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Study on growth and yield characteristics of twelve cherry tomato lines

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ABSTRACT

Cherry tomato is a high value vegetable and demand increased in the market. The study was conducted in the Sher-e-Bangla agriculture university at Horticultural Research Farm, Department of Horticulture, Dhaka, during the period from November 2016 to March 2017. Twelve cherry tomato lines under study, viz., L_1, Jhumka-red; L_2, Sweetie; L_3, Cherry Sweet red; L_4, SAU Olive cherry; L_5, Chinese; L_6, Jhumka-yellow; L_7, Clamentine; L_8, Golden juble; L_9,SAU Black cherry; L_{10}, Whitest; L_{11}, Orange; L_{12}, JP-$_{13}$. The data obtained for different characters were statistically analyzed by MSTAT-C computer package program. Three randomly selected competitive plants from each cherry tomato line in all plot, and were tagged plants used for recording observed for few characters. The quality of fruits and vegetables can be characterized by attributes such as appearance, flavor, texture, nutritional value and safety. However cherry tomato is a small size and has deferent color and shape, so we have the advantage going our market. Together with these factors arises the issue of how important the knowledge about growth conditions is for preference. This study has result that the highest fruit yield/hectare in L_7 (clementine) is attributed to better vegetative growth and quality yield.

Key Words: *Yield, Chlorophyll %, Brix %, 1000 Seed weight and Cherry tomato lines*

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I. Introduction

Cherry tomato is a high value vegetable in the world; and the demand for cherry tomato has increased in the market, chiefly due to the recognition of their high quality and good taste (Kobryn and Hallmann, 2005). Consumers' demands and competition imposed by the globalized market have forced the provision of high standard foods, with better sensory characteristics and nutritional value (Rocha *et al.*, 2013). The quality of fruits and vegetables can be characterized by attributes such as appearance, flavour, texture, nutritional value and safety. While environmental aspects were the most

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important factor related to why consumers choose to change from conven- tional to ecologically grown produce (Konsumentbe-redningen, 1997; Mathisson and Schollin, 1994). Appearance is one of the most important since it determines the product commercialization value (Chitarra and Chitarra, 2005; Gamble *et al.,* 2006), and it is a critical factor driving the initial purchase (Deliza and MacFie, 1996). However cherry tomato is a small size and has deferent color and shape, so we have the advantage going our market. Together with these factors arises the issue of how important the knowledge about growth conditions is for preference. In order to incorporate desirable characters to maximize marketable yield, the information on the nature and extent of genetic variability in a population of cherry tomato for desirable characters must improve. Considering the potentiality of this crop, there is a need for improvement and to develop varieties suited to specific agro-ecological conditions and also for specific end use (Rahul *et al.,* 2018). To study the better performance on yield and some character of twelve cherry tomato line in our country condition.

II. Materials and Methods

The experiment was carried out in the Sher-e-Bangla agriculture university at Horticultural Research Farm, Department of Horticulture, Dhaka, during the period from November 2016 to March 2017. The experiment consists of twelve lines of cherry tomato, which was laid out in Randomized complete Block Design (RCBD) with three replications. Twelve cherry tomato lines under study, *viz*., L_1, Jhumka-red; L_2, Sweetie; L_3, Cherry Sweet red; L_4, SAU Olive cherry; L_5, Chinese; L_6, Jhumka-yellow; L_7, Clamentine; L_8, Golden juble; L_9, SAU Black cherry; L_{10}, Whitest; L_{11}, Orange; L_{12}, JP-$_{13}$. The data obtained for different characters were statistically analyzed using MSTAT-C computer package program.

