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Evaluation of Cherry Tomato (*Solanum lycopersicum* var. *cerasiforme*) for Yield and Quality Traits under Protected Condition of Jammu and Kashmir

Rakesh Kumar*[1], Anil Bhushan[1], R. K. Samnotra[1], Uttam Tripura[2], Sonali Sharma[1], Mohammed Sajid Chheepa[1] and Atal Hameedi[1]

[1]Division of Vegetable Science & Floriculture, SKUAST, Jammu180 003, India
[2]Department of Horticulture, School of Agriculture, LPU, Phagwara, India

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ABSTRACT

The present study was conducted at experimental farm, Division of Vegetable Science and Floriculture, SKUAST, Jammu during winter 2018-19 to study the performance of cherry tomato genotypes under low-cost polyhouse condition. The study consisted of ten cherry tomato genotypes laid out in Randomized Block Design with single row plot due to lack of seeds. Three genotypes namely Punjab Kesar Cherry (3.30 kg/plant), G-12 (2.13 kg/plant) and G-16 (2.01 kg/plant) was identified for higher yield among all the genotypes. With respect to quality parameters maximum TSS was recorded in G-22 followed by G-14, lycopene content was higher in Punjab Red Cherry followed by Punjab Sona Cherry.

Key words: *Indeterminate, Cherry tomato, Off- season, Low-cost structure*

Introduction

Solanum lycopersicum L. var. *cerasiforme*, commonly known as cherry tomato is a cultivated species oftomato, has a great demand in global market due to its high quality and favor (Kobryn *et al.,* 2005). It's offered an excellent source of antioxidants and phyto chemicals such as β-carotene, flavonoids, lycopene, vitamin A, vitamin C, vitamin K and many other nutrients essential to human health (Rosales *et al.,* 2010). Generally, cherry tomatoes are often consumed as raw since they possess a variety of health benefits, including reduced risks of cancer and cardiovascular disease. Considering its high bioflavonoid and carotene content, it is also utilized as table crop that has an anti-inflammatory effect and can be used in treating chronic diseases and as a painkiller (Omprasad *et al.,* 2018). As a result of these qualitative attributes, cherry tomatoes fetch higher prices in the market, which results in higher returns for the farmer. High yielding indeterminate cherry tomato genotypes with long growing season are preferred for protected cultivation in regions with mild climate using low-cost structures. Due to rich qualitative properties of cherry tomato, it can be used as one of the parents in developing interspecific hybrid under low-cost structures. With this breeding motive, the selection of parents with high genetic value become one of the important steps where screening of the varieties under protected structure is the need of hour. Therefore, the investigation was carried out to estimate the quantitative and qualitative traits of cherry tomato genotypes under polyhouse conditions.

Materials and Methods

A field investigation was conducted on the experimental farm of Division of Vegetable Science and Floriculture at SKUAST, Jammu in winter season of 2018-19. It is situated at an altitude of about 332 m above MSL, lying between $32^0$40′ N latitude and 74^0 58′ E. The one-month age seedlings were transplanted at a spacing of 60×45 cm in single row plot under low-cost polyhouse to estimate the genetic constitution of cherry-tomato for yield and its contributing traits. The experiment was laid out in an augmented randomized block design with three replications. All the recommended package of practices were followed throughout the growing periods. Three randomly plants of each genotype were tagged and observations of yield and yield attributing traits *viz.*,plant height, number of branches/ plants, days to 50 per cent flowering, number of flowers/truss, number of fruits/truss, number of truss/plant, fruit set percentage, average fruit weight, fruit equatorial diameter, fruit polar diameter, fruit shape index, pericarp thickness, number of fruits/plant, fruit yield/plant, and quality traits namelytotal soluble solids and lycopene content were recorded. The ANOVA appropriate for augmented randomized block design was performed on the mean data of selected plants within each single row plot for individual genotype and the data were analyzed by using R statistical package.

Results and Discussion

Cherry tomato genotypes were significantly differed among themselves with respect to all the characters (Table 2). Among the genotypes, maximum plant height was recorded by Punjab Sona Cherry (326.38 cm) which was at par with G-12 (321.46 cm), Punjab Red Cherry (318.29 cm) and G-22 (290.36 cm) while the minimum plant height was recorded by G-14 (213.00 cm). Number of branches per plant was varied from 2.18 (G-16) to 2.89 (Punjab Red Cherry). The positive correlation was observedbetween number of branches with leaves production. An increase in growth and yield occurs due to improved photosynthesis activity, which is determined by the size and number of leaves per plant. The current findings are in accordance to those of Najeema *et al.* (2018).

