

Foliar Application of the Leachate from Vermicompost and Mustard Oil Cake on the Growth and Yield of Summer Tomato

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Abstract: This is in an environmental friendly approach to increase the yield of summer tomato as an alternative to the application of hazardous chemical fertilizers. An experiment was carried out in the experimental field of the Olericulture Research field, Horticulture Research Centre, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur, Dhaka, Bangladesh to investigate the potential of vermicompost and mustard oil cake leachate as foliar organic fertilizer with reference to the growth, yield and TSS status of BARI hybrid tomato 8 and then examined their effects on different parameters. Treatments of the experiment were: No foliar application (T_1); foliar application of leachate from vermicompost (T_2) and foliar application of leachate from mustard oil cake (T_3). The experimental data revealed that significant increase in growth; yield and TSS on BARI hybrid tomato 8 were observed due to foliar application of vermicompost and mustard oil cake. All parameters performed better results with the foliar application of the leachate from vermicompost which was very close the mustard oil cake. However, maximum number of fruit (30.9 plant^{-1}), yield ($14.3 \text{ kg plot}^{-1}$) and TSS (4.7%) were found from the foliar application of leachate from vermicompost which was followed by mustard oil cake (28.4 plant^{-1} , $12.7 \text{ kg plot}^{-1}$ and 4.2% respectively) whereas minimum from control.

Key words: *Lycopersicon esculentum* • BARI hybrid tomato 8 • TSS

INTRODUCTION

Tomato (*Lycopersicon esculentum* L.) is a popular vegetable mostly grown in winter months in Bangladesh but it has great potentiality to grow in summer also. Cultivation of summer vegetables is affected due to excessive rainfall, wind storm, etc. during the monsoon season. High temperature was reported as limiting fruit set due to an impaired complex of physiological process in the pistil, which results in floral or fruit abscission. Fruit setting in tomato is interrupted above 26 and 20°C and often completely stopped above 38 and 27°C day and night temperature respectively [1-3]. BARI has already developed some hybrid tomato varieties for summer cultivation [4]. These tomato hybrids are capable of growing tomato during summer season. Nowadays farmers of Bangladesh are very much fascinated to grow these hybrid tomatoes. Growers in some countries are also

commercially producing tomatoes at higher temperature through exogenous application of synthetic PGRs. Long time intensive use of chemical fertilizers creates some fertility problems through soil exhaustion as well as through interactions with other elements [5, 6] and causing micronutrients deficiency. Fruits harvested from plant receiving organic matter were firmer, have superior TSS and ascorbic acid, lower acidity, attractive color and exacerbate marketable fruit yield up to 58.6% with better quality [7]. Leachates from vermicompost is full of vitamins, antibiotics, microelements, minerals and enzymes and that lead into plants' growth and performance improvement and even cause the increased resistance of plants against diseases [8] also it has a huge storage of microorganisms fixing atmospheric nitrogen and plays a significant role in raising phosphorus of soil [9]. Mustard oil cake contains high amount of secondary and micronutrients in addition to N, P and K @ 5.1-5.2,

1.8-1.9 and 1.1-1.3%, respectively, [10]. Among the organic amendments, oil cakes have been found to be the most prospective because they do not only reduce nematode development but also stimulate plant growth supplying plant nutrients of some sorts [11]. Its also supply sufficient amount of S, Zn and B for the growth. Considering the above facts, the present study was therefore under taken to evaluate the performance of BARI hybrid tomato 8 by foliar application of vermicompost and mustard oil cake for summer tomato cultivation.

