JSTEI ONLINE JOURNAL
Journal of Science, Technology & Environment Informatics
Journal BiNET Scientific Publication

Volume 01, Issue 02, Article No. 8, pp. 68-74
http://www.journalbinet.com/current-issue-jstei1.html
Original Research Paper

Biswas, *et al.*, 2015

Nitrogen Levels on Morphological and Yield Response of BARI Tomato-9

M. Biswas[1], D. R. Sarkar[2], M. I. Asif[3], R. K. Sikder[4], H. Mehraj[5] and A. F. M. Jamal Uddin[5*]

Dept. of Agriculture Extension, Ministry of Agriculture, Dhaka[1]
Horticulture Development Division, Bangladesh Agriculture Development Cooperation, Dhaka[4]
Dept. of Soil Science[2], Dept. of Seed Technology[3] and Dept. of Horticulture[5], Sher-e-Bangla Agricultural University, Dhaka, Bangladesh

Article Info.

Key words:

Solanum lycopersicum, growth and yield

Received: 09.01.2015
Accepted: 15.01.2015
Published: 07.02.2015

***Contact author:**
jamal4@yahoo.com

ABSTRACT

An experiment was conducted to study the growth and yield response of tomato. Experiments consisted of four nitrogen levels viz. Control: No nitrogen, N_1*: 100 kg/ha,* N_2*: 150kg/ha and* N_3*: 200 kg/ha using Randomized Complete Block Design with three replications. Tallest plant (91.4 cm) was found from* N_2*. Maximum number of leaves (97.8/plant), number of branches (10.7/plant), number of flowers (6.4/cluster), number of fruits (5.1/cluster), number of clusters (15.3/plant), fruit diameter (15.6 cm), individual fruit weight (73.1 g), yield (22.2 kg/plot and 61.4 t/ha) and Total Soluble Solid (TSS) (5.5%) were found from* N_2 *while minimum from* N_0*. It was observed that yield, growth parameters and yield contributing attributes are positively correlated with nitrogen levels except control; 150 kg/ha nitrogen was found the best compared to other nitrogen level used in this experiment for growth and yield of BARI tomato - 9.*

Citation (APA): Biswas, M., Sarkar, D. R., Asif, M. I., Sikder, R. K., Mehraj, H. & Jamal Uddin, A. F. M. (2015). Nitrogen Levels on Morphological and Yield Response of BARI Tomato - 9. *Journal of Science, Technology & Environment Informatics 01(02), 68–74.*

I. Introduction

Tomato (*Solanum lycopersicum*) belonging to *Solanaceae* family is a vegetable crop grown in Bangladesh during winter. Its food value is very rich because of higher contents of vitamins A, B and C including calcium and carotene (Bose and Som, 1990). It is much popular as salad in the raw state and is