There was a significant difference for number of flowers/cluster, number of fruits/truss and fruit set percentage in ten genotypes studied (Table 2). Significantly the maximum number of flowers/cluster was recorded in Punjab Sona Cherry (15.36) followed by Punjab Kesar Cherry (11.86) while, the minimum number of flowers/cluster was recorded by G-8 (6.23). The number of fruits/truss was recorded highest in Punjab Sona Cherry (9.31) followed by Punjab Kesar Cherry (8.28), G-12 (6.38)and the lowest was found in G-6 (3.20). However, the maximum fruit set was recorded in G-8 (69.98 %) followed by Punjab Kesar Cherry (69.81 %) and G-16 (68.18 %). The least percent of fruit set was ob-

Table 1. Analysis of Variance in Cherry Tomato for Yield and Quality Traits

Sl. No.	Source Degrees of freedom	Replication 2	Treatment 9	Error 18
1	Plant height (cm)	197.766	4780.751**	615.817
2	Days to 50 % flowering	3.307	71.85**	3.932
3	Number of branches per plant	0.002	0.196**	0.015
4	Number of flowers per cluster	0.071	23.343**	0.654
5	Number of fruits per truss	0.171	12.18**	0.106
6	Fruit setting percentage (%)	2.422	209.22**	21.246
7	Number of truss per plant	6.655	67.768**	6.774
8	Number of fruits per plant	18.29	8502.142**	74.41
9	Average fruit weight (g)	0.371	40.328**	0.443
10	Fruit shape index	0.001	0.006*	0.002
11	Fruit pericarp thickness (mm)	0.029	2.836**	0.019
12	Yield per plant (Kg/Plant)	0.018	2.938**	0.027
13	Number of locules per fruit	0.034	0.483**	0.031
14	TSS (0B)	0.526	8.127**	0.258
15	Lycopene content (mg/100g)	0.005	4.869**	0.005

served in G-5 (47.89). The enhancement of fruit set could be attributed to the presence of a microclimate with better climatic conditions and ideal temperature, which aided in the higher rate of anther dehiscence, higher pollen viability, better pollination, and ultimately fruit set. Similar performance was also reported by Renuka *et al.,* (2014); Najeema *et al.,* (2018) and Anwarzai *et al.,* (2020).

In this present study, a significant variation was observed among the genotypes in term of yield and yield attributes traits (Table 3). Significantly higher average fruit weight was registered in Punjab Kesar Cherry (14.82 g) which was followed by G-16 (11.82 g), G-12 (11.20 g) whereas, the lowest average fruit weight was recorded by G-14 (3.14 g). This was in line with the research Najeema *et al.* (2018) andAnwarzai *et al.* (2020).

Punjab Kesar Cherry recordedthe maximum number of fruits/plant (223.28) followed by Punjab Sona Cherry (210.30), G-12 (190.16) and the minimum was recorded in G-6 (82.10). Similarly, the highest fruit yield/plant was registered in Punjab Kesar Cherry (3.30 kg) which was significantly higher than the all-other genotypes. Genotypes namely G-12, G-16 and Punjab Sona Cherry (2.13 kg, 2.01 kg and 1.46 kg, respectively) also hasrecorded the higher fruit yield/plant. However, the genotype G-6 (0.34 kg) recorded the minimum fruit yield/

Table 2. Mean performance of cherry tomato genotypes for yield and its contributing traits

