

# Effect of manures with inorganic fertilizers on the growth and yield of tomato

M.K. Islam, Tania, M.S.I. Majumder, M.S. Hossin and M.R. Uddin

Department of Soil Science, Patuakhali Science and technology University, Dumki, Patuakhali-8602

**Abstract:** An experiment was conducted at the Research Farm of Patuakhali Science and Technology University, Dumki, Patuakhali, during November 2014 to March 2015 to evaluate the growth and yield of tomato influenced by Integrated Nutrient Management (INM). The experiment was laid out in Randomized Complete Block Design with three replications. The experiment comprised of 12 treatment combinations - T<sub>1</sub> (262 kg urea + 120 kg TSP + 124 kg MOP); T<sub>2</sub> (3t cow dung + 196 kg urea + 90 kg TSP + 93 kg MOP); T<sub>3</sub> (2.4t poultry manur + 196 kg urea + 90 kg TSP + 93 kg MOP); T<sub>4</sub> (0.6t muster oil cake + 196 kg urea + 90 kg TSP + 93 kg MOP); T<sub>5</sub> (6t cow dung + 131 kg urea + 60 kg TSP + 62 kg MOP); T<sub>6</sub> (4.8t poultry manur + 131 kg urea + 60 kg TSP + 62 kg MOP); T<sub>7</sub> (1.2t muster oil cake + 131 kg urea + 60 kg TSP + 62 kg Mop); T<sub>8</sub> (9t cowdung + 66 kg urea + 30 kg TSP + 31 kg Mop); T<sub>9</sub> (9.2t poultry manur + 66 kg urea + 30 kg TSP + 31 kg Mop); T<sub>10</sub> (3t cow dung + 2.4t poultry manure + 0.6t muster oil cake + 66 kg urea + 30 kg TSP + 31 kg Mop); T<sub>11</sub> (4.2t cow dung + 3.36t poultry manure + 0.72t muster oil cake)/ha and T<sub>12</sub> (control). Data were analyzed by using MSTAT-C program. Different treatments had significant effect on the growth and yield parameters. Among 12 treatment combinations, the maximum plant height was observed in T<sub>5</sub> treatment at 35, 45 and 55 DAT but initially it was higher in T<sub>6</sub> treatment. The highest Number of fruits per plant 40.70 was found in T<sub>3</sub> treatment which was statistically identical with T<sub>5</sub> and T<sub>6</sub> treatment. The lowest number of fruits per plant 30.67 was recorded in T<sub>12</sub> (control). The maximum weight of individual fresh fruit obtained from T<sub>9</sub> treatment (143.70gm) compare to control treatment. Fruit length and diameter had not influenced by the application of manures with fertilizers.

**Key words:** Tomato, cow dung, poultry manure, inorganic fertilizer.

## Introduction

Tomato (*Lycopersicon esculentum* Miller) is one of the most important vegetable crops grown throughout the world under field and greenhouse conditions (Kaloo, 1986). It ranks third in the world's vegetable production, next to potato and sweet potato, placing itself first as processing crop among the vegetables. In terms of human health, tomato is a major component in the daily diet in many countries, and constitutes an important source of minerals, vitamins, and antioxidants (Grierson and Kader, 1986). It is an important source of vitamin-C. Tomato covers about 9.8% of the area under total winter vegetable in Bangladesh and its average yield 6.98 t/ha in the country during the year 2005-06 (BBS, 2007). Adequate supply of nutrient can increase the growth, yield, fruit quality, fruit size, keeping quality, color and taste of tomato. Micronutrient deficiencies are one of the major limiting factors for crop production in Bangladesh (Jones, 1995). Sufficient supply of rotting or decaying matter greatly increased crop yield and improved fruit quality (Saidu *et al.*, 2011; Makinde *et al.*, 2007). Cow dung applied with inorganic nitrogen (N), increased soil pH and ameliorated acidity (Olayinka and Ailenubhi, 2011). Saidu *et al.* (2011); Eghball *et al.* (2009) noted that k and P deficiencies were reduced when farm yard manure was applied. Organic manures such as cow dung; poultry manure and oil cake were used as alternatives for the inorganic fertilizers but no conclusive results were obtained to ascertain which among these organic sources of nutrition gave a higher yield of tomato (Saidu *et al.*, 2011). Therefore the present study was undertaken to find out the best combination of manures and fertilizers for obtaining the higher yield of tomato.