Three randomly selected competitive plants from each cherry tomato line in all plot, and were tagged plants used for recording observed for few characters. The plant height of was recorded with the help of a meter scale from the base of the plant to the shoot tip at the final picking and the average height (cm) per plant was calculated. The total number of leaves of selected plants were counted and averaged at the time of final picking. Leaf area was measured by destructive method using CL-202 Leaf Area Meter (USA). Mature leaf (from 4th node) were measured once at 50 days after transplanting and expressed in cm^2. Chlorophyll percentage was taken by non-destructive method using 'Konica Minolta SPAD meter' Stem diameter, single fruit length and girth was measured using Digital caliper-515 (DC-515) in millimeter (mm) Mean value was derived from the collected data, Every single fruit was blend and juice was collected to measure brix percentage were measured by Portable Refractometer (ERMA, Tokyo, Japan). Fruit weight and 1000 seed weight was measured by Electronic Precision Balance in gram. Fruit yield/ plant were calculated from weight of total fruits divided by the number of total plants. Fruit yield/ hectare was computed and expressed in ton hectare formula:

Fruit yield/ hectare = Yield/ plant × Total number of plant/ hectare

III. Results and Discussion

Plant height (cm)

Significant variation was found among cherry tomato lines performance in terms of plant height. Highly significant differences exist among different of Lines with regard to plant height at 20 days, 30 days, 40 days, 50 days and 60 days after transplanting (Figure 01). Significant increase in plant height was observed from 20-50 DAT in all the lines which then slowed down at 50-60 DAT because indicating it reaching it maturity. The tallest plant was found from L_7 (195.5 cm) whereas the shortest from L_3 (89 cm). Hossain (2007) recorded highly significant in the plant height, where, the tallest plant height (102 cm) was observed under poultry manure in Raton. Olaniyi *et al.* (2010) also found that plant height varied due to the varietal differences. It was observed that the tallness, shortness and other morphological differences are varietal characteristics, which are controlled and expressed by certain genes.

Number of leaves

The number of leaves per plant of cherry tomato significantly varied among the lines. Highly significant differences exist among different of Lines with regard to number of leaves at 20 days, 30

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days, 40 days, 50 days and 60 days after transplanting. The maximum number of leaves was found from L_7 (125.3) and minimum from L_3 (40) with 60 days after transplanting (Figure 02). Leaves are very important vegetative organs, as they are chiefly concerned with the physiological processes, photosynthesis and transpirations. The results were in confirmation with Deepa and Thakur (2008), Arun *et al.* (2004). Thus it influenced the growth of a plant very much and is positively correlated with the yield of a plant. Hossain (2007) observed highly significant variation in respect of number of leaves per plant in Raton. Number of leaves affects was of leaves as well as the net cherry tomato yield.

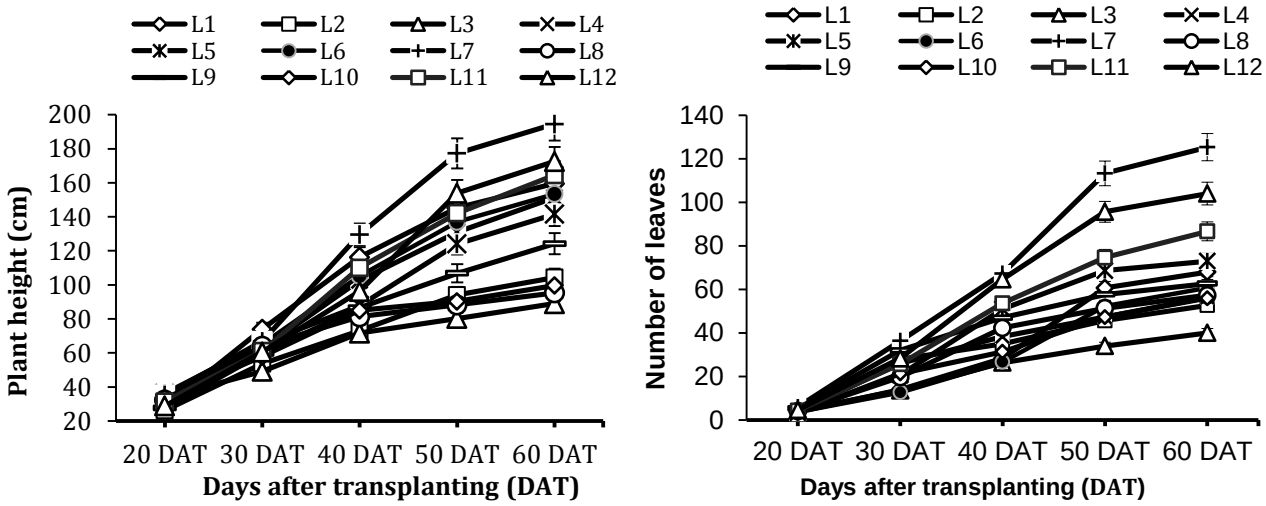

Figure 01. Plant height and Number of leaves of different cherry tomato lines at different days after transplanting (DAT).