Genotypes	PHT (cm)	DFF	NPB	NFC	NFT	FS (%)	NTP	NFP
G-5	281.300 $^{B\,bc}$	32.680 $^{B\,b}$	2.317 $^{C\,c}$	6.893 $^{E\,ef}$	3.300 $^{F\,f}$	47.890 $^{C\,c}$	31.287 $^{B\,cd}$	89.680 $^{F\,f}$
G-6	240.890 $^{C\,cd}$	36.453 $^{A\,a}$	2.257 $^{C\,c}$	6.363 $^{E\,f}$	3.200 $^{F\,f}$	50.313 $^{C\,c}$	29.300 $^{B\,de}$	82.100 $^{F\,f}$
G-8	236.360 $^{C\,d}$	29.230 $^{C\,c}$	2.300 $^{C\,c}$	6.230 $^{E\,f}$	4.363 $^{E\,e}$	69.983 $^{A\,a}$	22.180 $^{D\,f}$	84.803 $^{F\,f}$
G-12	321.460 $^{A\,ab}$	28.363 $^{C\,c}$	2.863 $^{A\,a}$	9.890 $^{C\,c}$	6.380 $^{C\,c}$	64.500 $^{B\,ab}$	35.380 ^{Aabc}	190.600 $^{B\,b}$
G-14	213.000 $^{C\,d}$	31.477 $^{B\,bc}$	2.307 $^{C\,c}$	8.197 $^{D\,de}$	5.320 $^{D\,d}$	64.870 $^{B\,ab}$	26.300 $^{C\,ef}$	120.100 $^{D\,e}$
G-16	280.800 $^{B\,bc}$	31.180 $^{B\,bc}$	2.180 $^{D\,c}$	9.240 $^{C\,cd}$	6.300 $^{C\,c}$	68.180 $^{A\,ab}$	32.800 $^{B\,bcd}$	170.120 $^{B\,c}$
G-22	290.360 $^{B\,ab}$	29.130 $^{C\,c}$	2.263 $^{C\,c}$	8.380 $^{D\,d}$	5.390 $^{D\,d}$	64.310 $^{B\,ab}$	31.180 $^{B\,cd}$	136.180 $^{C\,d}$
Punjab Sona Cherry	326.377 $^{A\,a}$	22.120 $^{D\,d}$	2.320 $^{C\,c}$	15.360 $^{A\,a}$	9.310 $^{A\,a}$	60.613 $^{B\,b}$	38.197 $^{A\,a}$	210.300 $^{A\,a}$
Punjab Red Cherry	318.297 $^{A\,ab}$	22.320 $^{D\,d}$	2.890 $^{A\,a}$	8.300 $^{D\,d}$	4.260 $^{E\,e}$	51.320 $^{C\,c}$	31.300 $^{B\,cd}$	110.807 $^{E\,e}$
Punjab Kesar Cherry	311.877 $^{A\,ab}$	22.260 $^{D\,d}$	2.540 $^{B\,b}$	11.863 $^{B\,b}$	8.280 $^{B\,b}$	69.810 $^{A\,a}$	36.280 $^{A\,ab}$	223.277 $^{A\,a}$
S.E.M.	14.327	1.145	0.071	0.467	0.188	2.661	1.503	4.980
C.D. 5%	42.569	3.401	0.212	1.387	0.559	7.907	4.465	14.797
C.V.	**8.798**	**6.952**	**5.094**	**8.912**	**5.806**	**7.534**	**8.284**	**6.084**

Note : **PHT**- Plant height, **DFF** - Days to 50 % flowering, **NPB** – Number of branches/plant, **NFC** Number of flowers/cluster, **NFT**–Number of fruits/truss, **FS** – Fruit set percentage, **NTP** – Number of truss/plant, **NFP** – Number of fruits/plant.

Table 3. Mean performance of cherry tomato genotypes for yield and its contributing traits

Genotypes	AFW (g)	FSI	FPT (mm)	YPP (Kg/Plant)	NLF	TSS (0B)	LYC (mg/100g)
G-5	5.333 $^{F\,ef}$	1.000 $^{B\,d}$	3.490 $^{B\,b}$	0.470 $^{E\,e}$	3.000 $^{A\,a}$	5.303 $^{C\,cd}$	0.220 $^{E\,ef}$
G-6	4.203 $^{G\,fg}$	1.007 $^{B\,cd}$	1.103 $^{E\,e}$	0.340 $^{F\,e}$	2.330 $^{C\,c}$	5.800 $^{C\,c}$	0.323 $^{D\,de}$
G-8	6.230 $^{E\,de}$	1.070 ^{Aabcd}	1.180 $^{E\,e}$	0.360 $^{F\,e}$	2.130 $^{D\,cd}$	7.680 $^{B\,b}$	0.120 $^{H\,f}$
G-12	11.197 $^{B\,b}$	1.020 $^{B\,bcd}$	1.260 $^{E\,e}$	2.130 $^{B\,b}$	2.897 $^{A\,ab}$	5.130 $^{C\,cd}$	0.900 $^{C\,c}$
G-14	3.140 $^{H\,g}$	1.023 $^{B\,bcd}$	1.210 $^{E\,e}$	0.380 $^{F\,e}$	2.000 $^{D\,d}$	7.980 $^{B\,b}$	0.357 $^{D\,d}$
G-16	11.820 $^{B\,b}$	1.030 $^{B\,bcd}$	3.830 $^{A\,a}$	2.013 $^{B\,b}$	2.003 $^{D\,d}$	4.500 $^{D\,d}$	0.160 $^{G\,f}$
G-22	7.320 $^{D\,cd}$	1.017 $^{B\,bcd}$	1.960 $^{D\,d}$	0.990 $^{D\,d}$	2.660 $^{B\,b}$	9.000 $^{A\,a}$	0.180 $^{F\,f}$
Punjab Sona Cherry	6.990 $^{D\,cd}$	1.100 $^{A\,ab}$	2.377 $^{C\,c}$	1.460 $^{C\,c}$	2.663 $^{B\,b}$	4.820 $^{D\,d}$	0.170 $^{G\,f}$
Punjab Red Cherry	7.880 $^{C\,c}$	1.090 ^{Aabc}	1.780 $^{D\,d}$	0.867 $^{D\,d}$	2.000 $^{D\,d}$	4.690 $^{D\,d}$	4.260 $^{A\,a}$
Punjab Kesar Cherry	14.820 $^{A\,a}$	1.130 $^{A\,a}$	2.360 $^{C\,c}$	3.303 $^{A\,a}$	2.000 $^{D\,d}$	7.623 $^{B\,b}$	1.260 $^{B\,b}$
S.E.M.	0.384	0.028	0.080	0.095	0.102	0.293	0.040
C.D. 5%	1.142	0.083	0.238	0.283	0.303	0.871	0.119
C.V.	**8.435**	**4.634**	**6.745**	**7.430**	**7.450**	**8.124**	**8.698**

