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Growth and yield of cherry tomato (*Solanum lycopersicum* L. var. *cerasiforme*) as influenced by different types of staking and inorganic fertilizers

Md Julfikar Ali Khan, Md Harun Ar Rashid*

Department of Horticulture, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

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Md Rezaul Karim
mrkarim1996@yahoo.com

**Corresponding Author*
Md Harun Ar Rashid
harun_hort@bau.edu.bd

ABSTRACT

Cherry tomato is an attractive, delicious, nutritious and healthy fruit which is very appealing to consumers. The demand of cherry tomato in the market is increasing day by day because of its superior quality and better sweet taste compared to large table tomatoes. A field experiment was conducted at the Landscaping Section of the Department of horticulture, Bangladesh Agricultural University, Mymensingh during the period from October 2018 to April 2019. The aim of this experiment was to study the growth and yield of cherry tomato cv. Binatomato-10 as influenced by determine the effects of different types of staking and inorganic fertilizers. The experiment included three types of staking viz., S0 = Single staking, S1 = Double staking, S2 = Trellis and five different levels of inorganic fertilizers treatment viz., T0 = Control, T1 = Nitrogen (N) @ 181 kg/ha, T2 = Phosphorus (P) @ 160 kg/ha, T3 = Potassium (K) @ 142 kg/ha, T4 = N+P+K @ (181+160+142) kg/ha. The experiment was laid out in the randomized complete block design with three replications. Different types of staking and inorganic fertilizers had significant influence on all the growth and yield contributing parameters under study. Results revealed that all the growth and yield parameters showed better performance in trellis plants along with N+P+K @ (181+160+142) kg/ha like highest plant height (150.84 cm), number of leaves (38.71) and branches per plant (7.56), longest leaf length (36.14 cm), maximum number of flower clusters (26.48), flowers (786.99) and fruits per plant (310.67), longest fruit length (4.4 cm) and diameter (2.9 cm), maximum individual fruit weight (10.0 g) and highest fruit yield (93.0 t/ha) while the parameters gave the lowest value from single staked plants with control. Therefore, trellis along with combined application of N+P+K @ (181+160+142) kg/ha was found to be better in respect of growth and yield of cherry tomato.

Keywords: Cherry tomato, staking, NPK fertilizers, growth, yield

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1 Introduction

Cherry tomato (*Solanum lycopersicum* L. var. cerasiforme) belonging to the Solanaceae family is a popular taste-bd delight, delicious and nutritioud table tomato which is considered as an additional genetic intermediate between wild-type and home garden tomatoes (Nesbitt and Tanksley, 2002). Cherry tomato is believed to be the direct ancestor of modern cultivated tomatoes and is the only wild tomato found outside South America (Kiple and Ornelas, 2000). Cherry tomato is round to cylindrical in shape, similar to a cherry juicy and meaty berry, bigger than 1.5 cm in diameter (Silva and Giordano, 2000). Cherry tomatoes are also very colourful (Red, Black, Green, Bi-Colour, White, Stripped, Yellow-Orange and Pink) and their unique size makes them more attractive to

the consumers (Kobryn and Hallmann, 2005). Cherry tomato is beneficial to human health due to its high content of antioxidant and anti-carcinogenic property, vitamin A and vitamin C, ascorbic acid, and phytochemical compounds, including lycopene, beta-carotene, flavonoids and many essential nutrients (Rosales et al., 2010). Cherry tomatoes can be directly used as raw vegetable as well as for preparing convenient foods such as sauce, soup, ketchup, curries, paste, Rasam and sandwich (USDA, 2009) but they are preferred as salad tomato to vegetable (Ramya et al., 2016). It is becoming very popular to many small farmers, special gardeners and green house managers around the world (Abdel-Razz et al., 2013) due to its higher commercial value compared to regular tomatoes (de Campos Menezes et al., 2012; Mantur et al., 2014; Venkadeswaran et al., 2018). Cherry tomato is a novel crop in Bangladesh and consumers always have a great fascination to new vegetables, hence growing cherry tomato could be a profitable activity for Bangladeshi farmers.

Staking is a special intercultural operation of tomato and cherry tomato which may increase yield and improve quality of the fruits. Cherry tomatoes on staked plants are larger and earlier than those on plants allowed to sprawl. Vertical staking or trellising could increase fruit production about 3 times than those of the plants without staking and also improve the quality of the fruits (Rashid et al., 2020). Good air circulation around the leaves and fruits of upright tomato plants lessens diseases problems and fruit held in high are free dirt and slug bites. On the other hand, staking practice may also give the uniform sized fruit, easy harvesting of fruits and conveniences in intercultural operations without damage to the fruits and less infestation of insects and diseases as well as increase the yield of cherry tomato (Santos et al., 1999).