## Materials and Methods

The experiment was conducted at research farm of patuakhali science and technology university, dumki, patuakhali, during the winter season, November 2014 to March 2015. The details of the materials and methods used to conduct the present experiment are described in Table 1.

**Table 1.** Geographical location of experimental field

Morphological features	Characteristics
Location	PSTU, Dumki.
AEZ No. and name	AEZ-13, Ganges tidal floodplain
Physiographic	Ganges tidal floodplain
Soil series	Barisal (gray/dark gray clay)
Topography	Nearly level
Depth of inundation	0-180 cm
Land type	High (5%), medium high (95%)
Drainage condition	Mainly poorly drained.

**Experimental treatments:** The treatment combination of organic and inorganic fertilizer used in the experiment are (i) T<sub>1</sub> = 262 kg urea + 120 kg TSP + 124 kg MOP/ha, (ii) T<sub>2</sub> = 3t cow dung + 196 kg urea + 90 kg TSP + 93 kg MOP/ha, (iii) T<sub>3</sub> = 2.4t poultry manur + 196 kg urea + 90 kg TSP + 93 kg MOP/ha, (iv) T<sub>4</sub> = 0.6t muster oil cake + 196 kg urea + 90 kg TSP + 93 kg MOP/ha, (v) T<sub>5</sub> = 6t cow dung + 131 kg urea + 60 kg TSP + 62 kg MOP/ha, (vi) T<sub>6</sub> = 4.8t poultry manur + 131 kg urea + 60 kg TSP + 62 kg MOP/ha, (vii) T<sub>7</sub> = 1.2t muster oil cake + 131 kg urea + 60 kg TSP + 62 kg Mop/ha, (viii) T<sub>8</sub> = 9t cowdung + 66 kg urea + 30 kg TSP + 31 kg Mop/ha, (ix) T<sub>9</sub> = 9.2t poultry manur + 66 kg urea + 30 kg TSP + 31 kg Mop/ha, (x) T<sub>10</sub> = 3t cow dung + 2400 kg poultry manure + 600 kg muster oil cake + 60 urea + 30 Kg TSP + 31 kg Mop/ha, (xi) T<sub>11</sub> = 4.2t cow dung + 3360 kg poultry manure + 720 kg muster oil cake/ha, and (x ii) T<sub>12</sub> = Control.

**Land preparation:** The selected land for the experiment was first opened on of 10 September, 2015 by disc plough. After discing, the land was ploughed and cross ploughed for six times with a power tiller and each pouching was followed by laddering to break up the soil clods to obtain good filth and to level the land.

**Layout and design of the experiment:** The experiment was laid out in a Randomized Complete Block Design (RCBD) design. There were three replications and 12 treatments; the unit plot size was 3 m x 2 m = 6 m<sup>2</sup> and maintaining a spacing of 75 cm x 60 cm and the plots were separated from each other by 0.5 m bunds. The block to block and plot to plot distances were 0.5 m and 1.0 m, respectively. Plant to plant and row to row spacing were also 40 and 60 cm. respectively.

**Manuring and fertilization:** Required amounts of nitrogen, phosphorus and potassium fertilizers were applied in the whole plots as basal dose according to the fertilizers Recommendation Guide (BARC,1997). Manure, half of nitrogen, whole of P and potassium were applied during final land preparation in the form of urea TSP and MOP.

**Transplantation and after care:** Healthy and uniform sized seedlings of 30 days were taken separately from the seedbed and were transplanted in the experimental plots in the afternoon of 25 November; 2015 maintaining a spacing of 75 cm x 60 cm between the rows and plants.

**Intercultural operations:** The crop was always kept under careful observation. After transplanting the seedlings, different intercultural operations were accomplished for better growth and development of the plant. Tomato fruits can normally be harvested after 75-85 days from the time of seed sowing. Harvesting was started in 20 January, 2015 and continued up to 18 March, 2015. Data were collected regarding growth, yield and yield components on (i) plant height (cm), (ii) number of fruits per plant, (iii) number of ripe fruits per plant, (iv) weight of individual green fruit (g), (v) weight of individual dry fruit (g), (vi) length of fruit, (vii) diameter of fruit, and

(viii) weight of individual dry fruit. Data recorded for each parameter and the significance of differences between treatments means were compared by Least Significant Difference (LSD) test (Gomez and Gomez, 1984).