Note : AFW-Average fruit weight (g), **FSI-** Fruit shape index, **FPT-** Fruit pericarp thickness (mm), **YPP-** Yield/plant (Kg/Plant), **NLF-** No. of locules/fruit, **TSS (0B)-** Total soluble solid, **LYC-** Lycopene content (mg/100g)

plant. The higher yield of Punjab Sona Cherry, Punjab Kesar Cherry, G-16, and G-12 was mostly leading to a high number of fruits per plant, as well as a higher proportion of flowers and fruits /cluster, as well as a higher number of branches and plant height which ultimately decided the greater yield improvement to the plant. The present findings were akin to that of Najeema *et al.* (2018) in tomato.

Among vegetables, tomatoes are the most popular processed vegetable in the world. A firm, well coloured with acceptable flavour of cherry-tomato fruits are preferred for fresh market and processing. Since the fruits with less number (2-3) of locules gives better firmness and high storability, hence, it can be preferred for processing industries. Most of the genotypes under the study has registered number of locules/fruit in the range of 2 to 3. The minimum number of locules/fruit (2.00) was observed in Punjab Kesar Cherry, Punjab Red Cherry, G-16 and G-14. Parallel results have been published by Renuka *et al.* (2014) in cherry tomato. The shelf life of fruit is directly correlated with higher pericarp thickness and firmness. The genotype G-16 (3.83 mm) recorded the maximum pericarp thickness followed by G-5 (3.49 mm) and Punjab Sona Cherry (2.38 mm) while the minimum was recorded in G-6 (1.10 mm). The presence of high total soluble solids (TSS) is one of the most important aspects to considered the manufacturing processed products. "One percent increase in TSS content of fruits result in 20 percent increase in recovery of processed product" (Berry *et al.,* 1988 and Shivanand, 2008). According to Ho *et al.* (1986) the TSS of tomatoes including cherry tomatoes chiefly comprises of reducing sugar. As a result, an increase in photosynthetic activity in the polyhouse would increase sucrose synthesis, impacting glucose and fructose accumulation in fruits, resulting in increased TSS (Caliman *et al.,* 2010). In the present study, the genotype G-22 (9.00 pB) recorded the highest TSS content followed by G-14 (7.98 pB), G-8 (7.68 pB) and the lowest TSS was recorded by G-16 (3.50 pB). This is in line with previous research by Sucheta *et al.* (2004) in the tomato and John *et al.*(2005) in cherry tomato.

The lycopene pigment in tomato fruit determines the optimal stage of ripening and is also an important criterion for salad consumption and processing. The lycopene level of the fruit differed greatly across the genotypes. The maximum lycopene content was observed in Punjab Red Cherry (4.26 mg/100g) followed by Punjab Kesar Cherry (1.26 mg/100g) and the minimum was observed in G-8 (0.12 mg/100g). The present outcomes are in accordance to those of Renuka *et al.,* (2014), Nazeema *et al.,* (2018) and Anwarzai *et al.* (2020).

Conclusion

In the present study, Punjab Sona Cherry, Punjab Kesar Cherry, G-12 and G-16 are found the best for yield and yield contributing traits in desirable direction. In case of quality parameters, Punjab Red Cherry, Punjab Kesar Cherry can be preferred for high lycopene content; for processing purpose accessions G-22 and G-14 with high TSS can be preferred. With future outline, suitability of different local accessions for different seasons along with standardization of agronomic practices along with screening for various biotic and abiotic stresses may be studied.

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