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Effect of activator in compost for management of seedling diseases of common bean

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Abstract: The experiments were carried out in the Greenhouse of Seed Pathology Centre (SPC), and in the Laboratory, Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh, Bangladesh in 2005 to determine the effectiveness of BAU-Biofungicide and prepared compost using BAU-Biofungicide for controlling seedling diseases of common bean cv. BARI Seem-1. BAU-Bio-fungicide gave the maximum germination (98%), normal seedlings (94%), healthy seedlings (92%) and vigour index and minimum failure of germination (2%), abnormal seedlings (4%), diseases and post-emergent death compared to other treatments. BAU-Biofungicide alone or with prepared compost increased germination (19.5%), normal seedlings (74.0%) and reduced anthracnose diseased (64.70%), post-emergence death (83.3%) over the control. The BAU-Biofungicide and prepared compost with BAU-Biofungicide resulted higher shoot length, root length, fresh shoot weight, fresh root weight of seedlings of common bean cv. BARI Seem-1 at different days after sowing. Treating seeds with BAU-Biofungicide and applying prepared compost with BAU-Biofungicide in soil resulted higher vigour index. Compost prepared by peel of banana var. sabri + disposed tomato fruits + BAU-Biofungicide resulted 42.14% higher vigour index over control when data was collected at 20 days after sowing.
Key words: Activator, compost, management, seedling diseases, common bean.

Introduction

Common bean (*Lablab purpurescens* L.) is an annual leguminous herb popularly known as "seem". The green pods and developed unripe seeds are used as vegetables and the ripe seeds are used as pulse, "dhal", in India and to some extent in Bangladesh (Matin, 1989).

There are various causes associated with lower yield of bean, where disease is considered as one of the most important factors of its yield reduction. Different phytopathogenic soil-borne as well as seed-borne fungi are responsible for disease development which attacks the plants during seedling to maturity stage. Out of different diseases of beans, anthracnose is considered as one of the most important. The disease anthracnose caused by *Colletotrichum lindemuthianum* Sacc & Magn Bri. & Cav is a serious disease causing considerable damage (Meah and Khan, 1987; Fakir *et al.*, 1991). In Bangladesh, Fakir (1980) observed 5% yield loss in beans due to the different diseases including anthracnose caused by *Colletotrichum lindemuthianum*.

Biological control of soil borne as well as seed-borne pathogens can be considered as environmentally safe, durable and cost effective alternative to chemicals (Papavizas and Lumsden, 1980). Among the biocontrol agents, *Trichoderma harzianum* has been found as an effective agent of soil and seed-borne plant pathogenic fungi (Begum *et al*., 1999; Sultana *et al.*, 2001; Shoresh *et al.* 2005). This antagonist also increased the percentage of seedling emergence, plant height, fresh weight and vigour index of plants (Begum *et al.*, 1999; Hossain and Shamsuzzaman, 2003; Yeasmin, 2004; Hossain and Naznin, 2005; and Bhuiyan, 2005).

Trichoderma harzianum also acts as an activator for preparing compost. In 1987, at the Institute of Biological Science of University of Philippines at Los Banos in Philippines *Trichoderma* was used as a fungus compost activator that offered a solution to the interest of farmers in the use of organic fertilizers. As well as their economic advantages, composts are good soil conditioners, which cannot be matched by chemical fertilizers. Cuevas *et al.* (1988) prepared mixed cultures of two *T. harzianum* strains which used as inoculant in composting. The inoculant was termed compost activator. Mixing the activator with substrates consisting entirely of plant materials reduced composting period from 58 d (control treatment) to 30 d. The composting period was reduced from 42 d (control treatment) to 23 d when substrates comprised of plant materials and chicken manure mixed with the activator. Initial C/N of substrates proved a significant factor affecting composting time.