Leaf area (cm²)

Cherry tomato lines showed statistically significant difference in case of leaf area. Maximum leaf area was found from L_{12} (147.9 cm²) and the minimum was L_{10} (95.5 cm²) (Table 01). Leaf area distribution in a tomato canopy is important for maximizing plant photosynthetic capacity (Wolk *et al.*, 1983) and protecting developing fruit from excessive exposure to solar radiation (Andegoroye and Jolliffe, 1983). Leaf area index is a growth indicators used as a photosynthetic system measurement. LAI is related to the biologic and economic yields and increase in LAI causes higher yield (Singh *et al.*, 2009).

Chlorophyll %

Chlorophyll (%) on leaves (SPAD reading) showed significant variation among the lines. The highest chlorophyll content observed from L_{10} (46.5%) whereas the lowest chlorophyll content observed from L_8 (32.2%) (Table 01). There were also significant differences in the amount of chlorophyll content of leaves in four different growths, development stages, the age groups and on different plant species (Blackburn, 1998; Yang and Ko, 1998). It also Variation in chlorophyll content was also observed previously in Rose (Ahmad *et al.*, 2011).

Stem diameter (mm)

Documented stem diameter showed significant statistical variation among different lines of cherry tomato under study. Maximum cherry tomato plant stem diameter was expressed by L_9 (11.9 mm) and minimum was observed in L_{10} (9.2 mm) and L_{12} (11.0 mm), L_1 (10.8 mm), L_6 (10.6 mm), L_7 (10.6 mm) statistically similar shows (Table 01). Uddin *et al.* (2015) who stated that stem thickness or diameter varies from line to line. Klepper *et al.* (1971) indicates that the stem diameter changes reflect changes in stem tissue hydration. The variation in stem diameter was also documented by Harbaugh *et al.* (2000).

Number of sucker/plant

The difference among the cherry tomato lines in respect to number of sucker was significantly variable. Maximum no of sucker was found form L_7 (9.3) and minimum was found L_3 (4.0) (Table 02). However, number of branches and sucker results in more production of leaves, the size of the leaf and number of leaves/plant decides the efficiency of photosynthesis activity which contributed towards

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better growth and yield the results were in confirmation with Deepa and Thakur (2008) and Arun *et al.,* (2004).

Number of flower /plant

Highly significant differences were observed among cherry tomato lines for number of flower per plant. Higher number of flower/plant was noticed L_7 (273.7) and it's were statistically similar with L_9, L_5, L_3, and L_4 (135.3, 125.3, 123.7 and 120.3 respectively) in the lines. Lowest was found from L_8 (75). it was related flower per plant in cherry tomato from L_{11}, L_{12} and L_6 (89.3, 86 and 78.7 respectively). Lobo and Medina (1994) evaluated the morphological variability of cherry tomato *Solanum lycopersicon* var. *cerasiforme* and found that the NFLR ranged from 4 to 20.

Fruit length (mm)

Significant difference was revealed on fruit length with cherry tomato lines. Maximum fruit length was observed L_8 (41.8 mm) which was of minimum fruit length L_{10} (21.1 mm) (Table 02). Sima *et al.* (2011) evaluated six tomato hybrids in greenhouse for yield potential and quality reported significantly highest fruit length for Monroe F1 (53.5 mm) followed by Menhir F1 (52.6 mm).

Fruit girth (mm)

Significant variation was recorded for fruit girth (mm) among cherry tomato lines. The maximum fruit girth was found from L_8 (32.8 mm) and minimum fruit girth was found from L_{10} (20.0 mm) (Table 02). Though fruit size is the genetic phenomenon, as well as cherry tomato size, is small than table tomato. Varietal influence on fruit diameter was reported by Bhangu and Singh (1993).

