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Combined effect of organic manures on growth and yield of tomato varieties

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Abstract
The field experiment was conducted in the Horticultural farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the period from October 2013 to March 2014. Two factors were used in the experiment, viz. factor A: four types of organic manure such as M_0= Control, M_1 = Cow dung (20 t/ha), M_2 = Poultry manure (16 t/ha) and M_3 = Vermi compost (14 t/ha) and factor B: three varieties such as V_1 = BARI tomato 15, V_2 = BARI tomato 14 and V_3 = BARI tomato 2. The experiment was laid out in Randomized complete Block Design (RCBD) with three replications. The maximum (49.64 kg/plot) yield was recorded from treatment combination of M_2V_1 while the treatment combination of M_0V_3 gave the minimum yield (18.00 kg/plot). The maximum yield (86.25 t/ha) was recorded from treatment combination of M_2V_1, while M_0V_3 gave the minimum (31.25 t/ha). So, poultry manure with BARI Tomato 15 may be used for tomato cultivation.

Keywords: Tomato, varieties, organic manures, growth and yield

1. Introduction

Tomato *(Lycopersicon esculentum* Mill.) belongs to the family Solanaceae. It was originated in tropical America (Salunkhe et al.1987), particularly in peru, Ecuador and Bolivia of the Andes (Kalloo, 1989). It is one of the important, popular and nutritious vegetables grown in Bangladesh in both winter and summer season around all parts of the country (Haque et al., 1999). Bangladesh produces 103 thousand tones of tomato from 18.16 thousand hectares of land, the average yield being 8.72 t/ha (BBS, 2010). This yield is very low compared to other tomato growing countries. This low yield may be due to use of low yielding varieties and poor crop management.

Organic matter is a source of food for the innumerable number of microorganisms and creatures like earthworm who breaks down these to micronutrients, which are easily absorbed by the plants. Organic manure plays a direct role in plant growth as a source of all necessary macro and micronutrients in available forms during mineralization, improving the physical and physiological properties of soils. Organic manures such as cow dung, poultry manure and vermin compost improves the soil structure, aeration, slow release nutrient which support root development leading to higher growth and yield of tomato plants. The macronutrients calcium and micronutrients boron, manganese, molybdenum and iron are important for tomato cultivation. Biologically active soils with adequate organic matter usually supply enough of these nutrients (Singh and Kushwah, 2006).

In Bangladesh, a large number of tomato varieties are grown which are of exotic origin and were developed long before. Most of them lost their potentiality due to genetic deterioration and disease contamination. Hence, in order to improve the present situation of tomato production in Bangladesh, it is essential to better varieties to the growers of Bangladesh. Recently the Bangladesh Agricultural Research Institute (BARI) developed some varieties with good contributing characters. The present study was undertaken in view of the following objectives to determine the best organic manure on growth and yield of tomato varieties.

2. Materials and methods

The field experiment was conducted in the Horticulturel farm at Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh during the period from October 2013 to March 2014. The location of the experimental site was at in 23.750 N latitude and 90.340 E longitudes with an elevation of 8.45 meter from the sea level. The climate of the experimental area was subtropical in nature. It is characterized by heavy rainfall, high temperature, high humidity and relatively long day during kharif season (April to September)

and a scanty rainfall associated with moderately low temperature, low humidity and short day period during rabi season (October to March). Soil of the study site was silty clay loam in texture. The area represents the Agro-Ecological Zone of Madhupur tract (AEZ-28) with p^H 5.8-6.5, ECE 25-28. Tomato seeds were collected from Vegetable division, Horticulture Research Centre (HRC), Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur. Two factors were used in the experiment, viz. factor A: four types of organic manure such as M_0= Control, M_1 = Cow dung (20 t/ha), M_2 = Poultry manure (16 t/ha) and M_3 = Vermi compost (14 t/ha) and factor B: three varieties such as V_1 = BARI tomato 15, V_2 = BARI tomato 14 and V_3 = BARI tomato 2. The experiment was laid out in Randomized complete Block Design (RCBD) with three replications. Seedbed was prepared on 8 October' 2013 for raising seedlings of tomato and the size of the seedbed was 3 m × 1 m. Seeds were sown on 12 October 2013 in the seedbed. Healthy and 30 days old seedlings were transplanted into the experimental field on 12 November 2013. The experimental plot was first divided into three blocks. Each block consisted of 12 plots. Thus, the total numbers of plot were 36. The experimental area was first opened on 15 October 2013 by a disc plough to open direct sunshine to kill soil borne pathogens and soil inhabitant insects. It was prepared by several ploughing and cross ploughing with a power tiller followed by laddering to bring about a good tilth. Thirty days-old healthy seedlings were transplanted at the spacing of 60 cm × 40 cm in the experimental plots on 12 November 2013. Fruits were harvested at 3-day intervals during early ripe stage when they attained slightly red color. Harvesting was started from 15 February, 2014 and was continued up to 15 March, 2014.