### Results and Discussion

This chapter includes the experimental results along with discussions. Data on different parameters were analyzed statistically. The effect of different organic and inorganic fertilizer doses and their combined effect have also been shown in tables and figures for understanding.

**Plant height:** The plant height increased continuously at different DAT observed in all treatment combinations (Table 2). At 25 DAYS the plant height ranged from 41.20 cm to 62.40 cm. the maximum plant height (62.40 cm) was found in T<sub>6</sub> treatment. The shortest plant (41.20 cm) was observed in the T<sub>12</sub> (control) treatment which was statistically similar with that of T<sub>7</sub> and T<sub>8</sub> treatments at 25 days after transplanting. At 35 DAYS the plant height ranged from 67.73 cm to 91.33 cm. the maximum plant height (91.33 cm) was found in T<sub>5</sub> treatment. The shortest plant (67.73 cm) was observed in the T<sub>12</sub> (control) treatment at 35 days after transplanting.

**Table 2.** Effect of manures with inorganic fertilizers on plant height of tomato

Treatments	Plant height (cm)			
	25 Days	35 Days	45 Days	55 Days
T <sub>1</sub>	46.80bc	75.93abc	106.5abc	134.7abc
T <sub>2</sub>	52.33abc	83.73abc	112.1abc	129.9abc
T <sub>3</sub>	56.40 abc	87.80ab	118.1ab	136.6ab
T <sub>4</sub>	49.47abc	82.07abc	111.1abc	125.9abcd
T <sub>5</sub>	60.07ab	91.33a	124.2a	147.1a
T <sub>6</sub>	62.40a	84.33abc	116.4abc	143.3ab
T <sub>7</sub>	42.00c	77.40abc	98.27cd	118.5bcd
T <sub>8</sub>	44.00c	72.60bc	103.7bc	128.1abc
T <sub>9</sub>	60.27ab	89.60ab	118.0ab	131.7abc
T <sub>10</sub>	48.67abc	79.87abc	112.7abc	137.4ab
T <sub>11</sub>	50.67abc	78.33abc	83.60de	108.7cd
T <sub>12</sub>	41.20c	67.73c	80.69e	100.6d
LSD (0.05)	13.43	15.96	16.72	24.23
CV%	15.49	11.65	9.22	11.13

In a column figures having similar letter (s) do not differ significantly at 5% level of probability.

At 45 DAYS the plant height ranged from 80.69 cm to 91.33 cm. the maximum plant height (91.33 cm) was found in T<sub>5</sub> treatment. The shortest plant (80.69 cm) was observed in the T<sub>12</sub> (control) treatment at 45 days after transplanting. At 55 DAYS the plant height ranged from 100.6 cm to 124.2 cm at 55 days. The maximum plant height (124.2 cm) was found in T<sub>5</sub> treatment with combined application of organic and inorganic fertilizer (6000 kg cow dung, 131 kg urea, 60 kg TSP and 62 kg MOP per hectare). The shortest plant (100.6 cm) was observed in the T<sub>12</sub> (control) treatment at 55 days after transplanting. During final reading the plant height of tomato in the experiment shows the following gradation in the decreasing order: T<sub>5</sub> > T<sub>6</sub> > T<sub>10</sub> > T<sub>3</sub> > T<sub>1</sub> > T<sub>9</sub> > T<sub>2</sub> > T<sub>4</sub> > T<sub>8</sub> > T<sub>7</sub> > T<sub>11</sub> > T<sub>12</sub>.

