

Original Research Article

EFFICACY OF DIFFERENT ORGANIC MANURES ON GROWTH AND YIELD PERFORMANCE OF ORGANICALLY GROWN TOMATO

ABSTRACT

The field experiment was conducted in the Horticultural farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka -1207 during the period from October 2014 to March 2015 to find out the efficacy of different organic manures and different varieties on the growth, yield performance of organically grown tomato. The experiment comprised of two different factors such as Factor A. four types of organic manure such as M_0 = Control (No organic manures application), M_1 = Cowdung (30 t/ha), M_2 = Poultry manure (25 t/ha) and M_3 = Vermicompost (20 t/ha). Factor B. three types of variety 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. Encouraging responses were monitored in all respects. Among the treatment combination M_2V_1 (Poultry manure + BARI Tomato 15) showed the highest plant height, maximum number of flower cluster, number of flower per cluster, number of fruits per cluster and number of fruit per plant with improved fruit size. The maximum yield (86.25 t/ha) was recorded from the treatment combination of M_2V_1 (Poultry manure + BARI Tomato 15), while the treatment combination of M_0V_3 (Control treatment + BARI Tomato 2) gave the minimum yield (31.25 t/ha). Therefore, BARI Tomato 15 coupled with poultry manure can be the most suitable for enhanced yield and can be considered a noble practice in sustainable agriculture.

Keywords: Organic manure, growth, yield, tomato

1. INTRODUCTION

Over the last two decades, organically grown vegetables have generated significant interest among the consumers and scientists due to healthier products and safer characteristics to human health. Consumers demand for organic vegetables has also on the rise. Therefore, sustainability of vegetable production with higher yield is the prime need to meet consumer demand. Furthermore, sustainable vegetable production has been often reported as an environmentally-friendly production system able to produce food with minimal hazardous effect to ecosystems and environment as well as minimal use of off-farm resources [1]. However, the major drawback of organic vegetable production is the lower yield compared to conventional agriculture [2, 3]. Therefore, farmers prefer to use commercial synthetic chemical fertilizers for vegetable production. However, extensive use of inorganic fertilizer may lead to environmental pollution including contamination of groundwater, and soil acidification as well as increase de-nitrification resulting in higher the emission of nitrous oxide (N_2O) to the atmosphere which is responsible for global warming. Therefore, there is prime need to bring new management practice to increase nutrient availability, plant uptake and assimilation, reduce disease intensity in order to close the gap between organic and conventional yields [4, 5]. Application of organic manures can be an effective practice to produce tomato in a sustainable production system. Organic manure 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 vermicompost 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 [6]. Tomato (*Lycopersicon esculentum* L.) is one of the most popular and versatile vegetables in the world which is cultivated in almost all parts of Bangladesh under both field and greenhouse conditions. Tomato fruits are eaten raw or cooked and other dishes like as soups, juice, Jam, Jelly, ketchup, pickles, sauces, conserves, puree, paste, powder and other products. In terms of human health, tomato is a major component in the daily diet and constitutes an important source of minerals, vitamins and antioxidants, like lycopene. Lycopene pigment is a vital anti-oxidant that helps to fight against cancerous cell formation as well as other kind of health complications and diseases [7]. Nevertheless, it plays a vital role in providing a substantial quantity of vitamin C and A in human diet [8]. Increasing the production and improving the keeping quality of tomato are of paramount importance, now-a-days, for meeting the internal demand of the consumers'. Hence efforts should be given to identify varieties with high yield potential in organic production system influenced by the application of different organic manures. Considering the above perspective, the present study was undertaken to identify the suitable tomato variety and the efficacy of different organic manures which can promote growth, increase yield of tomato in a sustainable and environment friendly way.

2. MATERIAL AND METHODS

2.1 Experimental Site

The experiment was conducted at the Horticultural farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh from October 2015 to February 2016. The location of the experimental site was 23°74'N latitude and 90°35'E longitude and at an elevation of 8.2 m from sea level. The climate of experimental site was under the subtropical climate, characterized by three distinct seasons, the winter season from October to February and the pre-monsoon or hot season from March to April and the monsoon period from May to October. The soil of the experimental area belongs to the Modhupur Tract (AEZ No 28). It had shallow red brown terrace soil. The selected plot was medium high land and the soil series was Tejgaon.