Ten plants were selected at random and uprooted carefully at the time of collecting data of root from each plot and mean data on the following parameters were recorded plant height, number of leaves per plant, number of flower clusters per plant, number of flowers per cluster, number of flowers per plant, number of fruits per plant, weight of individual fruit, yield of fruits per plant, yield of fruits per plot and yield of fruits per hectare.

The data in respect of yield, quality and yield components were statistically analyzed to find out the significance of the experimental results. The means of all the treatments were calculated and the analysis of variance for each of the characters under study was performed by F test. The difference among the treatment means were evaluated by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

3. Results and discussion

3.1 Plant height

The variation was found due to combined effect of organic manure and variety on plant height at different days after transplanting (Table 1). At harvest the maximum plant height (97.80 cm) was obtained from the treatment combination M_2V_1 whereas the minimum (58.90 cm) was found from the treatment combination of M_0V_3.

3.2 Number of leaves per plant

Due to combined effect of organic manure and variety showed significant differences on number of leaves per plant at different days after transplanting (Table 1). At harvest, the maximum (62.82) number of leaves per plant was obtain from the treatment combination of M_2V_1 whereas the minimum (43.91) was recorded from treatment combination of M_0V_3.

Table 1: Interaction effect of organic manures and varieties on plant height and number of leaves per plant of tomato

Treatment	Plant height (cm)	Number of leaves per plant
	Final harvest	Final harvest
M_0V_1	67.24 b-e	50.38 ab
M_0V_2	62.98 c-e	44.01 b
M_0V_3	58.90 e	43.91 b
M_1V_1	69.67 b-e	49.88 ab
M_1V_2	83.51 ab	57.30 ab
M_1V_3	81.16 a-c	61.41 a
M_2V_1	97.80 a	62.82 a
M_2V_2	65.36 de	51.38 ab
M_2V_3	84.49 ab	57.39 ab
M_3V_1	79.29 a-d	54.64 ab
M_3V_2	86.05 ab	54.33 ab
M_3V_3	76.18 b-e	55.48 ab
$LSD_{(0.05)}$	9.45	14.96
CV (%)	7.45	9.23

Means in the column followed by different letter(s) differed significantly by DMRT at 5% level of significance

3.3 Number of flower clusters per plant

The variation was found due to combined effect of organic manure and varieties for number of flower cluster per plant (Table 2). The maximum number of flower cluster per plant (11.64) was recorded from the treatment combination of M_2V_1 (Poultry manure + BARI Tomato 15) and the treatment combination of M_0V_3 (Control + BARI Tomato 2) gave the minimum (6.34) number of flower clusters per plant.

3.4 Number of flowers per cluster

The variation was also found due to combined effect of organic manures and varieties on number of flowers per cluster per tomato plant (Table 2). The maximum number of flower per cluster (11.43) was recorded from treatment combination of M_2V_1 (Poultry manure + BARI Tomato 15) and the treatment combination of M_0V_3 (Control + BARI Tomato 2) gave the minimum number of flowers per cluster (5.58).

3.5 Number of flowers per plant

The variation was found due to combined effect of organic manures and varieties on number of flowers per plant (Table 2). The maximum number of flower per plant (91.16) was recorded from the treatment combination of M_2V_1 (Poultry manure + BARI Tomato 15) and the treatment combination of M_0V_3 (Control +BARI Tomato 2) performed the minimum number of flower per plant (26.40).

3.6 Number of fruits per plant

Due to combined effect of organic manures and varieties showed significant differences on number of fruits per plant (Table 2). The maximum (55.91) number of fruit per plant was recorded from treatment combination of M_2V_1 (Poultry manure + BARI Tomato 15) and the treatment combination M_0V_3 (Control +BARI Tomato 2) gave the minimum (15.70) number of fruits per plant.

Table 2: Combined effect of organic manures and varieties on flower cluster per plant, flower per cluster, flower per plant and fruit per plant

Treatment	Cluster /plant	Flower /cluster	Flower /plant	Fruit /Plant
M_0V_1	7.73 f	8.01 c	30.75 e	19.04 ef
M_0V_2	7.27 f	6.12 d	26.89 e	19.62 d-f
M_0V_3	6.34 g	5.58 d	26.40 e	15.70 f
M_1V_1	8.40 e	8.24 c	28.75 e	19.71 ef
M_1V_2	8.61 de	8.29 c	43.78 c-e	30.93 cd
M_1V_3	8.99 cd	8.57 bc	71.19 b	38.96 bc
M_2V_1	11.64 a	11.43 a	91.16 a	55.91 a
M_2V_2	11.37 a	10.57 a	36.44 de	31.71 c
M_2V_3	10.34 b	10.45 ab	54.83 b-d	41.71 bc
M_3V_1	9.08 cd	9.62 ab	38.20 de	29.93 c-e
M_3V_2	9.27 c	10.25 ab	64.20 bc	50.58 ab
M_3V_3	10.34 b	8.54 bc	41.16 de	40.61 bc
$LSD_{(0.05)}$	0.5963	1.744	19.46	10.61
CV (%)	6.26	7.15	7.25	9.26

Means in the column followed by different letter(s) differed significantly by DMRT at 5% level of significance.