**Number of fruits per plant:** Number of fruits per plant increased continuously at all DAT. the treatment combinations effect of different organic and inorganic

fertilizers on Number of fruits per plant (Table 3). Number of fruits per plant ranged from 30.67 to 41.57 at 55 days after transplanting. At 55 DAYS the maximum Number of fruits per plant (41.57) was found in T<sub>6</sub> treatment with combined application of organic and inorganic fertilizer (4800kg cow dung, 131 kg urea, 60 kg TSP and 62 kg MOP per hectare) which was statistically similar with that of T<sub>5</sub> treatments with combined application of organic and inorganic fertilizer (4800 kg poultry manure, 131 kg urea, 60 kg TSP and 62 kg MOP per hectare). Application of poultry manure showed lower disease incidence, as shown by 80% healthy tomato, compared with the other fertilizers. However, the organic fertilizers used did not give higher yields compared with chemical fertilizers Ghorbani R. *et al* (2008). The lowest fruits number (30.67) was observed in the T<sub>12</sub> (control) treatment which was statistically similar with that of T<sub>8</sub> treatments. During final reading the Number of fruits per

plant of tomato in the experiment shows the following gradation in the decreasing order:  $T_3 > T_6 > T_5 > T_{10} > T_2 > T_9 > T_4 > T_1 > T_{11} > T_7 > T_8 > T_{12}$ .

**Table 3.** Effect of manures with inorganic fertilizers on Number of fruits per plant at Different days.

Treatments	Number of fruits per plant			
	25 Days	35 Days	45 Days	55 Days
T <sub>1</sub>	0.4000cd	6.333c	20.67cde	36.93ab
T <sub>2</sub>	0.8667bcd	6.533bc	22.87c	37.63ab
T <sub>3</sub>	1.333ab	8.800a	27.53ab	40.70a
T <sub>4</sub>	1.600a	6.200c	23.60bc	37.13ab
T <sub>5</sub>	1.333ab	9.200a	28.27a	40.47a
T <sub>6</sub>	1.600a	9.267a	23.93bc	41.57a
T <sub>7</sub>	0.4667cd	6.333c	19.80cde	33.40bc
T <sub>8</sub>	0.4667cd	5.600c	17.40e	31.00c
T <sub>9</sub>	1.267ab	8.067ab	22.73c	37.80ab
T <sub>10</sub>	0.4667cd	5.867c	22.33cd	38.07ab
T <sub>11</sub>	0.9333bc	8.067ab	18.20de	34.20bc
T <sub>12</sub>	0.3333d	5.000c	17.17e	30.67c
LSD (0.05)	0.5192	1.506	3.818	5.019
CV%	33.26	12.52	10.23	8.09

In a column figures having similar letter (s) do not differ significantly at 5% level of probability.

**Weight of individual fresh fruit:** A significant variation was recorded in consideration of Weight of individual fresh fruit in different combination of organic and inorganic fertilizer application and the result was presented in (Table 4). Weight of individual fresh fruit ranged from 96.43 g to 143.7 after harvest. The maximum Weight of individual fresh fruit (143.7) was found in T<sub>9</sub> treatment with combined application of organic and inorganic fertilizer (9200 kg poultry manure, 66 kg urea, 30 kg TSP and 31 kg MOP per hecter). Keeny and Nilson (1982) in evaluation the effect of organic and chemical

fertilizers on quantitative and qualitative yield of tomato c.v ‘Chief’ found that the Greatest fruit yield obtained in application of 15 ton/ha hen manure and 90 kg/ha pure nitrogen and the highest fruit number in application of 20 ton/ha hen manure and 135 kg/ha pure nitrogen. The lowest Weight of individual fresh fruit (96.43 g) was observed in the T<sub>12</sub> (control) treatment. Length of leaf of tomato in the experiment shows the following gradation in the decreasing order:  $T_9 > T_8 > T_4 > T_{10} > T_1 > T_7 > T_{11} > T_2 > T_5 > T_3 > T_6 > T_{12}$ .

**Table 4.** Effect of manures with inorganic fertilizers on weight of individual fresh fruit(gm.), diameter of fruit(cm) and length of fruit (cm)

Treatments	Weight of individual fresh fruit (gm)	Diameter of fruit (cm)	Length of fruit (cm)
T <sub>1</sub>	119.3bc	5.133ab	6.467a
T <sub>2</sub>	112.6bcde	5.567a	5.333ab
T <sub>3</sub>	108.0cde	5.500a	5.733ab
T <sub>4</sub>	124.8bc	5.667a	5.533ab
T <sub>5</sub>	112.2bcde	5.533a	5.833ab
T <sub>6</sub>	98.70de	4.733ab	5.200b
T <sub>7</sub>	116.4bcd	5.467a	5.533ab
T <sub>8</sub>	128.5ab	5.200a	5.533ab
T <sub>9</sub>	143.7a	5.733a	5.667ab
T <sub>10</sub>	120.9bc	5.800a	5.400ab
T <sub>11</sub>	113.9bcde	5.633a	5.700ab
T <sub>12</sub>	96.43e	4.167b	5.067b
LSD (0.05)	16.32	0.9367	1.010
CV%	8.29	10.36	10.69

In a column figures having similar letter (s) do not differ significantly at 5% level of probability.