Indiscriminate use of nitrogenous, phosphatic and potassic fertilizer is believed to cause deterioration of soil fertility, microbial activity, quality of ground water and finally decreases crop yield (Rashid, 2019). Nitrogen, phosphorus and potassium, or NPK, are the 'Big 3' primary nutrients in commercial inorganic fertilizers. The use of proper amount of NPK fertilizers improve texture, structure, humus, color, aeration, water holding capacity and microbial activity of soil. Each of these fundamental nutrients plays a key role in plant growth and development. Combined application of these nutrients along with good variety under vertical staking showed better growth, yield and quality of cherry tomato (Saha and Rashid, 2020). Nitrogen is considered to be the most important nutrient, and plants absorb more nitrogen than any other element. Nitrogen is essential to in making sure plants are healthy as they develop and nutritious to eat after they're harvested. That's because nitrogen is essential in the formation of protein, and protein makes up much of the tissues of most living things. The second of the Big 3, phosphorus, is linked to a plant's ability to use and store energy, including the process of photosynthesis. It's also needed to help plants grow and develop normally. Phosphorus in commercial fertilizers comes from phosphate rock. Potassium is the third key nutrient of commercial fertilizers. It helps strengthen plants' abilities to resist disease and plays an important role in increasing crop yields and overall quality. Potassium also protects the plant when the weather is cold or dry, strengthening its root system and preventing wilt (Ewulo et al., 2016). Staking associated with inorganic fertilizer treatments are important factors for cherry tomato production. Very limited research has been conducted on cherry tomato in Bangladesh. Therefore, the present work was undertaken to study growth and yield of cherry tomato as influenced by different types of staking and inorganic fertilizers.

2 Materials and Methods

2.1 Study location, climate and soil

The field experiment was conducted at the Landscaping Section of the Department of Horticulture, Bangladesh Agricultural University, Mymensingh during the period from October, 2018 to April, 2019 to determine the effects of different types of staking and inorganic fertilizers on the growth and yield of cherry tomato cv. Binatomato-10. The soil of the experimental plot was sandy loam in texture and it belongs to the Old Brahmaputra Flood Plain under Agro ecological zone 9 having non-calcareous dark gray floodplain soil (UNDP and FAO, 1988).

2.2 Plant materials

The cherry tomato variety Binatomato-10 was used in the experiment. The seeds of Binatomato-10 were collected from Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh Sadar, Mymensingh.

2.3 Raising of seedlings

Cherry tomato seedlings were raised in one seedbed situated on a relatively high land at the Landscaping Section of the Department of Horticulture, Bangladesh Agricultural University, Mymensingh (Fig. 1a). The size of each seedbed was 3 m $\times$ 1 m. A distance of 50 cm in the form of drain was maintained between the beds. The area was well prepared with spade and made into loose, friable and dried mass to obtain fine tilt. All weeds and stubbles were removed and the soil was mixed with well decomposed cowdung at the rate of 5 kg/bed. Sevin 85 SP was applied around each seedbed as precautionary measure against ants and cutworms. Seeds were

sown on the seedbed on 21th October 2018. After sowing, the seeds were covered with light soil to a depth of about 0.6 cm. Complete germination of the seeds took place within 4-6 days of sowing. Necessary shading by bamboo mat (chatai) was provided over the seedbed to protect the young seedlings from the scorching sunshine or heavy rain. Dithane M 45 was sprayed on the seedbed at the rate of 2g/L to protect the seedlings from damping-off and other diseases. Weeding, mulching, and water management were done from time to time as and when needed.

2.4 Treatments of the experiment

The two factor experiment consisted of three types of staking *viz.*, S0 = Single staking, S1 = Double staking, S2 = Trellis and five different levels of inorganic fertilizers treatment viz., T0 = Control, T1 = Nitrogen (N) @ 181 kg/ha, T2 = Phosphorus (P) @ 160 kg/ha, T3 = Potassium (K) @ 142 kg/ha, T4 = N+P+K @ (181+160+142) kg/ha.