Comment [Z1]: Please can you add some information about mechanical and chemical characteristics of soil . Its necessary if we have experiments with manure !!!!!!!

2.2 Planting Material

Three varieties of tomato were used in this experiment viz, V_1 = BARI tomato 15, V_2 = BARI tomato 14 and V_3 = BARI tomato 2. Tomato seeds were collected from Vegetable division, Horticulture Research Centre (HRC), Bangladesh Agricultural Research Institute (BARI), Gazipur, Bangladesh.

2.3 Organic Materials

Four types of organic manure coded as M_0 = Control (No organic manure), M_1 = Cow dung (30 t/ha), M_2 = Poultry manure (25 t/ha), M_3 = Vermicompost (20 t/ha)

Comment [Z2]: Composition of different manure which you applicated in experiment . Special content of N !!!!!!!

2.4 Experimental Design and Treatments

The experiment was laid out in Randomized Complete Block Design with three replications. There were altogether 12 (4 x 3) treatments combination used in each block were as follows; M_0V_1 , M_1V_2 , M_2V_3 , M_0V_2 , M_1V_3 , M_3V_1 , M_0V_3 , M_2V_1 , M_3V_2 , M_1V_1 , M_2V_2 , M_3V_3 . The experimental plot was first divided into three blocks. Each block consisted of 12 plots. Thus, the total numbers of plot were 36. Different combinations of treatments were assigned to each plot as per design of the experiment. The size of a unit plot was 2.4m x 2.4m. A distance of 0.5 m between the plots and 1.0 m between the blocks were kept.

2.5 Growth Condition of Tomato and application of Manures

89 The experimental land area was prepared by several ploughing and cross ploughing with a power
 90 tiller followed by laddering to bring about a good tilth. The land was leveled, corners were shaped and
 91 the clods were broken into pieces. The weeds, crop residues and stables were removed from the
 92 field. Total organic manures were applied according to their treatment and finally leveled. Thirty days
 93 old healthy seedlings were transplanted at the spacing of 60cm × 40cm in the experimental plots.
 94 Thus the 24 plants were accommodated in each unit plot.

Comment [Z3]: You obtained seedlings for 30-
 days ??? Its impossibleits very young seedlings
 ..its a short period for standard seedlings !!!!!!!!

95 2.6 Data Collection and Analysis

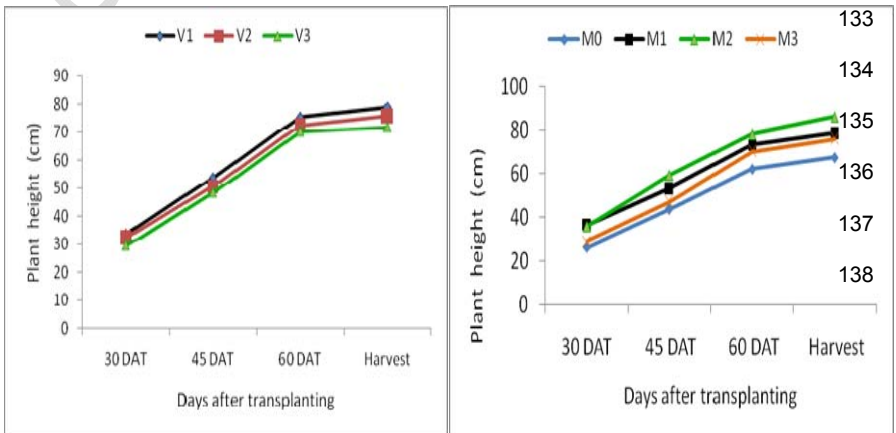
96 Five plants were randomly selected from each unit plot for the collection of data. The plants in the
 97 outer rows and the extreme end of the middle rows were excluded from the random selection to avoid
 98 the border effect. The height of the plants was measured from the ground level to the tip of the
 99 highest leaves. The data obtained for different parameters were statistically analyzed to find out the
 100 significant difference of variety and different manure application on yield and yield contributing
 101 characters of cabbage. The mean values of all the characters were calculated and analysis of
 102 variance was performed by the 'F' (variance ratio) test. The significance of the difference among the
 103 treatment combinations means was estimated by the Duncan's Multiple Range Test (DMRT) at 5%
 104 level of probability.

