are caused by fungi (Rangswami, 1988). Among the fungal diseases, damping off is the most prevalent disease in Bangladesh. In case of chili, 25% damping off incidence was found in the nursery bed (Islam *et al.*, 2007). The most common fungi reported to be responsible for damping off are *Pythium* spp., *Fusarium oxysporum, Sclerotium rolfsii, Phytophthora sp.* and *Rhizoctonia solani* etc (Singh, 1984). There are different methods available for controlling damping off disease. In case of cultural control, several methods are suggested to minimize the inoculum of *S. rolfsii, F. oxysporum* and *R. solani* in the soil. Most of the methods are not effective unless used in conjointly with fungicide or fertilizer applications (Gurkin and Jenkins, 1985; Punja *et al.*, 1985). Control measures like host resistance has not yet become a viable measure because no resistant variety has yet been developed against these soil borne pathogens causing damping off disease in chili in our country. Numerous fungicides inhibit the germination of sclerotia or mycelial growth of the causal fungi. Ridomil gold and formalin effectively control the disease of various vegetable crops in the field (Islam *et al*, 2007; Ayub *et al.*, 1998). But continuous use of chemicals has some adverse effect on human health and environment. Harmful chemical substances enter into the food chain that ultimately causes

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serious health hazards. Organic soil amendment is another important option and eco-friendly approach for controlling damping off disease by developing suppressive nature of soil. Poultry waste, saw dust proved to be effective for that purpose (Patil and Katan, 1997; Dey, 2005; Islam, *et al*, 2007). Soil amendment such as vermicompost reported to be effective against damping off of chili seedlings (Szczech, 1999). Hence, the present study has been aimed to evaluate the efficacy of different soil amendments against damping off disease as well as to evaluate their effect on seed germination and seedling growth of chili.

MATERIALS AND METHODS

The pot experiment was conducted in a randomized completely block design with three replications during the period of January to March 2008 in the open space in front of the Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka. Chili variety BARI Marich 1 (Banglalanka) was used in the experiment. The treatments were T_1 = Soil amendment with vermicompost, T_2 = Soil amendment with sand, T_3 = Soil amendment with ash, T_4 = Soil amendment with saw dust, T_5 = Soil amendment with cowdung, T_6 = Soil amendment with poultry refuse, T_7 = Soil amendment with neem compost and T_8 = Control. Soil was collected from Horticultural farm of Sher-e-Bangla Agricultural University. Vermicompost and neem compost was collected from the local nursery, Agargaon. Sawdust was collected from the Mohammadpur sawmill. Poultry refuse was collected from Agargaon kitchen market. Sand, cowdung and ash was collected from SAU farm. Different treatment materials were mixed at 1:3 ratio with experimental soil. After pot soil amendment experiment, pots were left for one month. Then the soil was exposed and pulverized before sowing seed. Data were recorded on percent seedling population at 18 DAS, damping off disease incidence at different days after sowing (DAS) and seedling growth characters such as shoot length, root length, seedling height, fresh shoot root and seedling weight at 40 DAS. The disease incidence was calculated by using the following formula:

$$\% \text{ disease incidence} = \frac{\text{Number of infected seedling(s)}}{\text{Number of inspected seedlings}} \times 100$$

The data were analyzed statistically using MSTAT-C software. Treatments means were compared by DMRT.

RESULTS AND DISCUSSION

The effects of different soil amendments on percent seedling population of chili at 18 days after sowing (DAS) were differed significantly in comparison to control (Table 1). At 18 DAS, the highest seedling population (90.33%) of chili was recorded in poultry refuse (T_6) that was statistically similar with neem compost (T_7) and vermicompost (T_1). Poultry refuse increased seedling population up to 34.82 % over control at 18 DAS. AT 18 DAS, the lowest percent seedling population of chili was recorded in control (T_8) followed by saw dust (T_4) and sand (T_2). The findings of the present study corroborates with the findings of the Islam *et al.*, (2007). They found that the poultry waste increased germination of chili seedlings up to 32.27% over control.