made into soups, juice, ketchup, pickles, sauces, conserved puree, paste, powder and other products (Ahmed *et al.*, 1986; Thompson and Kelly, 1983 and Bose and Som, 1990). In Bangladesh, there is a great possibility of increasing tomato yield per unit area with proper use of fertilizer. Tomato requires large quantity of readily available fertilizer nutrient (Gupta and Shukla, 1997). To get one ton fresh fruit, plant need to absorb on average 2.5-3 kg N. 0.2-0.3 kg P, and 3-3.5 kg K (Hedge, 1997). In absence of other production constraints, nutrient uptake and yield are very closely related. Nitrogen has the positive response (Koul, 1997, Omer, 1998, Gasim, 2001; Sawi, 1993) and essential for building up protoplasm and protein, which induce cell division and initial meristematic activity when applied in optimum quantity (Singh and Kumar, 1969). Nitrogen has largest effect on yield and quality of tomato (Xin *et al.* 1997). It also promotes vegetation growth, flower and fruit set of tomato (Bose and Som, 1990). It significantly increases the growth and yield of tomato (Banerjee *et al.* 1997). Nitrogen has a pronounced effect on growth and development of tomato. It promotes both vegetative and reproductive growth and impacts the characteristic deep green color of leaves. Nitrogen application resulted in greater values of plant height, leaf area, number of leaves and stem diameter of fodder maize, fresh and dry forage yield were also increased due to addition of nitrogen (Koul, 1997). Leaf to stem ratio was found also to be increased by nitrogen (Duncan, 1980) that the increase in leaf to stem ratio with nitrogen application is probably due to the increase in number of leaves and leaf area under nitrogen treatments, producing more and heavy leaves (Gasim, 2001). Application of N-fertilizer to the soil produces high tomato fruit yield and improves fruit quality (Adams *et al.*, 1978) whereas excessive application leads to luxuriant development of vegetative parts of the plant at the expense of reproductive growth (Tisdale *et al.*, 2003). It has been reported that tomato can grow on a variety of soils except worst soils such as gravelly soils and water-logged soils (Simons and Sobulo, 1974) but better yields were obtained from some soil types than others even with the same management practices and environmental conditions (Pettygrove *et al.*, 1999). The specific dose of nitrogen may affect yield and storage behavior of tomato fruits. The experiment objective is to find out amount of nitrogen for optimum growth and higher yield of tomato per unit area of land.

II. Materials and Methods

Location and period of the study: This experiment was conducted at the Agronomy Farm, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during October 2008 to March 2009.

Genetic materials: BARI Tomato-9 was used in the experiments and seeds were collected from the Horticulture Research Centre, Bangladesh Agricultural Research Institute (BARI) at Joydebpur, Gazipur.

Treatments and design: The experiment consisted of four levels of nitrogen doses viz. Control: No nitrogen, N_1: 100 kg/ha, N_2: 150kg/ha and N_3: 200 kg/ha using Randomized Complete Block Design with three replications.

Plot size: The size of unit plot was 2 m x 1.8 m. The distance between the blocks was 1 m and that between plots was 50 cm.

Fertilizers and Manure: 10 tones cow dung, 150 kg TSP and 250 kg MP per hectare were applied in the experimental plot. Entire cow dung, TSP and ½ of MP was applied during final land preparation. Urea was applied according to the treatments. The entire urea and rest of MP were applied in three equal installments at 15, 30 and 50 days after transplanting in the field.

Transplantation and spacing: Healthy and uniformed sized 30 days old seedlings were taken separately from the seedbed and were transplanted in the experimental field on 28 November 2008 maintaining spacing of 60 cm and 50 cm between the rows and plants respectively.

Data collection: Data were collected on plant height, number of leaves, number of branches, number of cluster, number of flowers, number of fruits, fruit length, fruit diameter, individual fruit weight,

yield/plot, yield/ha, and TSS content. A fruit was sliced into two halves horizontally with a sharp knife and a small quantity of juice from them was used to determine TSS in percentage with TSS meter.

Statistical analysis: Collected data were statistically analyzed using MSTAT-C statistical package programme and mean for all the treatments was calculated. Difference between treatments means were determined by Least Significance Difference (LSD) test at 5% level of significance (Gomez and Gomez, 1984).

III. Results and Discussion

Plant height: Plant height increased gradually with the advancement of time and continued up to 100% flowering. Tallest plant was found from N_2 (150kg/ha) both at 50% flowering stage (82.3 cm) and 100% flowering stage (91.4 cm) while shortest from V_4 (69.3 cm and 71.5 cm respectively) (Figure 01).