105 3. RESULTS AND DISCUSSION

106 3.1 Plant height (cm)

109 Application of organic manures exhibited a significant influence on the height of tomato plants at 30,
 110 45, and 60 days after transplanting (DAT) and at final harvest (Figure 1). At 30 DAT, the tallest plant
 111 (35.68cm) was found in the application of poultry manure (M₂) and the shortest plant (26.33cm) was
 112 recorded from control treatment (M₀). At 45 DAT, the plant height (59.32cm) was recorded from M₂,
 113 while the lowest (43.88cm) was recorded from M₀. At 60 DAT, the longest plant (77.35cm) was
 114 recorded from M₂ and the shortest plant (62.08cm) was recorded from M₀. At final harvest, plant
 115 height ranged from 67.44cm to 83.90cm. The highest plant (83.90cm) was recorded from M₂, while
 116 the lowest (67.44cm) was recorded from M₀. Poultry manure is rich in its nitrogen and nutrient
 117 content. This favorable condition creates better nutrient absorption and favors for vegetative growth.
 118 Consequently longest plant was found by application of poultry manure. This is an agreement with the
 119 findings of [6].

121 Different varieties showed significant influence on plant height of tomato plants at different DAT and
 122 final harvest (Figure 1). At 30 DAT, the tallest plant (33.71cm) was found from V₁ (BARI Tomato 15)
 123 and the shortest plant (29.53cm) was found from variety V₃ (BARI Tomato 2). At 45 DAT, the highest
 124 plant height (53.77cm) was recorded from V₁, while the lowest (48.48cm) was recorded from V₃. The
 125 plant height ranged from 70.31cm to 75.33cm at 60 DAT. The longest plant (75.33cm) was recorded
 126 from V₁ and the shortest plant (70.31cm) was recorded from V₃. At final harvest, the highest plant
 127 (78.12cm) was recorded from V₁, while the lowest (71.88cm) was recorded from V₃. Organic matter
 128 improves soil structure, increases the water holding capacity and promotes biological transformations
 129 such as N-mineralization and enhances crop growth and development [9]. The results of this study
 130 are also in agreement with the findings of [10, 11].



140 **Figure 1: Effect of manures and variety on plant height of tomato** (M_0 = Control, M_1 = Cowdung
 141 (30 t/ha), M_2 = Poultry manure (25 t/ha) and M_3 = Vermicompost (20 t/ha), V_1 = BARI tomato 15, V_2 =
 142 BARI tomato 14 and V_3 = BARI tomato 2

143 The variation was found due to combined effect of organic manure and variety on plant height at
 144 different days after transplanting (Table 1). The maximum plant height (48.80cm) was recorded from
 145 the treatment combination of M_2V_1 , while the treatment combination of M_0V_3 gave the minimum plant
 146 height (16.66 cm) at 30 DAT. At 45 DAT significant differences in terms of plant height was observed
 147 among the treatment combinations. However the largest plant (75.08cm) was recorded from the
 148 treatment combination of M_2V_1 whereas the minimum (36.20 cm) was recorded from treatment
 149 combination of M_0V_3 . At 60 DAT, the tallest plant (90.61 cm) was recorded from the treatment
 150 combination of M_2V_1 , while the minimum plant height (51.22 cm) was recorded from treatment
 151 combination of M_0V_3 . At harvest the maximum plant height (97.80 cm) was obtained from the
 152 treatment combination M_2V_1 whereas the minimum (58.90 cm) was found from the treatment
 153 combination of M_0V_3 .