The effects of different treatments on damping off incidence of chili seedlings at different DAS are presented in Table 1.

Table 1. Seedling population at 18 DAS and damping off disease incidence of chili seedlings under different treatment at different days after sowing (DAS)

Treatments	% seedling population at 18 DAS	% seedling population increased over control	Damping off incidence (%) Of chili seedlings at 20 DAS	% damping off reduction over control at 20 DAS	Damping off incidence (%) of chili seedlings at 25 DAS	% damping off reduction over control at 25 DAS	Damping off incidence (%) of chili seedlings at 30 DAS	% damping off reduction over control at 30 DAS
T_1 (Vermicompost)	88.33 ab	31.84	0.67 de	87.43	3.67 d	78.41	4.67 d	81.56
T_2 (Sand)	76.33 d	13.93	5.00 a	6.19	11.33 b	33.35	16.67 b	34.19
T_3 (Ash)	80.67 cd	20.40	2.33 cd	56.29	7.33 c	56.88	9.33 c	63.16
T_4 (Saw dust)	79.00 d	17.91	4.67 ab	12.38	9.00 c	47.06	10.67 c	57.88
T_5 (Cowdung)	83.00 bcd	23.88	3.00 bc	62.48	8.67 c	49.00	10.00 c	60.52
T_6 (Poultry refuse)	90.33 a	34.82	0.00 e	100	1.00 e	94.12	2.67 d	89.46
T_7 (Neem compost)	87.00 abc	29.85	1.00 de	81.23	2.33 de	86.29	3.33 d	86.85
T_8 (Control)	67.00 e	--	5.33 a	--	17.00 a	--	25.33 a	--
LSD (p=0.05)	6.409	--	1.801	--	2.081	--	2.84	--

Means within the same column having a common letter(s) do not differ significantly (P=0.05)

All the treatments were differed significantly in terms of disease incidence at different DAS. At 20 DAS, the lowest incidence of damping off seedlings was recorded in poultry refuse (T_6), which was statistically similar with vermicompost (0.67%) and neem compost (1.00%). Ash (T_3) also showed the better performance (2.33%) in reducing damping off incidence. At 25 DAS and 30 DAS, the highest effect against damping off disease incidence was observed in poultry refuse (T_6), where disease incidence was only 1.00% and 2.67%, respectively followed by neem compost and vermicompost. At 25 DAS, poultry refuse (T_6) decreased damping off incidence up to 94.12 % over control, where neem compost and vermicompost reduced disease incidence up to 86.29% and 78.41%, respectively. At 30 DAS, poultry refuse (T_6) decreased damping off incidence up to 89.46 % over control, where neem compost (T_7) and vermicompost (T_1) reduced disease incidence up to 86.85% and 81.56%, respectively. The findings of the present study corroborate with the findings of Szczech (1999), Rahman (2005) and Islam *et al.* (2007). Szczech (1999) found that Vermicompost added container media significantly inhibited the infection of tomato plants by *Fusarium oxysporum* f. sp. *lycopersici*. The protective effect increased in proportion to the rate of application of vermicompost and inhibition caused due to suppressive nature of the vermicompost. Rahman (2005) reported that application of mustard oil cake @ 3 ton/ha and half decomposed poultry manure @ 5 ton/ha 2 weeks before sowing seeds performed better in reducing incidence of collar rot of Chickpea. Islam *et al.* (2007) reported that Poultry waste reduced damping off up to 82.16% and increased germination up to 32.27% over control in chili.The effect of different treatments on growth characters of chili seedlings are presented in Table 2 and Table 3. All the treatments were differed significantly in terms of growth characters of chili seedlings. The highest shoot length (32.50 cm) was recorded in use of Poultry refuse (T_6) followed by neem compost (T_7) and vermicompost (T_1). Poultry refuse increased shoot length and root length up to 170.83% and 59.33%, respectively over control. The highest root length (8.00 cm) was recorded in case of vermicompost followed by neem compost and poultry refuse. Vermicompost increased shoot length and root length up to 61.08% and 77.77%, respectively over control. The highest seedling height (39.67 cm) was recorded in poultry refuse followed by neem compost and Vermicompost. Poultry refuse increased seedling height up to 140.42% over control. The highest weight of fresh shoot (4.36g), fresh root (0.45g) and fresh seedling (4.81g) were recorded in poultry.