3.7 Length of individual fruit

The variation was found due to combined effect of organic manures and varieties for length of individual fruit under the present trial (Table 3). The maximum (10.94 cm) length of individual fruit was recorded from treatment combination of M_2V_1 (Poultry manure + BARI tomato 15) and the treatment combination of M_0V_3 (Control treatment + BARI Tomato 2) performed the minimum (4.08 cm) length of individual fruit.

3.8 Diameter of individual fruit

Combined effect of organic manure and varieties varied significantly on diameter of individual fruit (Table 3). The maximum (13.31 cm) diameter of individual fruit was recorded from treatment combination of M_2V_1 (Poultry manure +BARI Tomato 15) and the treatment combination of M_0V_3 (Control treatment + BARI Tomato 2) gave the minimum (6.60 cm) diameter of individual fruit.

3.9 Weight of individual fruit

The variation was found to be the significant due to combined effect of organic manures and varieties on weight of individual fruit (Table 3). The maximum (176.66 g) weight of individual fruit was recorded from treatment combination of M_2V_1 (Poultry manure + BARI Tomato 15) and the treatment combination of M_0V_3 (Control treatment + BARI Tomato 2) performed the minimum (73.41 g) weight of individual fruit.

3.10 Yield per plant

A significant variation was found due to combined effect of organic manures and varieties for yield per plant (Table 3). The maximum (2.07 kg/plant) yield was recorded from treatment combination of M_2V_1 (Poultry manure + BARI Tomato 15) and the treatment combination M_0V_3 (Control treatment + BARI Tomato 2) gave the minimum yield (0.75 kg/plant).

3.11 Yield per plot

The variation was found due to combined effect of organic manures and varieties for yield per plot (Table 3). The maximum (49.68kg/plot) yield was recorded from treatment combination of M_2V_1 (Poultry manure + BARI Tomato 15) and the treatment combination of M_0V_3 (Control treatment + BARI Tomato 2) gave the minimum yield (18.00 kg/plot).

3.12 Yield per hectare

A significant variation was found due to combined effect of organic manures and varieties for yield per hectare (Table 3). The maximum yield (86.25 t/ha) was recorded from treatment combination of M_2V_1 (Poultry manure + BARI Tomato 15) and the treatment combination of M_0V_3 (Control treatment + BARI Tomato 2) gave the minimum yield (31.25t/ha).

Table 3: Combined effect of organic manures and varieties on length of individual fruit (cm), diameter of individual fruit (cm), individual fruit weight (g), yield per plant, yield per plot and yield of tomato

Treatment	Length of individual fruit (cm)	Diameter of individual fruit (cm)	Individual Fruit Weight (g)	Yield / Plant (Kg)	Yield /Plot (kg)	Yield (t/ha)
M_0V_1	5.02 h	7.39 gh	95.0 e	1.18 cd	28.32 cd	49.17 cd
M_0V_2	4.69 hi	7.06 gh	95.0 e	1.03 de	24.72 de	42.92 de
M_0V_3	4.08 i	6.60 h	73.41 f	0.75 e	18.0 e	31.25 e
M_1V_1	5.32 h	8.14 fgh	96.77 e	1.19 d	28.56 d	49.58 d
M_1V_2	6.98 f	8.84 efg	115.0 cd	1.39 c	33.36 c	57.92 c
M_1V_3	9.26 c	12.7 ab	121.66 c	1.50 bc	36.0 bc	62.50 bc
M_2V_1	10.9 a	13.31 a	176.66 a	2.07 a	49.68 a	86.25 a
M_2V_2	6.22 g	10.43 cde	106.66 de	1.69 bc	40.56 b	70.42 b
M_2V_3	7.97 de	10.34 cde	108.33 d	1.75 b	42.0 ab	72.92 ab
M_3V_1	7.71 e	9.45 def	133.33 b	1.71 bc	41.04 ab	71.25 ab
M_3V_2	10.10 b	11.82 abc	113.33 cd	1.70 bc	40.8 ab	70.83 b
M_3V_3	8.56 d	11.08 bcd	133.33 b	1.71 bc	41.04 ab	71.25 ab
$LSD_{(0.05)}$	0.63	1.76	10.10	0.32	9.01	15.65
CV (%)	9.21	10.12	7.63	8.21	7.54	9.21

Means in the column followed by different letter(s) differed significantly by DMRT at 5% level of significance.

4. Conclusion

The maximum (2.07 kg/plant) yield was recorded from treatment combination of M_2V_1 while the treatment combination M_0V_3 gave the minimum yield (0.75 kg/plant). The maximum (49.64 kg/plot) yield was recorded from treatment combination of M_2V_1 while the treatment combination of M_0V_3 gave the minimum yield (18.00 kg/plot). The maximum yield (86.25 t/ha) was recorded from treatment combination of M_2V_1 while the treatment combination of M_0V_3 gave the minimum yield (31.25 t/ha). So, poultry manure with BARI Tomato 15 may be used for tomato cultivation.

5. References

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