154 **Table 1: Interaction effect of organic manures and varieties on plant height of tomato**
 155

Treatment	Plant height (cm)			
	Plant height at 30 DAT	Plant height at 45 DAT	Plant height at 60 DAT	Plant height at Harvest
M_0V_1	22.56 ef	37.92 e	62.08de	67.24 b-e
M_0V_2	17.02 f	36.89 e	61.15 de	62.98 c-e
M_0V_3	16.66 f	36.20 e	51.22 e	58.90 e
M_1V_1	24.40 ef	51.13 b-e	66.24 cd	69.67 b-e
M_1V_2	36.58 bc	57.18 b-d	78.42 abc	83.51 ab
M_1V_3	48.76 a	65.04 ab	80.90 a	81.16 a-c
M_2V_1	48.80 a	75.08 a	90.61 a	97.80 a
M_2V_2	34.76 b-d	47.10 c-e	64.92 cd	65.36 de
M_2V_3	35.68 b-d	55.78 b-d	78.24 abc	84.49 ab
M_3V_1	40.94 ab	45.56 c-e	73.29 bcd	79.29 a-d
M_3V_2	28.80 c-e	59.66 bc	85.02 ab	86.05 ab
M_3V_3	27.22 de	43.60 de	72.95 bcd	76.18 b-e
LSD (0.05)	8.021	13.81	12.19	9.45
CV (%)	7.35	8.95	10.36	7.45

156 *In a column, means followed by same letter (s) do not differ significantly at 5% level of probability, M_0*
 157 *= Control, M_1 = Cowdung (30 t/ha), M_2 = Poultry manure (25 t/ha) and M_3 = Vermicompost (20 t/ha),*
 158 *V_1 = BARI tomato 15, V_2 = BARI tomato 14 and V_3 = BARI tomato 2*

159 3.2 Number of flower clusters per plant 160 161

162 Application of organic manures exhibited a significant influence on the number of flower cluster per
 163 tomato plant (Table 2). The maximum number of flower clusters per plant (9.74) was recorded from
 164 M_2 (Poultry manure), which was statistically identical (8.89) to M_1 while the minimum (8.27) was
 165 obtained from M_0 (Control treatment).

166 A significant variation was recorded due to combined effect of different varieties on number of flower
 167 clusters per plant under the present investigation (Table 2). The maximum number of flower cluster
 168 per plant (10.61) was recorded from V_1 (BARI Tomato 15) and the minimum number of flower cluster
 169 per plant (7.49) was obtained from V_3 .
 170

The variation was found due to combined effect of organic manure and varieties for number of flower cluster per plant (Table 3). 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) which was statistically identical to M_2V_2 (11.37) (Poultry manure + BARI Tomato 14), while the treatment combination of M_0V_3 (Control + BARI Tomato 2) gave the minimum (6.34) number of flower clusters per plant. This study is almost similar to the findings of [12].

3.3 Number of flowers per cluster

Organic manure varied significantly for number of flowers per cluster under the present study (Table 2). The maximum number of flower per cluster (9.24) was recorded from M_2 (Poultry manure), while the minimum (8.41) was obtained from control (M_0). These findings are similar to the findings [9, 11]. Different varieties showed significant variation on number of flowers per cluster under the present trial (Table 2). The maximum number of flower per cluster (10.52) was recorded from V_1 (BARI Tomato 15) which was statistically similar to V_2 (BARI Tomato 14) and the minimum number of flowers per cluster (7.07) was found from V_3 (BARI Tomato 2).

The variation was also found due to combined effect of organic manures and varieties on number of flowers per cluster per tomato plant (Table 3). The maximum number of flower per cluster (11.43) was recorded from treatment combination of M_2V_1 (Poultry manure + BARI Tomato 15), while the treatment combination of M_0V_3 (Control + BARI Tomato 2) gave the minimum number of flowers per cluster (5.58).

3.4 Number of flowers per plant

Number of flowers per plant varied significantly due to application of different organic manures (Table 2). The maximum number of flowers per plant (58.25) was recorded from M_2 (Poultry manure), while the minimum (36.11) was obtained from control treatment (M_0). Different varieties showed significant variation on number of flowers per plant under the present investigation (Table 2). The maximum number of flower per plant (48.05) was recorded from V_1 (BARI Tomato 15) and the minimum number of flower per plant (44.47) was found from V_3 (BARI Tomato 2). Application of manure facilitates slow release of nutrients and facilitates better nutrient uptake and assimilation during reproductive growth which might be the reason for higher number of flower per plant of tomato [11].

The variation was found due to combined effect of organic manures and varieties on number of flowers per plant (Table 3). The maximum number of flower per plant (91.16) was recorded from the treatment combination of M_2V_1 (Poultry manure + BARI Tomato 15), while the treatment combination of M_0V_3 (Control + BARI Tomato 2) performed the minimum number of flower per plant (26.40).