2.5 Design and layout of the experiment

The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The entire experimental plot was divided into 3 blocks each containing 15 unit plots. In total, there were 45 unit plots. The selected treatments were randomly assigned to each unit plot so as allocated one treatment once in each block. The unit plot was 1 m $\times$ 1 m in size with a distance between the blocks was 1 m and that between unit plots was 50 cm.

2.6 Manuring and fertilization

In the experiment nitrogen, phosphorus and potassium fertilizers were applied as the treatment at the rate of 181, 160, 142 kg per hectare (Kobryn and Hallmann, 2005). Urea, triple super phosphate (TSP) and muriate of potash (MoP) were used as the sources of nitrogen, phosphorus and potassium. Entire amount of MoP was applied during final land preparation and incorporated into soil. Whole amount of TSP was applied making ring prior to planting. Urea was applied as top-dressed in three equal instalments at 15, 45 and 60 days after transplanting.

2.7 Land preparation and transplanting

The selected land for transplanting the crop prepared by ploughing and cross ploughing followed by laddering and then levelling the surface of soil to bring the land under a good tilth condition. Finally the unit plots were prepared as 10 cm raised beds along with the addition of the basal doses of manures and fertilizers. The soil of each unit plot was treated with insecticide (Furadan 5G) to protect young plants from the attack of mole cricket and cutworms. Healthy cherry tomato seedlings were taken from the seedbed and were transplanted in the experimental plots during late hours in the afternoon of 20th November maintaining a spacing of 60 cm between rows and 50 cm between the plants. This allowed an accommodation of 5 plants in each plot (Fig. 1c). The distance between plot to plot was 50 cm and the blocks were 1 m. The seedbed was watered before uprooting the seedlings from the seedbed so as to minimize against the root injury. Light irrigation was given immediately after transplanting by using a watering cane. In order to gap filling and to check the border effect, some extra seedlings were also transplanted around the border area of the experimental field. Shading was provided by pieces of banana leaf sheath for three days to protect the seedlings from the direct sunlight (Fig. 1d).

2.8 Intercultural operations

After transplanting the seedlings, various kinds of intercultural operations were accomplished for better growth and development of plants. Gap filling was done in place of dead or wilted seedlings of cherry tomato in the field using healthy seedlings of the same stock previously planted in the border area on the same date of transplanting. The soil around the base of each seedling was pulverized after the establishment of seedlings. Weeding and mulching were accomplished as and whenever necessary to keep the crop free from weeds, for better soil aeration and to break the soil crust. It also helps in conservation of soil moisture. When the plants were well-established, different types of staking were given to the required plants according to the treatment by bamboo sticks to keep them erect (Fig. 1e). Irrigation was provided immediately after transplanting and continued every 2-3 days intervals until the seedlings were well stablished. Mulching was also done by breaking the soil crust after each irrigation properly. Spraying of Malathion 57 EC 2ml/L. as preventive measure against the insect pests like cutworms, leaf hoppers, and fruit borers. The insecticide applications were done fortnightly as a routine work from a week after transplanting to a week before first harvesting. Furadan 5G was also applied during the final land preparation as soil insecticide. The precautionary measures against disease infections especially late blight and foot rot were taken by spraying of Dithane M-45 @2g/L at the early vegetative stage as well as the period of foggy weather. Ridomil Gold was also applied @ 2 g/1 against late blight disease of cherry tomato.

2.9 Harvesting

Fruits were harvested at 5 days interval during early ripe stage when they attained slightly red color