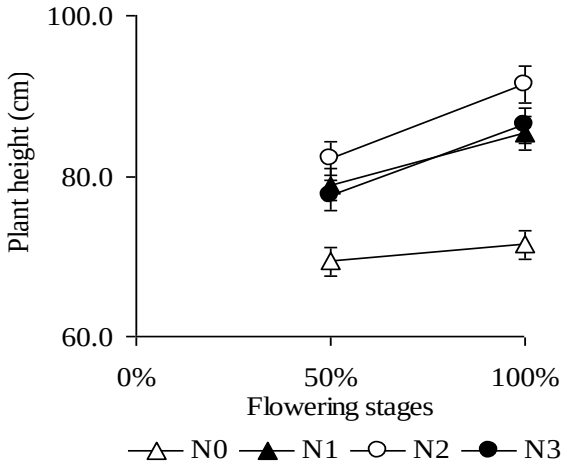

Figure 01. Effect of different nitrogen levels on plant height of tomato

Moniruzzaman *et al.* (2009) found 161 Kg N/ha as the best for plant height of tomato that was agreed with Islam *et al.* (2003). Plant height was increased possibly due to the readily available nitrogen, which might have encouraged more vegetative growth and development. The height of tomato plants increased significantly with the increased levels of nitrogen. Addition of nitrogen fertilizer increased plant height (Sharma, 1973). The plant height, considered to be an important factor to judge the vigor was found increased to a significant level resulting in accumulation of more dry matter, N, P and K in the stems and leaves (Nanthakumar and Veeraragavathatham, 2001). Increase in plant height resulted in an increase in leaf number/plant (Akintoye, 1996). Increase in plant height with nitrogen fertilizer is due to the fact that nitrogen promotes plant growth, increases the number of internodes and length of the internodes which results in progressive increase in plant height (Gasim, 2001; Chandler, 1969; Turkhede and Rajendra, 1978; Koul, 1997). Nitrogen is necessary for photosynthesis, formation of chlorophyll and nucleic acids, its absence or deficiency causes stunted growth (Tisdale *et al*., 2003). This study was also indicated that the application of nitrogen fertilizer increase the plant height but above 150 kg/ha plant height become retarded.

Number of leaves and branches per plant: Number of leaves/plant varied significantly among the nitrogen levels. Maximum number of leaves was found from N_2 (97.8/plant) while minimum from N_0 (82.8/plant). Increments in nitrogen rate increased the number of leaves in spinach but these increases were not statistically significant (Gulser, 2005). Karic *et al.* (2005) applied four nitrogen levels (0, 50, 100 and 200 kg N ha^{-1}) to leek culture and reported that application of 200 kg N ha^{-1} resulted in a maximum number of leaves (14.4/plant). Maximum number of branches was found from N_2 (10.7/plant) while minimum from N_0 (5.7/plant) (Figure 02). These results indicate that nitrogen

increases the growth of tomato, which ensured the maximum number of branch than control. Nitrogen fertilization increased number of leaves per plant (El Noeman *et al.*, 1990; Gasim, 2001). Nitrogen has a significant effect on number of branches/plant as it activates vegetative growth (Manchanda and Singh, 1988).

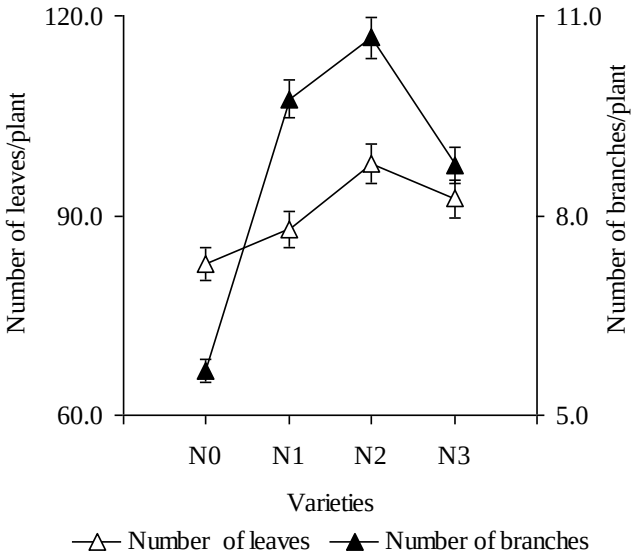

Figure 02. Number of leaves and branches to different nitrogen levels

Number of clusters per plant, flowers and fruits per cluster: There was a significant difference among the nitrogen levels in number of cluster/plant, flowers/cluster and fruits/cluster. Maximum number of clusters, flowers and fruits was found from N_2 (15.3/plant, 6.4/cluster and 5.1/cluster respectively) while minimum from N_0 (7.8/plant, 5.0/cluster and 3.4/cluster respectively) (Figure 03). Number of flowers per plant and fruits per plant were increased with increase in N level (Arya *et al.*, 1999; Aujla *et al.*, 2007; Ahmed and Butt, 1999).