MATERIALS AND METHODS

Experiment was conducted at Olericulture Research field, Horticulture Research Centre, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur. Dhaka, Bangladesh during the month of April to August 2013 following Completely Randomized Complete Block Design (RCBD) with three replications. Seeds were sown on the seedbed in 14th April and seedlings were transplanted into the main field on 10th May, 2013. BARI hybrid tomato 8 and three treatments viz., T₁: No foliar application; T₂: foliar application of leachate from vermicompost and T₃: foliar application of leachate from mustard oil cake) were used in the experiment. The unit plot size was 2.4 x 1.0 m². The plant spacing was 40cm in rows of 60cm apart from. Manures and fertilizers were applied as recommended by Bangladesh Agricultural Research Institute [4]. Data were collected on plant height, number of leaves plant⁻¹, leaf area, number of branches plant⁻¹, percentage of disease infected plant, number of fruit plant⁻¹, fruit length, fruit diameter, single fruit weight, yield plant⁻¹ and TSS. Collected data were statistically analyzed using MSTAT-C program, mean was calculated and analysis of variance (ANOVA) for each of treatment was represented by F-test. Differences between treatment means were evaluated by Least Significance Difference (LSD) test at 5% level of significance [12].

RESULTS

Plant Growth Characteristics

Plant Height: Plant height of tomato plant varied significantly among the treatments. Tallest plant was found from T₂ (122.4 cm) which was statistically identical with T₃ (115.6 cm) while minimum from T₁ (108.5 cm) at 75 DAT (Table 1).

Leaves Number: Statistically significant variation was found among the treatments for number of leaves. Maximum number of leaves was found from T₂ (61.8 plant⁻¹) which was statistically identical with T₃ (59.8 plant⁻¹) whereas minimum from T₁ (53.9 plant⁻¹) at 75 DAT (Table 1).

Leaf Area: Statistically significant variation was found among the treatments for leaf area. Maximum leaf area was found from T₂ (58.4 cm²) which was statistically identical with T₃ (57.0 cm²) whereas minimum from T₁ (47.4 cm²) at 75 DAT (Table 1).

Number of Branches: Statistically significant variation was found among the treatments for number of branches. Maximum number of branches was found from T₂ (11.3 plant⁻¹) which was statistically identical with T₃ (10.3 plant⁻¹) whereas minimum from T₁ (8.7 plant⁻¹) at 75 DAT (Table 1).

Diseases Susceptibility

Disease Infected Plant: Percentage of the diseases infected plant varied in different foliar application. However, minimum disease infected plant was found from T₂ (10.5%) which was statistically identical with T₃ (11.0%) whereas maximum from T₁ (17.1%) at 75 DAT (Table 1). From this experiment it was found that foliar application of vermicompost and mustard oil cake leachates reduces the diseases infection.

Table 1: Response of BARI hybrid tomato 8 to foliar application of vermicompost and mustard oil cake on growth characteristics and diseases susceptibility^x

Treatments	Plant height (cm)		Leaves number plant ⁻¹		Leaf area (cm ²)		Number of branches plant ⁻¹		Disease infected plant (%)	
T ₁	108.5	B	53.9	b	47.4	b	8.7	b	17.1	a
T ₂	122.4	A	61.8	a	58.4	a	11.3	a	10.5	b
T ₃	115.6	ab	59.8	a	57.0	a	10.3	a	11.0	b
LSD0.05	7.1		2.0		7.7		1.5		3.3	
CV%	2.7		1.5		6.3		6.6		11.3	

^xIn a column means values having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of significance.

Table 2: Response of BARI hybrid tomato 8 to foliar application of vermicompost and mustard oil cake on yield and quality characteristics^x

Treatments	Number of fruits plant ⁻¹		Fruit length (cm)		Fruit diameter (cm)		Single fruit weight (g)		Yield (kg plant ⁻¹)		Yield (kg plot ⁻¹)		TSS (%)	
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T ₁	22.3	c	4.0	c	3.7	c	43.5	a	1.0	b	9.4	c	3.5	c
T ₂	30.9	a	4.6	a	4.6	a	49.5	a	1.5	a	14.3	a	4.7	a
T ₃	28.4	b	4.4	b	4.2	b	47.1	a	1.3	a	12.7	b	4.2	b
LSD0.05	1.8		0.2		0.3		6.6		0.2		1.5		0.4	
CV%	2.9		1.8		2.9		6.2		8.3		3.7		4.3	

^xIn a column means values having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly as per 0.05 level of significance

Yield Characteristics

Number of Fruit Plant⁻¹: Number of fruit plant⁻¹ showed significant variation due to the foliar application of vermicompost and mustard oil cake. Maximum number of fruit was found from T₂ (30.9 plant⁻¹) followed by T₃ (28.4 plant⁻¹) while minimum from T₁ (22.3 plant⁻¹) (Table 2).