refuse (T_6) followed by neem compost (T_7) and vermicompost (T_1). Poultry refuse increased the weight of fresh shoot, fresh root and fresh seedling up to 165.85%, 350.00% and 176.43%, respectively over control. The present findings keep in with the findings of Nahar *et al.* (1996) and Manjarrez *et al.* (1999). Nahar *et al.* (1996) found that organic amendments (poultry manure) caused reduction of root-knot severity and improved growth of tomato plants. Manjarrez *et al.* (1999) found that the foliar area, dry shoot weight, radical volume and foliage content phosphorus increased in chili when mycorrhizal fungi and vermicompost were applied. Narpinderjeet *et al.* (2001) reported that organic amendments significantly increased in height and weight of seedlings.

Table 2. Effect of different soil amendments on shoot length, root length, seedling height of chili seedlings at 30 days after sowing (DAS)

Treatments	Shoot length (cm)	% shoot length increased over Control	Root length (cm)	% root length increased over control	Seedling height (cm)	% seedling height increased over control
T_1 (Vermicompost)	19.33 b	61.08	8.00 a	77.77	27.33 b	65.64
T_2 (Sand)	12.50 c	4.16	4.83 c	7.33	17.33 de	5.03
T_3 (Ash)	13.67 c	13.92	6.50 ab	44.44	20.16 c	22.18
T_4 (Saw dust)	12.67 c	5.58	4.83 c	7.33	17.50 de	6.06
T_5 (Cowdung)	13.01 c	8.42	5.00 bc	11.11	18.01 d	9.15
T_6 (Poultry refuse)	32.50 a	170.83	7.17 ab	59.33	39.67 a	140.42
T_7 (Neem compost)	20.67 b	72.25	6.67 ab	48.22	27.16 b	64.61
T_8 (Control)	12.00 c	--	4.50 c	--	16.50 e	--
LSD (p=0.05)	4.048	--	2.372	--	1.253	--

Means within the same column having a common letter(s) do not differ significantly (P=0.05)

Table 3. Effect of different soil amendments on shoot weight, root weight, seedling weight of chili seedlings at 30 days after sowing (DAS)

Treatments	Fresh shoot weight (g)	% Fresh shoot weight increased over control	Fresh Root weight (g)	%Fresh root weight increased over control	Fresh seedling weight (g)	% Fresh seedling weight increased over control
T_1 (Vermicompost)	3.64 b	121.95	0.25 b	150.00	3.89 b	123.56
T_2 (Sand)	2.05 d	25.00	0.12 e	20.00	1.84 e	5.75
T_3 (Ash)	2.03 d	23.78	0.18 cd	80.00	2.21 d	27.01
T_4 (Saw dust)	2.61 c	59.14	0.15 de	50.00	2.76 c	58.62
T_5 (Cowdung)	2.54 c	54.88	0.22 bc	120.00	2.76 c	58.62
T_6 (Poultry refuse)	4.36 a	165.85	0.45 a	350.00	4.81 a	176.43
T_7 (Neem compost)	3.56 b	117.07	0.24 b	140.00	3.80 b	118.39
T_8 (Control)	1.64 e		0.10 e		1.74 f	
LSD (p=0.05)	0.436		0.053		0.092	

Means within the same column having a common letter(s) do not differ significantly (P=0.05)

From the above findings if may be concluded that among the soil amendments treatments, application of poultry refuse, neem compost and vermicompost could be used as eco-friendly approach and may be advised to the farmers for the management of damping off disease of chili seedlings and increasing seed germination and seedling growth.

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