Crop production by using organic manure such as compost does not create health hazards and environmental pollution. Moreover, use of compost improves texture, structure, organic matter, colour, aeration, micronutrient status and increases the water holding capacity of soil. In general, the OM content of Bangladesh soil is below 1% compared to an ideal minimum value of 4% (Islam and Hossain, 1992). In the area of continuous cropping, OM supply to crop fields through compost is made one of procedure to a minimum extent.

Therefore, the present research programme was undertaken to find out the effect of *Trichoderma* based BAU-Biofungicide either alone or in combination with compost for controlling the seedling diseases of country bean.

Materials and Methods

The experiments were conducted both in the Greenhouse of Seed Pathology Centre (SPC) and in the Laboratory of Department of Plant Pathology, Bangladesh Agricultural University (BAU), Mymensingh, Bangladesh during February to August 2005. BAU-Biofungicide, Agro-wastages viz: disposed tomatoes, Cabbage leaves, and Banana peels were collected from the different departmental laboratories of BAU, Mymensingh, Bangladesh. Seed sample of Country Bean cv. BARI Seem-1 was collected from Natun Bazar, market of Mymensingh. Cabbage leaves, disposed tomato fruits and banana peels were cut into small pieces and placed in plastic container. The materials in plastic container were then placed at room temperature for two weeks. Then the decomposed materials were dried in the greenhouse using melamine plates for 4 days. The dried materials were grinded in powder. BAU-Biofungicide was used with agro-wastages in 1:3 (BAU-Biofungicide:agro-wastages) ratios for preparing the compost. The following sixteen treatments were used: T_1 = Control, T_2 = Compost prepared by disposed tomato fruits, T_3 = Compost

prepared by cabbage leaves, T_4 = Compost prepared by peel of banana, $T_5 = T_2 + T_3$, $T_6 = T_3 + T_4$, $T_7 = T_2 + T_4$, $T_8 = T_2 + T_3 + T_4$, T_9 = BAU-Biofungicide, $T_{10} = T_2 + T_9$, $T_{11} = T_3 + T_9$, $T_{12} = T_4 + T_9$, $T_{13} = T_2 + T_3 + T_9$, $T_{14} = T_3 + T_4 + T_9$, $T_{15} = T_2 + T_4 + T_9$, $T_{16} = T_2 + T_3 + T_4 + T_9$. Soil was collected from the Field Laboratory of the Department of Plant Pathology, Bangladesh Agricultural University (BAU), Mymensingh and the collected soil was dried. The dried soil was sterilized with formalin (40%) at the rate of 5 ml formalin diluted with 12 ml of water for four kg soil (Dasgupta, 1988). The formalin treated soil was covered with polythene sheet for 48 hrs and then exposed of 72 hrs for aeration before setting the experiment. For each treatment, soils of 4 trays were drenched with subsequent prepared compost except BAU-Biofungicide and control treatments. The prepared composts were given in soil at 6 g/kg soil.

Two hundred seeds were taken in a beaker and 25 drops of water was added to it for uniform moistening the seed surface. Seeds were then treated with BAU-Biofungicide as per treatment @ 25 g/kg seed. The treated seeds as well as non-treated seeds were sown in row in trays (50 seeds/tray) as per treatment used. There were four replications for each treatment. The experiment was conducted following Completely Randomized Design. The following data were recorded : (a) **g**ermination (%), (b) germination failure(%), (c) normal seedlings(%), (d) abnormal seedling(%), (e) disease free healthy seedlings (%), (f) anthracnose diseased seedling (%), (g) post-emergence death (%), (h) Shoot weight (g), (i) Root weight (g), (j) Shoot length (cm), (k) Root length (cm) and (l) Vigour index (%). Vigour index was calculated at 10, 15 and 20 DAS by using the formula of (Baki and Anderson, 1973) as shown below: Vigour index (VI) = (Mean shoot length + Mean root length) x % germination.