Fruit length and diameter: Fruit length showed statistically significant variation and fruit diameter showed statistically identical among the varieties. However, longest fruit was found from N_3 (9.0 cm) while shortest from N_0 (6.1 cm) (Table 01). On the other hand, maximum fruit diameter was found from N_2 (15.6 cm) while minimum from N_0 (14.2 cm) (Table 01). Lal and Pundrik (1973) observed that an improvement in fruit size with increasing nitrogen.

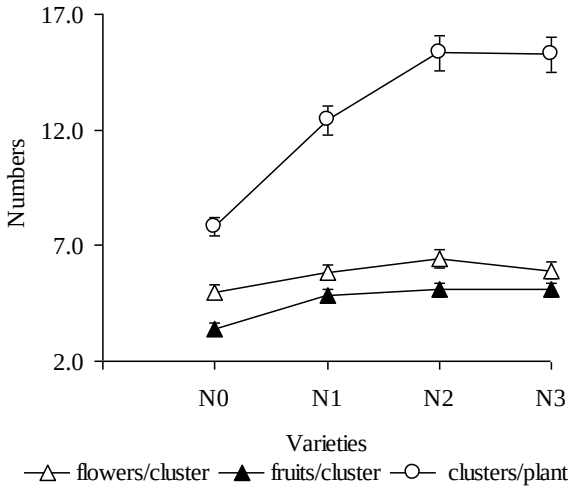

Figure 03. Nitrogen levels on cluster per plant; and flowers and fruits per cluster

Individual fruit weight, yield per plot and yield per ha: Weight of individual fruit weight was significantly influenced by different levels of nitrogen. Maximum individual fruit weight, yield/plot and yield/ha was found from N_2 (73.1 g, 22.3 kg and 61.4 t respectively) which was statistically identical with N_3 while minimum from N_0 (60.5 g, 14.7 kg and 41.0 t) (Table 01). This result showed that the yield of tomato increased gradually with the increased doses of nitrogen fertilizer. Many researchers confirmed that commercial yield depends to the N fertilizer of application rate. They were shown that fertilizer N levels affected not only quantity but also on quality of tomato fruit (De Pascale *et al.*, 2006; Parisi *et al.*, 2006).

Total soluble solid (TSS): TSS content showed significant variation among the different nitrogen levels. Maximum TSS content was found from N_2 (5.5%) while minimum from N_0 (4.0 %) (Table 01).

Table 1. Effect of nitrogen levels on yield attributes of tomato[x]

Nitrogen levels	Fruit length (cm)		Fruit diameter (cm)		Individual fruit weight (g)		Yield (kg)/plot		Yield (t)/ha		TSS (%)	
N_0	6.1	b	14.2	a	60.5	b	14.7	c	41.0	c	4.0	b
N_1	7.8	a	15.2	a	63.6	A	19.8	b	54.0	b	5.2	a
N_2	8.0	a	15.6	a	73.1	A	22.3	a	61.4	a	5.5	a
N_3	9.0	a	15.1	a	68.8	A	20.9	ab	57.3	ab	5.1	ab
LSD 0.05	2.8		3.7		10.7		2.8		8.0		1.1	
CV %	10.0		9.6		9.6		5.8		7.1		3.2	

[x] In a column means having similar letter (s) are statistically identical and those having dissimilar letter (s) differ significantly as per 0.05 level of probability

IV. Conclusion

Yield and yield contributing parameters are positively correlated with nitrogen levels as found in this experiment with BARI tomato - 9 except control treatment. Nitrogen applied at the rate of 150 kg/ha gave high yield. Growth parameters and yield contributing attributes of tomato also performed better with 150 kg/ha; whereas control treatments showed minimum results for yield and growth performance. 150 kg/ha would be beneficial for the farmers to obtain optimum growth and higher yield of BARI tomato - 9.