3.5 Number of fruits per plant

Number of fruits per plant differed significantly for application of different organic manures under the present investigation (Table 2). The maximum (42.07) number of fruits per plant was recorded from M_2 (Poultry manure), while the minimum (26.83) was recorded from M_0 (Control treatment). It was revealed that number of fruits per plant increased in poultry manure. This might be caused that Poultry manure contents high amount of nitrogen and nitrogen enhance photosynthesis, cell division and cell enlargement. Similar trend of the results were found by [13] who reported that application of manure improves microbial population and facilitates better nutrient uptake and increased the number of fruits per plant.

Different varieties showed significant variation on number of fruits per plant under the present trial (Table 2). The maximum (36.65) number of fruit per plant was recorded from V_1 (BARI Tomato 15) and the minimum (31.63) number of fruits per plant was observed in V_3 (BARI Tomato 2). The reports also supported to the results of [5, 9, 11].

Due to combined effect of organic manures and varieties showed significant differences on number of fruits per plant (Table 3). The maximum (55.91) number of fruit per plant was recorded from treatment combination of M_2V_1 (Poultry manure + BARI Tomato 15), while the treatment combination M_0V_3 (Control + BARI Tomato 2) gave the minimum (15.70) number of fruits per plant.

Table 2: Effect of organic manure and variety on yield contributing attributes of tomato

Treatment	Flower Cluster /plant	Flower/cluster	Flower/plant	Fruit/Plant
M ₀	8.27 b	8.41 a	36.11 b	26.83 b
M ₁	8.89 b	8.76 a	47.12 ab	32.87 ab
M ₂	9.74 a	9.24 a	58.25 a	42.07 a
M ₃	8.99 b	8.81 a	43.10 ab	33.04 ab
LSD (0.05)	0.5963	1.744	19.46	10.61
CV (%)	6.26	7.15	7.25	9.26
Treatment	Cluster/plant	Flower/cluster	Flower/plant	Fruit/Plant
V ₁	10.61 a	10.52 a	48.05 a	36.65 a
V ₂	9.25 b	8.83 a	45.92 a	32.83 a
V ₃	7.49 c	7.07 b	44.47 a	31.63 a
LSD(0.05)	0.5963	1.744	19.46	10.61
CV (%)	6.26	7.15	7.25	9.26

In a column, means followed by same letter (s) do not differ significantly at 5% level of probability, M₀ = Control, M₁ = Cowdung (30 t/ha), M₂ = Poultry manure (25 t/ha) and M₃ = Vermicompost (20 t/ha), V₁ = BARI tomato 15, V₂ = BARI tomato 14 and V₃ = BARI tomato 2

Table 3: Combined effect of organic manure and variety on yield contributing attributes of tomato

Treatment	Cluster /plant	Flower /cluster	Flower /plant	Fruit /Plant
M ₀ V ₁	7.73 f	8.01 c	30.75 e	19.04ef
M ₀ V ₂	7.27 f	6.12 d	26.89 e	19.62 def
M ₀ V ₃	6.34 g	5.58 d	26.40 e	15.70 f
M ₁ V ₁	8.40 e	8.24 c	28.75 e	19.71 ef
M ₁ V ₂	8.61 de	8.29 c	43.78 cde	30.93 cd
M ₁ V ₃	8.99 cd	8.57 bc	71.19 b	38.96 bc
M ₂ V ₁	11.64 a	11.43 a	91.16 a	55.91 a
M ₂ V ₂	11.37 a	10.57 a	36.44 de	31.71 c
M ₂ V ₃	10.34 b	10.45 ab	54.83 bcd	41.71 bc
M ₃ V ₁	9.08 cd	9.62 ab	38.20 de	29.93 cde
M ₃ V ₂	9.27 c	10.25 ab	64.20 bc	50.58 ab
M ₃ V 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

In a column, means followed by same letter (s) do not differ significantly at 5% level of probability, M₀ = Control, M₁ = Cowdung (30 t/ha), M₂ = Poultry manure (25 t/ha) and M₃ = Vermicompost (20 t/ha), V₁ = BARI tomato 15, V₂ = BARI tomato 14 and V₃ = BARI tomato 2

3.6 Length of individual fruit (cm)

Length of individual fruit varied significantly for different organic manures (Table 4). The maximum length of individual fruit (7.97 cm) was recorded from M₂ (Poultry manure), while the minimum (6.29 cm) was recorded from M₀ (Control) which was statistically identical (7.71 cm) to M₃ (Vermicompost). Similar types of results can be found by [14, 15].