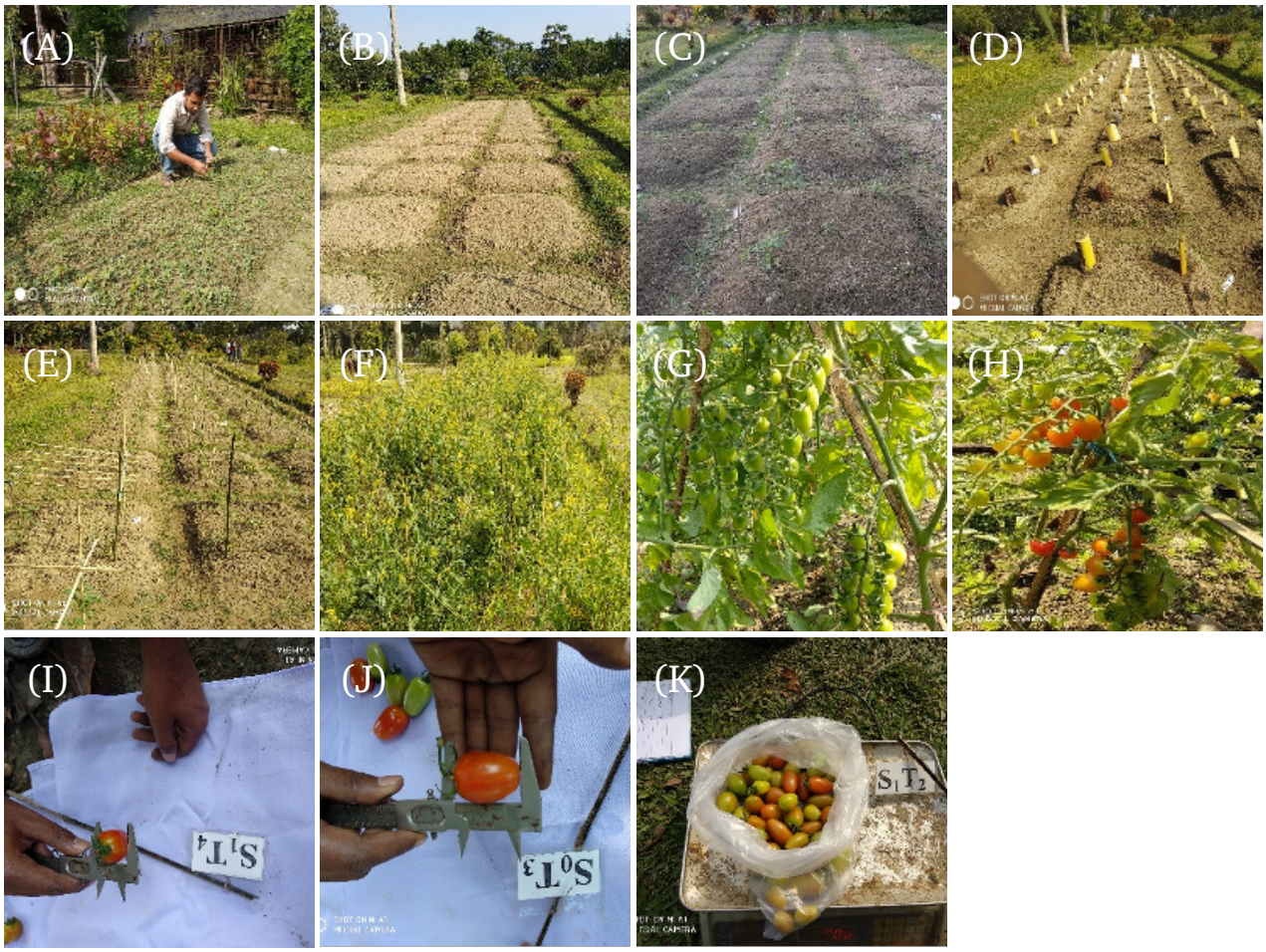

Figure 1. Different growth and development stages of cherry tomato. (A) seedbed and raising of seedling, (B) experimental plots,(C) seedling stage, (D) sheading, (E) different types of staking, (F) flowering stage, (G) green fruit, (H) ripe fruit, (I) measurement of fruit diameter, (J) measurement of fruit length, and (K) measurement of fruit weight

(Fig. 1h). The harvesting was started from 16th February, 2019 and completed by 20 April, 2019.

2.10 Collection of data

Three plants were selected randomly from each plot for data collection in such a way that the border effect could be avoided for the highest precision. Data on various parameters were recorded from the sample plants during the course of experiment such as plant height (cm), number of leaves per plant, number of branches per plant, leaf length (cm), number of flower cluster per plant, number of flowers per cluster, number of flowers per plant, number of fruits per plant, fruit length (cm) and diameter (cm), weight of individual fruit (g), fruit yield (t/ha). Plant height was measured from the sample plants from the ground level to the tip of the longest stem and mean value was calculated. Plant height was recorded at 15 days interval starting from 30 days of transplanting up to 75 days to observe the growth rate of plants. Total number of leaves from transplant to harvest was counted from the sample plants and their average was taken as the number of total leaves per plant. Total number of branches per plant from transplant to harvest was counted from the sample plants and their average was taken as the number of total branches per plant. Leaf length was measured from the sample plants from the selected compound leaf and mean value was calculated. The numbers of flowers cluster were counted from the sample plants and average number of flowers cluster produced per plant was recorded at the time of final harvest. The numbers of flowers per cluster were counted from the sample plants and average number of flowers per cluster was recorded. Total number of flowers per plant was counted from selected plants and their average was taken as the number of flowers per plant. The number of fruits per plant was counted from the sample plants and the average number of fruits per plant was recorded at the final harvest. The fruit length was measured with a slide calliper from the neck of the fruit to the bottom of 20 selected marketable fruits from each plot and their average was taken in centimetre as the length of fruit. The diameter of fruit was measured at the middle portion of 20 selected marketable fruits from each plot with a slide calliper and their average was taken in centimetre as the fruit diameter. Among the several harvests of marketable fruits during the period from first to final harvest, the first and last harvests were omitted, and intermediate harvests were used for individual fruit weight in gram. A pan scale balance was used to take the weight of fruits per plot. It was measured by totalling of fruit yield from each unit plot separately during the period first to final harvest and was recorded in kilogram (kg). Yield per hectare was calculated and expressed in ton.

