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Effects of organic fertilizers on the seed germination and seedling vigour of tomato

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Abstract

An experiment was carried out in the net house at Bangladesh Agricultural Research Institute, Gazipur during the season, 2011 to evaluate the seed germination and seedling growth of tomatoes as affected by different organic fertilizers. There were five treatments viz. trichocompost, vermicompost, kitchen waste compost, cowdung based bioslurry and control (soil). Treatments significantly influenced the germination and seedling growth. The results showed germination percentage and co-efficient of germination were significantly higher in trichocompost which was identical with vermicompost and cowdung based bioslurry but different from kitchen waste compost and control, Similarly the seedling growth characters like root length, shoot length, number of leaves, number of roots, fresh and dry weight of 10 seedlings and effectiveness against damping off disease were significantly highest in the treatment media of trichocompost which reflected on higher vigour index in the same treatment. However, there was no significant variation among the treatments in respect of root and shoot length ratio. The results suggest that trichocmpost and vermicompost are suitable for raising healthy seedlings in organic tomato production.

Introduction

The prerequisite for successful organic tomato production is to have strong and healthy seedlings in due time. Accordingly, usages of organic growth media like trichocompost, vermicompost, cowdung etc. in pot could possibly be one of the effective techniques for rasing seedlings in organic production system. Such organic fertilizers can be an effective alternative to chemical fertilizers as they contain high levels of nutrients and organic matter (Shabani *et al*., 2011). Sometimes farmers face problems to raise tomato seedlings in due time due to adverse environmental conditions like rainfall. This technique has the potential to use in adverse condition as the pots can be easily moved in safe places and ultimately facilitates the production of tomato seedlings in due time. Hence, this study was undertaken to evaluate the effect of organic fertilizers as potting amendment on seed germination and production of healthy tomato seedling.

Material and methods

The experiment was conducted at the central farm of Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur, Bangladesh in 2011. The experiment was laid out in a randomized complete block design with three replicates. This experiment included five different treatments like Kitchen Waste Compost, Vermicompost, Trichocompost, Cow dung based Bioslurry, and Soil (control**).** They were analyzed following proper methods just after have been received. Plastic pots measuring 15 cm x 12cm x 7 cm (1260 cm^3) were used for raising the seedlings. 10 pots were used for each of treatment and thus fifty pots for each replication. Sterilized soils were mixed with individual organic fertilizer at the ratio of 50:50 (Soil:Fertilizers by volume) for potting. Ten (10) seeds were sown in each pot. The speed of emergence was determined by counting the number of seeds emerged at twenty four (24) hours interval immediately after sowing. The criterion used for seed germination was taken as emergence of 2 mm radicle at the time of observation (Odoemena, 1988). Germination counts were recorded until 21 days after sowing. The germination percentage of the seeds was finally determined for each of the treatments. Co-efficient of germination was calculated using the following formulae (Copeland, 1976). Coefficient of Germination, CG = (A_1 + A_2+ … ... +A_x)/ (A_1T_1 + A_2T_2+ … ...+ A_xT_x)100. Where, CG = Co-efficient of Germination (%), A = Number of seeds germinated, T = time corresponding to A, X = number of days to final count. For determination of seedling vigour index 10 seedlings were randomly selected from each treatment and their individual shoot and root length were measured. The vigour of the seedlings was determined by following the formula of Abdul-Baki and Anderson (1973). Vigor index = [mean of root length (cm) + mean of shoot length (cm)] × percentage of

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seed germinations. After 21 days, the growth parameters were estimated after uprooting and cleaning the seedlings. Different parameters were recorded with appropriate measures. The fresh weight and dry weight (in grams per 10 seedlings) was measured with a digital weighing balance. Damping off disease incidence of infected seedlings was recorded and calculated by using the following formula, % Disease incidence = (Number of infected seedling) x 100/Number of inspected seedling. Percentage data were transformed to square root and were analyzed including other data by using MSTAT-C program.

Results

The analyzed report of different compost materials is furnished in Table 1 and it revealed that trichocompost contained more nutrients which was followed by vermicompost.

Table1. Result of the chemical analysis of different kinds of compost

Types of compost	Nutrient content					
	N (%)	P(%)	K(%)	S(%)	Ca (%)	Zn (ppm)
Trichocompost	1.63	1.18	1.46	0.52	1.73	186.0
Vermicompost	1.71	1.07	1.31	0.44	1.43	139.0
Paragon compost	1.57	0.87	1.04	0.37	1.03	112.0
Kitchen waste compost	1.38	1.09	1.12	0.41	0.89	136.0
Cow dung based bioslurry	1.42	0.93	1.25	0.33	0.92	126.0

The seed germination percentage was significantly (P=0.05) affected by different types of organic fertilizer and ranged from 65.3 to 94.0 (Table 2). The highest seed germination was recorded in trichocompost which was statistically similar to vermicompost and the least performance was observed in case of kitchen waste compost which was identical with control (soil). Significant variation was also observed in case of co-efficient of germination (%). Trichocompost gave the best performance in co-efficient of germination velocity (12.9) which was statistically similar with vermicompost and cow-dung based bioslurry while poor performance (8.9) was observed in case of kitchen waste compost even less than the control. The longest root (16.0 cm) was found in trichocompost which was followed by vermicompost and the shortest root (6.0 cm) was appeared in case of kitchen waste compost.