Single fruit weight (g)

Single fruit weight showed significant variation among the cherry tomato lines. Maximum single fruit weight was found from L_8 (17.2g) and minimum was found from L_{10} (5.2g) followed from L_7 (5.7g) and L_5 (9.0g), L_9 (8.6g) and L_3 (8.5g) shows significantly similar (Table 02). These results are in line with the findings of Prema *et al.* (2011) and Islam *et al.* (2012) in cherry tomato. Ahmad (2002) also found a significant variation of single fruit weight among the 25 heat tolerant hybrids which supports the findings of the present study.

Table 01. Leaf area, Chlorophyll %, stem diameter (mm), sucker, No of Flower/ plant, fruit length (mm), fruit girth (mm) of different cherry tomato lines **

Lines	Leaf area	Chlorophyll %	Stem diameter (mm)	Sucker	No of Flower/ plant	Fruit leanth	Fruit girth
Line 1	117.9 Cd	33.8 de	10.8 abcd	7.7 abc	93.0 d	31.8 b	26.9 cd
Line 2	106.4 Efg	42.6 abc	10.5 bcde	5.7 defg	76.3 e	29.9 bc	26.0 d
Line 3	99.9 Fg	42.3 abc	9.6 de	4.0 G	123.7 c	25.0 f	27.1 cd
Line 4	119.8 C	33.1 e	11.7 ab	5.3 efg	120.3 c	28.3 cd	22.9 f
Line 5	101.2 Fg	39.9 bcd	10.3 cde	4.7 fg	125.3 c	26.0 ef	23.2 f
Line 6	112.5 Cde	38.4 bcde	10.6 abcde	5.7 defg	78.7 de	26.4 def	28.2 b
Line 7	108.6 Def	44.2 ab	10.6 abcde	9.3 A	273.7 a	25.2 f	21.4 g
Line 8	104.8 Efg	32.3 e	11.7 ab	6.0 cdef	75.0 e	41.8 a	32.8 a
Line 9	97.9 Fg	36.3 cde	11.9 a	8.0 ab	135.3 c	28.1 cde	24.3 e
Line 10	95.5 G	46.5 a	9.2 e	6.7 bcde	196.0 b	21.1 g	20.0 h
Line 11	133.7 B	44.4 ab	11.2 abc	7.3 bcd	89.3 de	29.8 bc	27.4 bc
Line 12	147.9 A	43.0 ab	11.0 abcd	8.3 ab	86.0 de	27.9 cde	20.6 gh
C.V %	*5.7*	*9.6*	*7.50*	*16.1*	*7.3*	*4.5*	*2.5*
LSD Value	*10.8*	*6.4*	*1.30*	*1.7*	*15.2*	*2.1*	*1.0*

* Here, *L_1 = Jhumka-red, L_2 = Sweetie, L_3 = Cherry Sweet red, L_4 = SAU Olive cherry, L_5 = Chinese, L_6 = Jhumka-yellow, L_7 = Clamentine, L_8 = Golden juble, L_9 = SAU Black cherry, L_{10} = Whitest, L_{11} = Orange, L_{12} = JP-13.
**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

Number of fruit/plant

The number of fruit/plant significantly varied among different cherry tomato lines. Highest number of fruits/plant was found from L_7 (237.0) which was followed number of fruit with L_{10} (187.7). The

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lowest was obtained from L_8 (58.0) (Table 02).The present findings agree with the report of Bhangu and Singh (1993).

Brix %

Cherry tomato limes was showed statistically significant difference in brix percentage among all Lines. Highest brix was found from L_{12} (3.6) and lowest was found from L_6 (1.6) (Table 02). Brix % of cherry tomato showed the significant variation. Raffo et al. (2003), on the other hand, reported fluctuating but high SSC (6.1 °Brix) and sugar content (3.6 g/100 g) in cherry tomato grown in greenhouse conditions.