Results and Discussion

It has been observed that soil and seed treatment with BAU-Biofungicide gave maximum germination (98 %) and normal seedlings (94 %) and the minimum germination failure (2%) and abnormal seedlings (4%) of common bean which was recorded at 5, 7 and 10 days after sowing as shown in Table 1. Seed treatment with BAU-Biofungicide increased germination of seeds of common bean up to 19.5% over the control where germination was 82%. The findings of the present study have been supported by Naznin (2004) who reported that seed treatment with BAU-Biofungicide increased germination of sweet gourd, snake gourd, cowpea, cucumber and okra by 5.22, 2.35, 46.24, 7.92 and 50.80%; respectively over the untreated control. Bhuiyan (2005) examined that using BAU-Biofungicide as seed treating material of winter vegetables increased germination, which was recorded 16.7, 7.5, 9.7, 13.5, 17.0, 1.0, 3.0, 9.0, 18.0, 5.0, 22.0, 19.0, 4.0, 7.0, 3.0, 8.0 and 3.0% over control in snake gourd, ridged gourd, cucumber, bottle gourd, bitter gourd, sweet gourd, kalmi shak, tomato, cabbage, radish, brinjal, amaranth, yard long bean, lal shak, watermelon, okra and spinach respectively.

Table 1. Effect of BAU-Biofungicide and compost on germination and seedlings of Common Bean cv. BARI Seem-1

Treatments	% germination			% germination failure			% normal seedlings			% abnormal seedlings		
	5DAS	7DAS	10DAS	5DAS	7DAS	10DAS	5DAS	7DAS	10DAS	5DAS	7DAS	10DAS
T_1	78.0	82.0	82.0	22.0	18.0	18.0	42.0	52.0	54.0	22.0	16.0	16.0
T_2	86.0	88.0	88.0	14.0	12.0	12.0	60.0	66.0	70.0	16.0	14.0	10.0
T_3	86.0	88.0	88.0	14.0	12.0	12.0	58.0	62.0	68.0	18.0	16.0	12.0
T_4	90.0	92.0	94.0	10.0	8.0	6.0	62.0	70.0	78.0	18.0	14.0	10.0
T_5	80.0	86.0	88.0	20.0	14.0	12.0	50.0	62.0	70.0	16.0	14.0	12.0
T_6	72.0	76.0	78.0	28.0	24.0	22.0	44.0	54.0	58.0	18.0	14.0	12.0
T_7	78.0	82.0	84.0	22.0	18.0	16.0	42.0	54.0	60.0	22.0	18.0	14.0
T_8	80.0	86.0	86.0	20.0	14.0	14.0	48.0	58.0	66.0	28.0	18.0	14.0
T_9	94.0	98.0	98.0	6.0	2.0	2.0	84.0	90.0	94.0	6.0	6.0	4.0
T_{10}	86.0	88.0	90.0	14.0	12.0	10.0	68.0	74.0	80.0	12.0	10.0	6.0
T_{11}	92.0	94.0	94.0	8.0	6.0	6.0	74.0	78.0	82.0	10.0	8.0	4.0
T_{12}	92.0	94.0	96.0	8.0	6.0	4.0	74.0	76.0	80.0	14.0	12.0	10.0
T_{13}	94.0	96.0	96.0	6.0	4.0	4.0	76.0	80.0	82.0	12.0	10.0	8.0
T_{14}	88.0	90.0	92.0	12.0	10.0	8.0	64.0	70.0	76.0	14.0	12.0	8.0
T_{15}	94.0	96.0	94.0	6.0	4.0	6.0	72.0	76.0	84.0	14.0	12.0	4.0
T_{16}	92.0	96.0	96.0	8.0	4.0	4.0	72.0	80.0	82.0	14.0	12.0	10.0
LSD (P≥ 0.01)	16.1	13.8	12.8	16.1	13.8	12.8	15.4	15.0	16.1	10.57	NS	NS