V. Reference

Adams, P., Graves, C. J. & Winsor, G. W. (1978). Tomato yields in relation to the nitrogen, potassium and magnesium status of the plants and of the peat substrate. *Plant Soil, 49*, 137-148.

Ahmed, C. M. S. & Butt, S. J. (1999). Effect of NPK on some yield components of tomato. *Anadolu., 9*(1), 56-62.

Ahmed, S. U., Saha, H. K., Rahman, L. & Sharfuddin, A. F. M. (1986). Performance of some advance lines of tomato. *Bangladesh Hort., 14*(1), 47-48.

Akintoye, 1996. Thesis Abstract, International Institute of Tropical Agri Research, March 12, pp. 25–27.

Arya, P. S., Vidyasagar & Singh, S. R. (1999). Effect of N, P and K on tomato seed production. *Sci. Hort., 6*, 89-91.

Aujla, M. S., Thind, H. S. & Buttar, G. S. (2007). Fruit yield and water use efficiency of eggplant (*Solanum melongena* L.) as influenced by different quantities of nitrogen and water applied through drip and furrow irrigation. *Scientia Hortic., 112*, 142-148.

Banerjee, M. K., Balyan, D. S., Kallo, G., Singh, A. & Saini, P. S. (1997). Effect of Nitrogen fertilizer and planting pattern on fruit yield of Tomato CV. Hisar Lalmia. *Crop Res., 14*(3), 441-446.

Bose, T. K. & Som, M. G. (1990). Vegetable Crops in India. Published by B. Mitra and Naya Prokash, 206 Bidlran Sarani, Calcutta, India, p. 241 and 249.

Chandler, W. V. (1969). Plant morphology and stand geometry in relation to nitrogen physiological aspects of crop yield. In: Proc. Symp. Amer. Soc. Agron. pp. 265–285.

De Pascale, S., Tamburrino, R., Maggio, A., Barbieri, G., Fogliano, V. & Pernice, R. (2006). Effect of nitrogen fertilization on the nutritional value of organically and conventionally grown tomatoes. *Acta Hort., 700*, 107-110.

Duncan, W. G. (1980). Maize. L.T. Evans (Ed.), Crop Physiology, Cambridge Univ. Press pp. 23–50

El Noeman, A. A., El-Halem, A. K. A. & El-Zeiny H. A. (1990). Response of maize (*Zea mays* L.) to irrigation intervals under different levels of nitrogen fertilization. *Egyptian J. Agron., 15*(1–2), 147–158.

Gasim, S. H. (2001). Effect of nitrogen, phosphorus and seed rate on growth, yield and quality of forage maize (*Zea mays* L.). M.Sc. Thesis, Faculty of Agric., Univ. of Khartoum.

Gomez. K. A. & Gomez, A. A. (1984). Statistical Procedures for Agricultural Research (2nd Edn.). John Willey and Sons, Singapore, pp. 28-92.

Gulser, F. (2005). Effect of ammonium sulphate and urea on NO_3^- and NO_2^- accumulation nutrient contents and yield criteria in spinach. *Scientia Hortic., 106*, 330-340.

Gupta, A. & Shukla, V. (1997). Response of tomato (*Lycopersicon esculentum* Mill.) to plant spacing, nitrogen, phosphorus and potassium fertilizer. Indian *J. Hort., 33-34*, 270-276.

Hedge, D. M. (1997). Nutrient requirements of *solanaceous* vegetable crops. Food and Fertilizer Technology Center for the Asian and Pacific Region Extension Bulletin, Taipei, 441, 9.

Islam, M. R., Mozumder, S. N., Moniruzzaman, M. & Alam S. N. (2003). Effects of N, P, K on yield and profitability of Bilatidhonia in the hilly region. *Bangladesh J. Agril. Res., 28*(1), 105-1 10.