2.11 Statistical analysis

The data in respect of growth and yield characteristics were statistically analysed to find out the statistical significance of the experimental results. The means of all the treatments were calculated and the analysis of variance was performed by F (Variance ratio) test. The differences among the treatment means were evaluated by Least Significant Difference (LSD) test at 1 and 5% levels of probability (Gomez and Gomez, 1984).

3 Results and Discussion

3.1 Effects of staking on tomato

3.1.1 Growth characters

The different types of staking had significant effects on all the growth parameters of cherry tomato under study (Table 1). The highest plant height (131.91 cm), maximum number of leaves per plant (34.07), highest number of branches per plant (6.90), longest leaf length (34.35 cm), maximum number of flower clusters per plant (22.86), maximum number of flowers per cluster (25.26) and number of flowers per plant (578.97) were recorded from trellis plants (S2) at 75 DAT, while the lowest plant height (121.71 cm), minimum number of leaves per plant (25.37), lowest number of branches per plant (6.38), shortest leaf length (32.34 cm), minimum number of flower clusters per plant (19.62), minimum number of flowers per cluster (15.30) and number of flowers per plant (312.53) were recorded from single staked plants (S0) at 75 DAT (Table 1). This might be due to the higher rate of photosynthesis in the trellis plants produce more stored food materials and consequently increased fruit length and diameter of cherry tomato. The current result is similar with the findings of Rashid et al. (2020) observed in strawberry. Trellis plants gave the best performance on vegetative growth and development. Trellis is good for plant growth. Trellising provided strong and more support for growth on the other hand single or double staking gave less support for growth that's why the trellis type plants gave the best performance vegetative growth and development.

3.1.2 Yield and yield contributing characters

Results revealed that the different types of staking had significant effects on all the yield and yield contributing characters of cherry tomato under study (Table 2). The maximum of number of fruits per plant (232.58), longest fruit length (3.98 cm) and diameter (2.74 cm), maximum individual fruit weight (8.0 g), highest fruit yield (82.11 t/ha) were obtained from the trellis plants (S2), while the minimum number of fruits per plant (167.56), shortest fruit length (3.88

Table 1. Main effect of different types of staking on growth characters of cherry tomato at 75 days after transplanting (DAT)

Staking types	Plant height (cm)	Leaves/ plant†	Branches/ plant†	Leaf length (cm)	Flower cluster/ plant†	Flowers/ cluster†	Flowers/ plant†
S0	121.71	25.37	6.38	32.34	19.62	15.3	312.53
S1	125.89	31.51	6.63	33.04	20.43	22.41	464.13
S2	131.91	34.07	6.9	34.35	22.86	25.26	578.97
LSD0.05	10.261	1.637	1.637	0.543	0.801	2.126	0.824
LSD0.01	14.773	2.357	2.357	0.783	1.154	3.061	1.253
Sig. level	**	**	**	**	*	**	**

**, * = Significant at 1 and 5% levels of probability, respectively. S0 = Single staking, S1 = Double staking, S2 = Trellis; † values are individual numbers

cm) and diameter (2.70 cm), minimum individual fruit weight (7.0 g), lowest fruit yield (77.9 t/ha) were recorded from single staked (S0) (Table 2). Trellis is good for plant growth and for better production. Trellising provided strong and more support for bearing fruits on the other hand single or double staking gave less support for bearing fruits that's why the trellis type plants gave the highest yield. The results of present experiment were also in agreement with the findings of Srinivasan et al. (1999) and Ignatov (1975) who observed that staked plants of tomato were significantly taller than non-staked plants and the staked plants produced higher yield compare to non-staked plants. Alam et al. (2016) conducted a research on BARI hybrid tomato 4 to find out the response of plants to some staking and pruning treatments on yield, fruit quality and cost of production. It was two factor experiment consisting of three staking methods and four level of pruning, laid out in complete block design. Plants were staked on inverted 'V' shaped staking gave high platform and string. From the economic point of view, the authors found that summer tomato produced by string staking with four stem pruning exhibited better performance compared to other treatment combinations in relation to net return and BCR (2.10).