DAS = Days after sowing, T_1 = Control, $T_7 = T_2 + T_4$,, $T_{12} = T_4 + T_9$, T_2 = Compost prepared by disposed tomato fruits, $T_8 = T_2 + T_3 + T_4$, $T_{13} = T_2 + T_3 + T_9$, T_3 = Compost prepared by cabbage leaves, T_9 = BAU-Biofungicide, $T_{14} = T_3 + T_4 + T_9$, T_4 = Compost prepared by peel of banana, $T_{10} = T_2 + T_9$, $T_{15} = T_2 + T_4 + T_9$, $T_5 = T_2 + T_3$, $T_{11} = T_3 + T_9$
$T_{16} = T_2 + T_3 + T_4 + T_9$, $T_6 = T_3 + T_4$

BAU-Biofungicide either alone or in combination with compost resulted reduction of post-emergence death of seedlings by up to 83.33% over the control (Table 2). The findings of the present study have been supported by other researchers. Yeasmin (2004) reported that pre-emergence and post-emergence mortality of the seedlings due to foot rot disease were successfully reduced by treating seeds of blackgram, BARI Moog-2 and BARI Lentil-2 with BAU-Biofungicide and recorded reduced diseased symptoms up to 6.5, 2.0 and 3.0% over control. Bhuiyan (2005) reported that treating seeds with BAU-Biofungicide of winter vegetables viz. snake gourd, ridged gourd, cucumber, bottle gourd, bitter gourd, sweet gourd, kalmi shak, tomato, cabbage, rakish, brinjal, amaranth, yard long bean, lal shak, water melon, khol rabi, okra, Indian spinach and spinach reduced post-emergence death of seedlings by 8.53, 10.41, 19.06, 9.99, 10.89, 8.19, 4.9, 6.82, 21.43, 7.63, 14.32,

20.22, 8.91, 18.9, 5.68, 11.91, 4.49 and 2.29% respectively over control.

Seed treatment with BAU-Biofungicide and applying prepared compost (with or without BAU-Biofungicide) in soil reduced the incidence of disease in BARI Seem-1. This has been supported by Ravi *et al.* (1999) who reported that *T. viride* recorded the maximum inhibition of mycelial growth of *Colletotrichum lindemuthianum* in *Phaseolus vulgaris* which followed by *T. harzianum*. Infected *P. vulgaris* seeds soaked in 10% culture filtrate, treated with 0.4% talc formulation of *T. viride* recorded minimum seed infection and maximum seed germination.

BAU-Biofungicide as a growth promoting agent resulted higher shoot length, root length, shoot weight and root weight over the control (Table 3). Sultana and Hossain (1999) obtained longer shoots and roots of lentil cv. BARI masur-1 when the seeds were coated with *Trichoderma harzianum*. Naznin (2004) found that seed treating with *Trichoderma* as an antagonist increased shoot length, root length, shoot weight, root weight, vigour index of the seedlings of sweet gourd, snake gourd, cowpea, cucumber and okra. Yeasmin (2004) reported that BAU-Biofungicide treated seeds resulted significantly higher shoot length, root length, shoot weight, root weight of seedlings of blackgram, BARI Moog-2 and BARI Lentil-2.

Table 2. Effect of BAU-Biofungicide and compost on seedling health and shoot weight of Common Bean cv. BARI Seem-1