Different varieties showed significant variation on length of individual fruit under the present investigation (Table 4). The maximum (7.66cm) length of individual fruit was recorded from V₁ (BARI Tomato 15) and the minimum (6.66cm) length of individual fruit was obtained from V₃ (BARI Tomato 2).

The variation was found due to combined effect of organic manures and varieties for length of individual fruit under the present trial (Table 5). The maximum (10.94cm) length of individual fruit was recorded from treatment combination of M₂V₁ (Poultry manure + BARI tomato 15), while the treatment combination of M₀V₃ (Control treatment + BARI Tomato 2) performed the minimum (4.08 cm) length of individual fruit.

3.7 Diameter of individual fruit (cm)

Diameter of individual fruit significantly influence by different organic manures (Table 4). The maximum (10.43 cm) diameter of individual fruit was recorded from M₂ (Poultry manure), which was statistically identical with M₃ (9.44 cm) and M₁ (10.35), while the minimum (8.84 cm) was recorded from M₀ (Control treatment). This trend is similar to [16, 17].

Different varieties showed significant variation on diameter of individual fruit under the present investigation (Table 4). The maximum (10.18cm) diameter of individual fruit was recorded from V₁ (BARI Tomato 15) and the minimum (9.18cm) diameter of individual fruit was obtained from V₃ (BARI Tomato 2).

Combined effect of organic manure and varieties varied significantly on diameter of individual fruit (Table 5). The maximum (13.31 cm) diameter of individual fruit was recorded from treatment combination of M₂V₁ (Poultry manure +BARI Tomato 15), while the treatment combination of M₀V₃ (Control treatment + BARI Tomato 2) gave the minimum (6.60 cm) diameter of individual fruit. Our findings are in agreement with the findings of [18].

Comment [Z4]: Unnecessarily !!!!!!!!!!!!!

3.8 Weight of individual fruit (g)

Weight of individual fruit varied significantly due to application of different organic manures. (Table 4). The maximum (123.33 g) weight of individual fruit was recorded from M₂ (Poultry manure), while the minimum (91.69g) was recorded from M₀ (Control treatment).

A significant variation found different varieties on weight of individual fruit under the present trial (Table 4). The maximum (134.58 g) weight of individual fruit was recorded from V₁ (BARI Tomato 15) and the minimum (99.18 g) weight of individual fruit was recorded from V₃ (BARI Tomato 2).

The variation was found due to combined effect of organic manures and varieties on weight of individual fruit (Table 5) The maximum (176.66 g) weight of individual fruit was recorded from treatment combination of M₂V₁ (Poultry manure + BARI Tomato 15), while the treatment combination of M₀V₃ (Control treatment + BARI Tomato 2) performed the minimum (73.41 g) weight of individual fruit. Application of manures supply slow release of nutrients and increase the accumulation of carbohydrates which might be the reason for higher individual fruit weight. This was supported by [19, 20, 21].

3.9 Yield (kg/plant)

Yield per plant varied significantly due to application of different organic manures (Table 4). The maximum (2.06 kg/plant) yield was recorded from M₂ (Poultry manure), while the minimum (0.99kg/plant) was found from M₀ (Control treatment). Poultry manure is rich in its nitrogen and nutrients content. These favorable conditions creates better nutrients absorption and favors the growth and development of root system which in true reflects better vegetative growth, photosynthetic activity. Consequently higher total yield would be obtained by poultry manure. The results also agreed to the findings of [22].

Different varieties showed significant variation on yield per plant under the present investigation (Table 4). The maximum (1.75 kg/plant) yield was recorded from V₁ (BARI Tomato 15) and the

minimum (1.37kg/plant) yield was obtained from V₃ (BARI Tomato2). Similar trend of results were found by [23].