3.2 Effects of inorganic fertilizers on tomato

3.2.1 Growth characters

It was found that inorganic fertilizers had significant influence on all the growth parameters of cherry tomato under study (Table 3). The highest plant height (141.0 cm), maximum number of leaves per plant (34.34), highest number of branches per plant (5.78), longest leaf length (34.71 cm), maximum number of flower clusters per plant (24.16), maximum number of flowers per cluster (23.41) and number of flowers per plant (601.37) were recorded from the application of N+P+K @ (181+160+142) kg/ha (T4) at 75 DAT, while the lowest plant height (109.22 cm), minimum number of leaves per plant (26.45), lowest number of branches per plant (4.50), shortest leaf length (31.12 cm), minimum number of flower clusters per plant (18.42), minimum number of flowers per cluster (17.40) and number of flowers per plant (328.93) were recorded from control treatment (T0) at 75 DAT (Table 3). This might be due to the high content of nitrogen, phosphorus and potassium contained in fertilizers (Reyhan and Amiraslani, 2006) and release of nutrients that promoted vigorous plant growth along with effective photosynthesis (Sanni, 2016). Nitrogen helps in cell division and cell elongation and thus increases the vegetative growth of the plants (Mazumder et al., 2019). N+P+K (T4) plants gave the best performance on vegetative growth and development than others treatment. Proper nutrient supply gave better vegetative growth.

3.2.2 Yield and yield contributing characters

Results revealed that inorganic fertilizers had significant influence on all the yield and yield contributing characters of cherry tomato under study (Table 4). The maximum of number of fruits per plant (263.89), longest fruit length (4.20 cm) and diameter (2.83 cm), maximum individual fruit weight (9.3), highest fruit yield (92.10 t/ha) were recorded from the application of N+P+K @ (181+160+142) kg/ha (T4), while the minimum number of fruits per plant (132.28), shortest fruit length (3.77 cm) and diameter (2.39 cm), minimum individual fruit weight (5.8 g), lowest fruit yield (55.61 t/ha) were found control treatment (T0) (Table 4). N+P+K (T4) treatments gave the highest yield than others treatment. N+P+K (T4) is essential nutrient for plants growth, healthy plants produce more flowers as well as fruits than others. That's why the maximum yield was showed for N+P+K (T4) treatments. The results of the current experiment was in agreement with the findings of Kumar et al. (2013), who conducted a field experiment during the winter season of (2009-2010) to study the effect of nitrogen,

Table 2. Main effect of different types of staking on yield and yield contributing characters of cherry tomato

Staking types	Number of fruits/plant	Fruit length (cm)	Fruit diameter (cm)	Individual fruit weight (g)	Fruit yield (t/ha)
S0	167.56	3.88	2.7	7	77.9
S1	199.63	3.96	2.62	7.7	79.82
S2	232.58	3.98	2.74	8	82.11
LSD0.01	1.253	0.721	0.891	1.0267	0.798
Sig. level	**	**	**	**	**

** = Significant at 1% level of probability. S0 = Single staking, S1 = Double staking, S2 = Trellis

Table 3. Main effect of inorganic fertilizers on growth characters of cherry tomato at 75 days after transplanting (DAT)

Inorganic fertilizers	Plant height (cm)	Leaves/ plant	Branches/ plant	Leaf length (cm)	Flower cluster/ plant	Flowers/ cluster	Flowers/ plant
T0	109.22	26.45	4.5	31.12	18.42	17.4	328.93
T1	131.58	30.27	5.35	33.82	21.41	21.9	487.21
T2	123.66	29.74	5.14	32.73	21.28	20.87	457.3
T3	127.06	30.77	5.54	32.19	19.57	21.37	405.65
T4	141	34.34	5.78	34.71	24.16	23.41	601.37
LSD0.01	9.761	4.759	0.703	2.357	2.106	3.061	6.061
Sig. level	**	**	**	**	**	**	**