Treatments	% healthy seedlings			% diseased seedlings			% post-emergence death			Fresh shoot wt (g)/plant		
	5DAS	7DAS	10DAS	5DAS	7DAS	10DAS	5DAS	7DAS	10DAS	10DAS	15DAS	20DAS
T_1	14.00	18.00	46.00	28.00	34.00	4.00	14.0	14.0	12.0	2.360	2.544	2.172
T_2	38.00	40.00	70.00	22.00	26.00	0.00	10.0	8.0	8.0	2.558	3.136	2.274
T_3	42.00	36.00	68.00	16.00	26.00	0.00	10.0	10.0	8.0	2.490	2.840	2.196
T_4	40.00	38.00	74.00	22.00	32.00	2.00	10.0	8.0	6.0	2.262	2.288	2.696
T_5	36.00	40.00	66.00	14.00	22.00	2.00	14.0	10.0	6.0	2.424	2.514	2.070
T_6	28.00	26.00	58.00	16.00	28.00	0.00	10.0	8.0	8.0	2.482	2.446	2.396
T_7	24.00	26.00	58.00	18.00	28.00	1.00	14.0	10.0	10.0	2.628	2.374	2.370
T_8	30.00	26.00	62.00	18.00	32.00	2.00	10.0	10.0	6.0	2.272	2.444	2.640
T_9	76.00	76.00	92.00	8.00	14.00	0.00	2.0	2.0	2.0	2.430	2.274	2.020
T_{10}	58.00	56.00	80.00	10.00	18.00	0.00	6.0	4.0	4.0	2.642	2.708	2.674
T_{11}	64.00	66.00	82.00	10.00	12.00	0.00	8.0	8.0	8.0	2.440	2.616	2.076
T_{12}	66.00	62.00	80.00	8.00	14.00	0.00	4.0	6.0	6.0	2.804	2.536	2.582
T_{13}	60.00	62.00	82.00	16.00	18.00	0.00	6.0	6.0	6.0	2.824	2.798	2.498
T_{14}	56.00	58.00	76.00	8.00	12.00	0.00	10.0	8.0	8.0	2.524	2.518	2.282
T_{15}	66.00	62.00	84.00	6.00	14.00	0.00	8.0	8.0	6.0	2.360	2.462	2.576
T_{16}	60.00	68.00	82.00	12.00	12.00	0.00	6.0	4.0	4.0	2.552	2.516	2.208
LSD ($P \geq 0.01$)	18.63	22.21	18.58		14.72	NS	8.20	10.03	9.31	0.3973	NS	NS
LSD ($P \geq 0.05$)				12.15								

DAS = Days after sowing, T_1 = Control, T_7 = $T_2 + T_4$, $T_{12} = T_4 + T_9$, T_2 = Compost prepared by disposed tomato fruits, T_8 = $T_2 + T_3 + T_4$, $T_{13} = T_2 + T_3 + T_9$, T_3 = Compost prepared by cabbage leaves, T_9 = BAU-Biofungicide, $T_{14} = T_3 + T_4 + T_9$, T_4 = Compost prepared by peel of banana, $T_{10} = T_2 + T_9$, $T_{15} = T_2 + T_4 + T_9$, $T_5 = T_2 + T_3$, $T_{11} = T_3 + T_9$, $T_{16} = T_2 + T_3 + T_4 + T_9$, $T_6 = T_3 + T_4$

Table 3. Effect of BAU-Biofungicide and compost on plant growth and seedling vigour of Common Bean cv. BARI Seem-1