Fruit Length and Diameter: Fruit length and diameter showed significant variation due to the foliar application of vermicompost and mustard oil cake. Longest fruit was found from T₂ (4.6 cm) followed by T₃ (4.4 cm) while minimum from T₁ (4.0 cm) (Table 2). Maximum fruit diameter was found from T₂ (4.6 cm) followed by T₃ (4.2 cm) while minimum from T₁ (3.7 cm) (Table 2).

Single Fruit Weight: BARI hybrid tomato 8 did not show any significant variation for single fruit weight. Maximum single fruit weight was found from T₂ (49.5 g) followed by T₃ (47.1 g) whereas minimum from T₁ (43.5 g) (Table 2).

Yield: Yield of tomato was varied significantly among the different treatments. However, maximum yield was found from T₂ (1.5 kg plant⁻¹ and 14.3 kg plot⁻¹) while minimum from T₁ (1.0 kg plant⁻¹ and 9.4 kg plot⁻¹) (Table 2).

Quality Characteristics

TSS: TSS content of BARI hybrid tomato 8 showed significant variation among the treatments. However, maximum TSS content was found from T₂ (4.7%) which was followed by T₃ (4.2%) whereas minimum from T₁ (3.5%) (Table 2).

DISCUSSION

Vermicompost increased the plant height in tomato, carrot [13], in *Allium sativum* (garlic) [14], eggplant, okra and tomato plants [15] and evergreen [16] which may be due to the stimulation of the production of auxin-like

substances [13]. Vermicompost an organic source of plant nutrients contains a higher percentage of nutrients necessary for plant growth in readily available forms [17], has the capacity to supply both macro and micronutrients for improving optimum plant growth [18, 19]. Leachates from vermicompost are a huge storage of microorganisms fixing atmospheric nitrogen and play a significant role in raising the phosphorus of soil [9]. The stimulatory effect of vermiwash on plant growth of black gram reported [20] and on tea, coconut and horticultural crops [21]. Zaller [22] have studied the effect of vermiwash on the field grown tomato (*Lycopersicon esculentum*) indicated the late blight suppression and improve the fruit quality. The application of vermiwash has been shown to reduce disease caused by necrotrophs as well as biotrophs [23, 24]; depress soil born pathogen and pest [25, 26]. On the other hand, MOC (mustard oil cake) application showed the better performance of the growth and yield characteristics of rice [27, 28, 29]. Islam *et al.* [30] observed that rice grain yield was increased with the application of MOC. Mustard oil cake was also found to give comparatively better effect in respect of plant growth characters with improved length of shoot and root and fresh weight of shoot and root correspondingly with reduced galling incidence and different stages of nematode population and also reported that oil cake amendments reduced plant parasitic nematode populations, the most common of which were *Hoplolaimus indicus*, *Tylenchorynchus brassicae*, *Helicorylenchus spp.* and *Meloidogyne incognita*. Mustard oil cake was most effective in tomato, carrot and potato fields [31-33].

CONCLUSIONS

Foliar application of vermicompost and mustard oil cake leachates have remarkable influence on growth, yield and TSS content of BARI hybrid tomato 8 during summer cultivation. Thus, to obtain higher yield with better TSS of BARI hybrid tomato 8 foliar application of

vermicompost should be incorporated with recommended NPK fertilizers but unavailability of vermicompost mustard oil cake (MOC) can also be incorporated.

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