** = Significant at 1% level of probability; T0 = Control, T1 = N @ 181 kg/ha, T2 = P @ 160 kg/ha, T3 = K @ 142 kg/ha, T4 = N+P+K @ (181+ 160+ 142) kg/ha

phosphorus and potassium fertilizers on the growth, yield and quality of tomato var. Azad T-6 at the Horticultural Research Farm of the Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Lucknow where tomato plants were fertilized with different rates of chemical fertilizers i.e. two doses of nitrogen fertilizers Ni and N2 (120 and 180 kg/ha), single dose of phosphorus P1 (80 kg/ha) and potassium K1 (75 kg/ha) and the results revealed that significantly the highest plant height, higher yield and yield attributing characters were recorded with the application of 100% NPK i.e. 180 kg N/ha along with 80 kg P/ha and 75 kg K/ha.

3.3 Combined effects of staking and inorganic fertilizers

3.3.1 Growth characters

Result showed that combined effects of different types of staking and inorganic fertilizers had significant influence on all the growth parameters of cherry tomato under study (Table 5 and Fig. 2). The highest plant height (150.84 cm), maximum number of leaves per plant (38.71), highest number of branches per plant (7.56), longest leaf length (36.14 cm), maximum number of flower clusters per plant (26.48), maximum number of flowers per cluster (28.56) and number of flowers per plant (786.99) were recorded from the combined treatment of trellis plants and application of N+P+K @ (181+160+142) kg/ha (S2T4) at 75 DAT, while the lowest plant height (98.33 cm), minimum number of leaves per plant (23.89), lowest number of branches per plant (5.63), shortest leaf length (29.67 cm), minimum number of flower clusters per plant (16.02), minimum number of flowers per cluster (13.78) and number of flowers per plant (244.33) were recorded from the combined treatment of single staked plants along with control (S0T0) at 75 DAT (Table 5). The results of the present experiment were also in agreement with the observation of Rughoo and Govinden (1999) and Adriance and Brison (1979) who reported that staked plants and stem pruning gave better yield, net return and BCR of tomato compared to the non-staked and unprunned plants.

3.3.2 Yield and yield contributing characters

Results revealed that inorganic fertilizers had significant influence on all the yield and yield contributing characters of cherry tomato under study ((Table 6 and Fig. 2). The maximum of number of fruits per plant (310.67), longest fruit length (4.4 cm) and diameter (2.9 cm), maximum individual fruit weight (10.0), highest fruit yield (93.0 t/ha) were recorded from the combined treatment of trellis plants and N+P+K @ (181+160+142) kg/ha (S2T4), while the minimum

Table 4. Main effect of inorganic fertilizers on yield and yield contributing characters of cherry tomato

Staking types	Number of fruits/plant	Fruit length (cm)	Fruit diameter (cm)	Individual fruit weight (g)	Fruit yield (t/ha)
T0	132.28	3.77	2.39	5.8	55.61
T1	210.44	4.03	2.67	8.3	84.05
T2	202.62	3.87	2.77	7.3	81.42
T3	190.37	3.8	2.77	7.8	86.53
T4	263.89	4.2	2.83	9.3	92.1
LSD0.01	6.061	0.921	1.291	1.271	0.959
Sig. level	**	**	**	**	**

** = Significant at 1% level of probability. T0 = Control, T1 = N @ 181 kg/ha, T2 = P @ 160 kg/ha, T3 = K @ 142 kg/ha, T4 = N+P+K @ (181+ 160+ 142) kg/ha

Table 5. Main effect of different types of staking on growth characters of cherry tomato at 75 days after transplanting (DAT)

Treatment combination	Plant height (cm)	Leaves/ plant†	Branches/ plant†	Leaf length (cm)	Flower cluster/ plant†	Flowers/ cluster†	Flowers/ plant†
S0T0	98.33	23.89	5.63	29.67	16.02	13.78	244.33
S0T1	117.61	24.87	6.56	31.33	21.19	15.82	338.21
S0T2	120.12	25.32	6.5	31	20.15	14.32	310.62
S0T3	126.45	24.68	5.86	33	18.5	16.04	279.72
S0T4	129.61	28.08	7.34	34	22.22	16.56	400.58
S1T0	114.89	24.07	6.5	33.33	17.83	17.71	335.22
S1T1	131.61	32.15	5.78	31	21.07	23.52	499.94
S1T2	117.51	31.9	6.56	39	20.15	22.82	458.88
S1T3	123.2	33.18	6.82	30.67	19.33	22.89	430.28
S1T4	142.54	36.22	7.5	32.67	23.78	25.11	616.53
S2T0	114.73	31.4	6.22	30.67	21.42	20.7	407.23
S2T1	145.51	33.78	7.5	37	21.96	26.37	623.48
S2T2	133.34	32	6.65	37.67	23.56	25.48	602.4
S2T3	131.53	34.44	6.56	30.67	20.88	25.18	506.96
S2T4	150.84	38.71	7.56	36.14	26.48	28.56	786.99
LSD0.01	0.904	1.007	0.783	2.357	1.141	1.196	1.196
Sig. level	**	**	**	**	**	**	**