Yield/plant (kg)

It was observed from the result of the experiment that the cherry tomato lines showed significant variation for yield/plant (kg). Maximum yield/plant (kg) was found from L_7 (1.3 kg) followed by $L_{11,}$ L_{12} and L_5 (1.2 kg). While minimum from L_3 (0.9 kg) (Table 02). The variations of yield may also depend on genetic differences among the varieties, since they were grown under the same environmental conditions (Olaniyi and Fagbayide, 1999). Mehraj *et al.* (2014) also observed that yield per plant varied significantly among the tomato varieties. Yield of tomato varied depending on the level of heat tolerance of the hybrids (Baki, 1991).

Yield/ha (ton)

Significant differences between the cherry tomato lines respect to yield were highly varied. The highest fruit yield/ hectare was found from L_7 (54.9 t/h) with the statistically similar from $L_{12}$and L11 (47.9 and 47.6 t/h). The lowest was significantly obtained from L_3 (34.4). This may be due to the inherent ability of the hybrids and their better response to controlled environment condition. Similar reports of better performance of hybrids due to genetic makeup have been reported by Munshi and Kumar (2000), Arora *et al.* (2007), Parvej *et al.* (2010), Chapagain *et al.* (2011) and Razzak *et al.* (2013) in cherry tomato.

1000-seed weight

Significant variation was found for 1000-seed weight of cherry tomato lines (Appendix VII). Maximum 1000-seed weight was found from L_9 (2.4) followed by L_{11} and L_8 (2.2 g). While minimum from L_4 (1.2 g) (Table 02) Light weight of Cherry tomato seeds may be due to genetic character of the cerasiforme species.

Table 02. Weight (g), No of fruit/plant, brix, yield/plant (kg), yield/ha (ton), 1000 seed weight of different cherry tomato lines **

Lines	Weight (g)	No of fruit/plant	Brix	Fruit /plant (kg)	Yield/ ton/ha	1000 seed wight (g)
Line 1	14.1 c	78.3 f	1.6 g	1.1 bcd	45.8 d	1.5 defg
Line 2	13.6 c	69.0 fg	1.9 fg	0.9 de	39.2 h	1.8 cd
Line 3	8.5 e	100.3 d	1.7 g	0.9 e	35.4 i	1.4 efg
Line 4	10.4 d	97.7 de	2.7 cde	1.1 bcd	41.7 g	1.2 g
Line 5	9.0 e	119.0 c	1.7 g	1.2 abc	44.7 e	1.7 cde
Line 6	15.3 b	72.3 fg	1.6 g	1.1 bcd	46.4 c	1.5 def
Line 7	5.7 f	237.0 a	2.3 ef	1.3 a	54.9 a	1.3 fg
Line 8	17.2 a	58.0 g	3.3 ab	1.0 cde	42.4 f	2.2 ab
Line 9	8.6 e	126.7 c	2.3 def	1.1 bcd	44.7 e	2.4 a
Line 10	5.2 f	187.7 b	2.7 cd	1.0 de	39.6 h	1.2 fg
Line 11	14.2 c	83.0 ef	3.0 bc	1.2 abc	47.6 b	2.2 ab
Line 12	16.4 a	73.3 fg	3.6 a	1.2 ab	47.9 b	2.0 bc
C.V %	*0.7*	*8.7*	*11.2*	*9.4*	*4.6*	*11.7*
LSD Value	*0.9*	*15.9*	*0.4*	*0.2*	*0.5*	*0.3*

* Here, *L_1 = Jhumka-red, L_2 = Sweetie, L_3 = Cherry Sweet red, L_4 = SAU Olive cherry, L_5 = Chinese, L_6 = Jhumka-yellow, L_7 = Clamentine, L_8 = Golden juble, L_9 = SAU Black cherry, L_{10} = Whitest, L_{11} = Orange, L_{12} = JP-13.

**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

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IV. Conclusion

This study has clearly concluded that the highest fruit yield/hectare in L_7 (clementine) is attributed to better vegetative growth, more number of fruits cluster per plant, highest average fruit weight, higher fruit set percentage and taller plants over the other lines. The cherry tomato lines under study showed significant variation in the studied characteristics under Bangladesh condition. L_7 (Clamentine) appeared to be the best line among the 12 cherry tomato lines across all the parameter under study based on the yield.

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