**Length of fruit:** From the present research it is observed that the Length of fruit did not influence significantly by the application of different combination of organic and inorganic fertilizer. Length of fruit ranged from 5.067 g to 6.46 g at 55 days after harvest. The highest Length of fruit (6.46) was found in T<sub>1</sub> treatment with combined application of organic and inorganic fertilizer (262 kg urea, 120 kg TSP and 124 kg MOP per hecter). Tomato plants have a high demand for potash, phosphate and nitrogen. Fertilizers containing these nutrients should be

applied to the soil before planting. The amount of nitrogen is being somewhat less than that of either phosphorous or potassium (Tonny, 2004). The lowest Length of fruit (5.067g) was observed in the T<sub>12</sub> (control) treatment which was statistically similar with that of T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub>, T<sub>7</sub>, T<sub>9</sub>, T<sub>10</sub>, and T<sub>11</sub> treatments. Length of fruit of tomato in the experiment shows the following gradation in the decreasing order:  $T_1 > T_5 > T_3 > T_{11} > T_9 > T_2 > T_4 > T_7 > T_8 > T_1 > T_{10} > T_{12}$ .

**Diameter of fruit:** From the present research it is observed that the diameter of the fruit did not influence significantly by the application of different combination of organic and inorganic fertilizer. Diameter of fruit ranged from 4.167 g to 5.800g at 55 days after harvest. The highest Diameter of fruit (5.800cm) was found in T<sub>10</sub> treatment which was statistically similar with that of T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub>, T<sub>7</sub>, T<sub>9</sub>, T<sub>10</sub>, and T<sub>11</sub> treatments. The lowest Diameter of fruit (4.167g) was observed in the T<sub>12</sub> (control) treatment which was statistically similar with that of T<sub>8</sub> treatments. Diameter of fruit of tomato in the experiment shows the following gradation in the decreasing order: T<sub>10</sub> > T<sub>9</sub> > T<sub>4</sub> > T<sub>11</sub> > T<sub>2</sub> > T<sub>5</sub> > T<sub>3</sub> > T<sub>7</sub> > T<sub>8</sub> > T<sub>1</sub> > T<sub>6</sub> > T<sub>12</sub>.

### References

- BBS. 2007. Year Book of Agricultural Statistics of Bangladesh. Bangladesh Bureau of Statistics, Ministry of Planning, Govt. of the Peoples' Republic of Bangladesh, Dhaka.p.17.
- Eghball, B. and Power, J.F. 2009. Phosphorus and nitrogen based manure and soil compost application. *Journal of Soil Science* 63: 19 – 41.
- Gomez, K.A. and Gomez, A.A. 1984. *Statistical Procedure for Agricultural Research*. John voiley and Sons, New York, Chickester Brisbane, Toronto, Singapore. pp. 139-240.
- Grierson, D. and Kader, A.A. 1986. Fruit ripening and quality. *The tomato crop*. Chapman and hall, London. Pp 240-280.
- Jones, J.B. 1999. *Tomato plant culture: In the field, greenhouse, and home garden*.CRC Press LLC, Florida: 11-53.
- Kaloo, G. 1986. *Tomato (Lycopersiconesculentum Miller)*.Allied Publishers Pvt.Ltd., NewDehli.203-220.
- Makinde, E.A, Ayoola, O.T. and Akande, M.O. 2007. Effects of organo-mineral fertilizer application on the growth and yield of egusi melon. *Australian Journal of Basic and applied sciences* 1:15 – 19.
- Olayinka, A. and Ailenubhi, V. 2011. Influence of combined application of cow dung and inorganic nitrogen on microbial respiration and nitrogen transformation in an alfisol. *Nigerian Journal of Soil Research* 2, 15 – 20.
- Saidu, A., Bello, L.Y., Tsado, E.K. and Ibrahim, F.K. 2011. Effect of cow dung on the performance of tomato. *International Journal of Applied Biological Research*.