Treatments	fresh root wt. (g)			shoot length of seedlings (cm)			root length of seedlings (cm)			vigour index (VI)		
	10DAS	15DAS	20DAS	10DAS	15DAS	20DAS	10DAS	15DAS	20DAS	10DAS	15DAS	20DAS
T_1	0.562	0.282	0.096	42.48	63.64	80.30	8.78	9.39	10.00	4394.8	6178.6	7232.2
T_2	0.718	0.382	0.100	61.16	78.16	81.86	7.80	10.02	12.12	6284.8	7838.6	8194.0
T_3	0.610	0.428	0.126	63.14	69.16	78.66	11.12	11.16	13.88	6779.8	7330.4	8053.2
T_4	0.568	0.312	0.138	68.50	75.56	79.52	10.52	12.00	12.28	7666.6	8175.2	7607.0
T_5	0.482	0.340	0.114	61.46	69.88	74.06	10.54	11.53	8.22	6525.0	6930.8	7116.0
T_6	0.484	0.356	0.106	60.96	72.74	75.80	8.20	10.24	12.54	6175.4	6937.2	6882.4
T_7	0.426	0.302	0.136	62.36	67.72	75.80	7.32	12.48	14.04	6087.2	6680.6	7424.6
T_8	0.418	0.310	0.180	59.06	61.22	85.82	7.36	11.08	12.98	5939	6242.0	8391.2
T_9	0.448	0.248	0.136	64.06	78.42	81.62	7.56	7.56	7.56	7305.6	8480.2	8648.2
T_{10}	0.568	0.268	0.090	62.88	68.62	70.72	1.06	12.01	12.77	6872.8	7783.6	6947.0
T_{11}	0.532	0.300	0.154	63.18	79.28	82.52	9.86	11.02	12.16	7086.0	8455.6	8170.0
T_{12}	0.596	0.368	0.116	60.10	60.22	77.12	10.92	11.62	14.96	7961.6	6744.0	8723.6
T_{13}	0.558	0.348	0.128	69.98	75.56	80.68	9.00	11.82	12.32	7830.2	8420.0	8139.8
T_{14}	0.460	0.476	0.108	69.22	73.08	70.58	12.64	12.68	14.98	7729.8	7821.0	7735.4
T_{15}	0.632	0.260	0.172	65.14	71.40	93.44	11.74	12.66	16.76	7469.6	7894.4	10280.4
T_{16}	0.512	0.268	0.086	64.18	68.48	68.84	10.58	11.39	10.68	7402.8	7469.6	7540.0
LSD ($P \geq 0.01$)	0.1405	0.1199	0.0565		12.60		4.149	NS	5.212	1450.5		949.2
LSD ($P \geq 0.05$)				10.89		14.39					1447.5	

DAS = Days after sowing, T_1 = Control, T_7 = $T_2 + T_4$, $T_{12} = T_4 + T_9$, T_2 = Compost prepared by disposed tomato fruits, T_8 = $T_2 + T_3 + T_4$, $T_{13} = T_2 + T_3 + T_9$, T_3 = Compost prepared by cabbage leaves, T_9 = BAU-Biofungicide, $T_{14} = T_3 + T_4 + T_9$, T_4 = Compost prepared by peel of banana, $T_{10} = T_2 + T_9$, $T_{15} = T_2 + T_4 + T_9$, $T_5 = T_2 + T_3$, $T_{11} = T_3 + T_9$, $T_{16} = T_2 + T_3 + T_4 + T_9$, $T_6 = T_3 + T_4$

Vigour index (VI) of seedlings of BARI Seem-1 have been found to be increased due to treating seeds with BAU-Biofungicide and prepared compost (with or without BAU-Biofungicide). These results are strongly supported by Krishnamoorthy and Bhaskaran (1990), Hossain and Fakir (2001). Shamsuzzaman *et al.* (2003) reported that

Trichoderma harzianum treated seeds of sweet gourd resulted 98.62% higher vigour index over control. Naznin (2004), Hossain and Naznin (2005) found *Trichoderma* as a strong antagonist that increased vigour index of snake gourd, cowpea, sweet gourd, cucumber and okra. Yeasmin (2004) reported that bau-biofungicide treated seeds resulted significantly higher vigour index of Blackgram, BARI Moog-2 and BARI Lentil-2 by 42.7, 73.28 and 138.50%, over control respectively. Bhuiyan (2005) reported that vigour index of snake gourd, ridge gourd, cucumber, bottle gourd, bitter gourd, sweet gourd, kalmi shak, tomato, cabbage, radish, brinjal, amaranth, yard long bean, lal shak, watermelon, okra and spinach increased up to 35.18, 26.69, 57.21, 35.08, 35.88, 8.34, 6.41, 34.38, 24.93, 12.52, 56.65, 56.68, 21.91, 33.21, 13.14, 20.48, and 21.31%, respectively over control when seeds were treated with BAU-Biofungicide.

The findings of the present study revealed that BAU-Biofungicide alone or prepared compost with BAU-Biofungicide have shown strong potentiality to control anthracnose of seedlings of bean with increasing seedling stand.

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