Karic, L., Vukasinovic, S. & Znidarcic, D. (2005). Response of leek (*Allium porrum* L.) to different levels of nitrogen dose under agro-climatic conditions of Bosnia and Herzegovina. *Acta Agric. Slovenica, 85*, 219-226.

Koul, G. G. (1997). Effect of sowing methods, nitrogen levels and seed rates on yield and quality of fodder maize (*Zea mays* L.). M.Sc. Thesis, Univ. of Khartoum, Faculty of Agric.

Lal, N. & Pundrik, K. C. (1973). Effect of N, P and K on the growth and yield of chilli. *Punjab Hortic J., 11*, 82-86.

Manchanda, A. K. & Singh, B. (1988). Effect of plant density and nitrogen on growth and fruit yield of bell pepper. *Indian J. Hortic., 33*, 445-447

Moniruzzaman, M., Islam, M. S., Hossain, M. M., Hossain, T. & Miah, M. G. (2009). Effects of Shade and Nitrogen Levels on Quality Bngladhonia Production. *Bangladesh J. Agril. Res., 34*(2), 205-213.

Nanthakumar, S. & Veeraragavathatham, D. (2001). Effect of integrated nutrient management on yield and quality attributes of brinjal cv "Plr 1". *South Indian J. Hort.,* 49 (Special), 195-198.

Omer, E. A. (1998). Farm yard manure and urea fertilization on growth and forage yield of tow maize (*Zea mays* L.) cultivars. Thesis, Faculty of Agric., Univ. of Khartoum.

Parisi, M., Giordano, L., Pentangelo, L., D'Onofrio, B. A. & Villari, G. (2006). Effects of different levels of nitrogen fertilization on yield and fruit quality in processing tomato. *Acta Hortic., 700*, 129-132.

Pettygrove, G. S., Upadhyaya, S. K., Young, J. A., Miyao, E. M. & Pelletier, M. G. (1999). Tomato yield variability related to soil texture and inadequate phosphorus supply. *Better Crops, 83*, 7-9.

Sawi, S. M. A. (1993). The effect of nitrogen, phosphorus and time of application on growth and yield of maize of Agric. Univ. of Khartoum.

Sharma, R. K. (1973). Response of maize to nitrogen fertilization. *Madras Agric. J., 60*, 399–440.

Simons, J. H. & Sobulo, R. A. (1974). Methods for higher tomatoes yield in Western Nigeria. Ministry of Agriculture, Western State, Nigeria.

Singh, K. & Kumar (1969). Effect of Nitrogen and Phosphorus fertilization on the growth and yield of tomato. *J. Res. Ludhiana., 6*, 764-768.

Thompson, H. C. & Kelly, W. C. (1983). Vegetable Crops. 5th Edn. Tata McGraw Hill Publishing Co. Ltd. New Delhi. p611 .

Tisdale, S. L., Nelson, W. L., Beaton, J. D. & Havlin, J. L. (2003). Soil Fertility and Fertilizers. 5th Edn., Prentice-Hall of India, New Delhi, India.

Turkhede, B. B. & Rajendra, P. (1978). Effect of rates and timing of nitrogen application on hybrid sorghum. *Indian J. Agron., 23*(2), 113–126.

Xin, X. Y., Hui, L. J. & Lili, H. (1997). The effect of N, P, and K mixed application on yields and quality of tomato in solar green house. *China Veg., 4*, 10-13.

Citation for this article (APA Style):

Biswas, M., Sarkar, D. R., Asif, M. I., Sikder, R. K., Mehraj, H. & Jamal Uddin, A .F. M. (2015). Nitrogen Levels on Morphological and Yield Response of BARI Tomato - 9. *Journal of Science, Technology & Environment Informatics 01(02), 68–74*.

Retrieved 07 February, 2015 from http://www.journalbinet.com/current-issue-jstei1.html