The variation was found due to interaction effect of organic manures and varieties for yield per plant (Table 5). The maximum (2.07 kg/plant) yield was recorded from treatment combination of M₂V₁ (Poultry manure + BARI Tomato 15), while the treatment combination M₀V₃ (Control treatment + BARI Tomato 2) gave the minimum yield (0.75 kg/plant). Application of organic manure supply plant nutrients including micronutrients, improve soil physical properties like structure, water holding capacity, increase the availability of nutrients and favors the beneficial microorganisms which positively increase the yield and quality of tomato [24,25].

Table 4: Effect of organic manures and variety on fruit length, fruit diameter, individual fruit weight and fruity yield per plant of tomato

Treatment	Length of individual fruit (cm)	Diameter of individual fruit (cm)	Individual Fruit Weight(g)	yield /Plant(Kg)
M ₀	6.290 c	8.840 a	91.69b	0.993 c
M ₁	6.980 b	10.35 a	122.81ab	1.532 bc
M ₂	7.977 a	10.43 a	123.33a	2.061 a
M ₃	7.713 a	9.446 a	118.33ab	1.651 b
LSD(0.05)	0.6358	1.761	10.10	0.32
CV (%)	9.21	10.12	7.63	8.21
V ₁	7.665 a	10.18 a	134.58 a	1.75 a
V ₂	7.392 a	9.938 a	108.35 b	1.54 ab
V ₃	6.662 b	9.181 a	99.18 bc	1.37 b
LSD(0.05)	0.6358	1.761	10.10	0.32
CV (%)	9.21	10.12	7.63	8.21

In a column, means followed by same letter (s) do not differ significantly at 5% level of probability, M₀ = Control, M₁ = Cowdung (30 t/ha), M₂ = Poultry manure (25 t/ha) and M₃ = Vermicompost (20 t/ha), V₁ = BARI tomato 15, V₂ = BARI tomato 14 and V₃ = BARI tomato 2

Table 5: Combined effect of organic manures and variety on fruit length, fruit diameter, individual fruit weight and fruity yield per plant of tomato

Treatment	Length of individual fruit (cm)	Diameter of individual fruit (cm)	Individual Fruit Weight (g)	Yield / Plant (Kg)
M ₀ V ₁	5.017 h	7.393 gh	95.0 e	1.18 cd
M ₀ V ₂	4.697 hi	7.067 gh	95.0 e	1.03 de
M ₀ V ₃	4.083 i	6.600 h	73.41 f	0.75 e
M ₁ V ₁	5.327 h	8.147 fgh	96.77 e	1.19 d
M ₁ V ₂	6.980 f	8.840 efg	115.0 cd	1.39 c
M ₁ V ₃	9.263 c	12.71 ab	121.66 c	1.50 bc
M ₂ V ₁	10.94 a	13.31 a	176.66 a	2.07 a
M ₂ V ₂	6.223 g	10.43 cde	106.66 de	1.69 bc
M ₂ V ₃	7.977 de	10.34 cde	108.33 d	1.75 b
M ₃ V ₁	7.713 e	9.453 def	133.33 b	1.71 bc
M ₃ V ₂	10.10 b	11.82 abc	113.33 cd	1.70 bc
M ₃ V ₃	8.563 d	11.08 bcd	133.33 b	1.71 bc
LSD (0.05)	0.6358	1.761	10.10	0.32
CV (%)	9.21	10.12	7.63	8.21

In a column, means followed by same letter (s) do not differ significantly at 5% level of probability, M₀ = Control, M₁ = Cowdung (30 t/ha), M₂ = Poultry manure (25 t/ha) and M₃ = Vermicompost (20 t/ha), V₁ = BARI tomato 15, V₂ = BARI tomato 14 and V₃ = BARI tomato 2

4. CONCLUSION

In this study, organic manures played a significant role in enhanced growth and yield performance of tomato in sustainable production system. BARI Tomato 15 coupled with poultry manure showed enhanced vegetative and reproductive growth with higher yield of tomato by slow and steady release of nutrients to the plants compared to other treatments. Thus the application of BARI Tomato 15 coupled with poultry manure can reduce the cultivation cost of tomato while minimizing pollution by excessive use synthetic fertilizers and could be considered as a good production strategy for obtaining high yields with lower impact on the environment.

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