** = Significant at 1% level of probability; S0 = Single staking, S1 = Double staking, S2 = Trellis, T0 = Control, T1 = N @ 181 kg/ha, T2 = P @ 160 kg/ha, T3 = K @ 142 kg/ha, T4 = N+P+K @ (181+ 160+ 142) kg/ha

Figure 2. Photographs showing differences in combined effects of different types of staking and inorganic fertilizers on cherry tomato. S0 = Single staking, S1 = Double staking, S2 = Trellis, T0 = Control, T1 = N @ 181 kg/ha, T2 = P @ 160 kg/ha, T3 = K @ 142 kg/ha, T4 = N+P+K @ (181+ 160+ 142) kg/ha

Table 6. Main effect of different types of staking on growth characters of cherry tomato at 75 days after transplanting (DAT)

Treatment combination	Number of fruits/plant	Fruit length (cm)	Fruit diameter (cm)	Individual fruit weight (g)	Fruit yield (t/ha)
S0T0	120.67	3.7	2.1	5	46.27
S0T1	180.34	4	2.8	8	84.3
S0T2	175.76	3.4	2.7	6.5	79.9
S0T3	150.34	3.9	2.8	7.1	87.6
S0T4	210.67	4.3	2.8	9	91.4
S1T0	130.5	4.2	2.6	6	55.04
S1T1	210.44	3.9	2.7	8.8	78.4
S1T2	196.55	4.1	2.9	7	88.98
S1T3	190.33	3.8	2.7	7.8	84.77
S1T4	270.34	3.9	2.8	9.4	91.9
S2T0	145.66	3.6	2.5	6.5	65.51
S2T1	240.55	4.2	2.6	9	89.44
S2T2	235.56	3.8	2.7	8	75.38
S2T3	230.44	3.8	2.8	9.9	87.22
S2T4	310.67	4.4	2.9	10	93.01
LSD0.01	6.19648	1.2496	1.487	1.196	1.163
Sig. level	**	**	**	**	**

** = Significant at 1% level of probability; S0 = Single staking, S1 = Double staking, S2 = Trellis, T0 = Control, T1 = N @ 181 kg/ha, T2 = P @ 160 kg/ha, T3 = K @ 142 kg/ha, T4 = N+P+K @ (181+ 160+ 142) kg/ha

number of fruits per plant (120.67), shortest fruit length (3.7 cm) and diameter (2.1 cm), minimum individual fruit weight (5.0 g), lowest fruit yield (46.27 t/ha) were recorded from the combined treatment of single staked plants along with control (S0T0) (Table 6). Trellis type staking along with the combination of N+P+K (S2T4) plants gave the highest yield. Trellis is good for plant growth and for better production. Trellising provided strong and more support for bearing fruits on the other hand single or double staking gave less support for bearing fruits that's why the trellis type plants gave the highest yield. Similar finding was also observed by Saha and Rashid (2020) who found that mixed application of NPK nutrients along with the cherry tomato variety Binatomato-10 under vertical staking showed better growth, yield and quality.

4 Conclusion

Staking played an important role on growth, yield and quality of cherry tomato. From the present study it was found that staking and inorganic fertilizers had significant effect on all the growth and yield contributing characters of cherry tomato. The highest fruit weight (10.0 g) and yield (93.01 t/ha) were obtained from the treatment combination of trellis plants and N+P+K @ (181+160+142) kg/ha (S2T4). Results that trellis was most effective for the production of high yield of cherry tomato. Out of different inorganic fertilizers, the combined application of N+P+K @ (181+160+142) kg/ha (T4) was the best among the others in respect of yield of cherry tomato. In case of combined treatments, the application of trellis plants along with N+P+K @ (181+160+142) kg/ha treatment gave the best results than the others. Therefore, it can be concluded that trellising along with the application of N+P+K @ (181+160+142) kg/ha could be recommended for cherry tomato production under Bangladesh Agricultural University farm condition.

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Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

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