Table 2. Effect of organic fertilizers on germination and seedling growth of tomato

Treatment	% Germination	% Co-efficient of Germination	Root length (cm)	Shoot length (cm)	Vigour index
Kitchen Waste Compost	65.3 c (8.1)	8.9 c (2.9)	6.0 c	3.0 c	587.9 e
Trichocompost	94.0 a (9.7)	12.9 a (3.6)	16.0 a	9.0 a	2351. 0a
Vermicompost	90.0 ab (9.5)	11.8 ab (3.4)	13.3 a	7.8 a	1899.0 b
Cowdung based bioslurry	86.0 ab (9.3)	11.4 ab (3.4)	10.2 b	5.4 b	1340.0 c
Control (Soil)	77.3 bc (8.8)	10.8 b (3.3)	8.3 bc	4.0 bc	939.0 d
CV(%)	6.2	8.6	10.3	11.0	13.1

Figures in the parenthesis indicate the transformed value; in a column, figures having the same letter(s) do not differ significantly by DMRT at the 5% level; NS – Not Significant.

Table 2. Contd.

Treatments	No. of leaves	No. of roots	Fresh wt. of 10 seedlings (g)	Dry wt. of 10 seedlings (g)	Root/ shoot length ratio (NS)	% Damping – off infected seedling
Kitchen Waste Compost	3.1 c	4.0 c	1.5 c	0.15 e	2.02	16.30 b (4.037)
Trichocompost	6.1 a	12.3 a	7.8 a	0.71 a	1.78	5.200 d (2.27)
Vermicompost	5.3 ab	9.4 b	6.6 a	0.61 b	1.73	12.40 c (3.518)
Cow dung based bioslurry	4.3 bc	11.5 a	3.5 b	0.37 d	1.88	15.10 b (3.886)
Control (Soil)	4.1 bc	9.1 b	3.5b	0.46 c	2.06	19.50 a (4.413)
CV(%)	9.2	7.6	9.7	7.70	9.56	8.48

Shoot length followed the similar trend and ultimately these impacts were significantly attributed in case of vigour index. It ranged from 2351.0 to 587.9 and the highest vigour index was found in case of trichocompost while kitchen waste compost gave the lowest vigour index. More or less similar trends were observed in case of root and shoot number, fresh and dry weight of 10 seedlings. However, no significant difference was observed among the treatments in case of root and shoot length ratio although highest ratio (2.06) was found in case of control. Irrespective days after sowing, the highest effect against damping off disease was recorded in trichocompost (5.20%) and was followed by vermicompost while the poor performance (19.5%) was found in control.

Discussion

Trichocompost gave the best performance might be due to the synergistic effect of compost and trichoderma in increasing the root surface area per unit of soil volume, water use efficiency and photosynthetic activity of seedlings in addition of higher nutrient contents in trichocompost which had been reflected in sample analysis. It also gave the better performance against damping off disease which is in agreement with the findings of Islam *et al.,* 2007; and Manoranjitham *et al.,* 2000. In most cases, the performance of trichocompost was followed by vermicompost. This finding was supported by many investigators (Arancon *et al.,* 2003; and Atiyeh *et al*., 2002) who reported that worm worked waste and their excretory products (vermicast) can induce excellent seed germination and enhanced rate of tomato seedling growth. However, kitchen waste compost gave the poor performance could be due to presence of heavy metal like lead and copper which was observed by Jaja and Odoemena (2004).

Suggestions to tackle with the future challenges of raising seedlings in organic tomato production

The findings of the present study concluded that potting media with trichocompost and vermicompost offered better performance in producing faster emergence of seedling with higher vigority and healthy those had the potential against damping off disease in tomato.

References

Abdul-Baki A & Anderson JD (1973). Vigour determination of soybean seed by multiple criteria. Crop Science 3, 630-633.

Arancon NQ, Edwards CA, Biennan P, Metzger JD, Lee S & Welch C (2003). Effects of vermicomposts to tomatoes and peppers grown in the field and strawberries under high plastic tunnels. Pedobiologia 47, 731-735.

Atiyeh RM, Lee S, Edwards CA, Arancon NQ, & Metzger JD (2002). The influence of humic acids derived from earthworm-processed organic wastes on plant growth. Bioresource Technology 84, 7-14.

Copeland LO (1976). Principles of seed science and technology. Burgess Pub. Com., Minneapolis, Minnesota, pp 164 - 165.

Islam MT, Islam MR, Aminuzzaman FM & Yesmin S (2007). Management of Damping off of Vegetable seedlings through some selected Soil amendments and Chemicals. Journal of Agricultural Science and Technology 8(2), 27-31.

Jaja ET & Odomena, CSI (2004). Effect of Pb, Cu and Fe on the germination and early seedling growth of tomato varieties. Journal of Applied Science and Environment Management 8(2), 51 – 53.
Manoranjitham SK, Prakasan V, Rajappan K & Amutha G (2000). Effect of two antagonists on damping off disease of tomato. Indian Phytopathology, 53 (4), 441-443.
Odoemena CS (1988). Breaking of seed coat dormancy in a medicinal plant *Tetrapleura tetraptera.* Journal of Agricultural Science (Cambridge) 111 (2), 393 – 394.
Shabani H, Peyvast G, Olfati JA & Ramezani PK (2011). Effect of municipal solid waste compost on yield and quality of eggplant. Comunicata Scientiae 2(2), 85-90.