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RESEARCH ARTICLE

Appraisal of cherry tomato genotypes for diversity and principal component analysis

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Abstract

The current study was conducted to screen 63 cherry tomato genotypes, including three checks with the goal of identifying the genotypes with superior yield and better quality at Vegetable Research Farm, Punjab Agricultural University, Ludhiana, during 2021-22 and 2022-23. The research concluded that the genotypes varied significantly for all the traits. This variability can be later exploited in the future for trait-specific breeding programs. The genotype PCT-40 demonstrated the highest yield at 2.88 kg. Genotype PCT-13 stood out for bearing the highest number of fruits per plant (215), while PCT-36 exhibited the highest average fruit weight at 20.23 g. PCT-33 displayed the maximum pericarp thickness (5.58 mm). Best best-performing genotypes for fruit diameter and fruit length were PCT-36 (32.91 mm) and PCT-43 (67.77 mm), respectively. In terms of quality traits, noteworthy performances were observed among specific genotypes. PCT-44 emerged as the superior performer for total soluble solids (TSS) with a measurement of 9.7 °Brix. PCT-2 demonstrated excellence in both titrable acidity (1 g/100 mL) and ascorbic acid content (63.82 mg/100 g). PCT-41 showcased the highest lycopene content at 4.59 mg/100 g, while PCT-44 exhibited the highest beta-carotene content at 14.89 mg/100g. Additionally, substantial variations in both fruit color and fruit shape were evident among the genotypes, underscoring the diverse characteristics within the cherry tomato population. Eleven components were found by principal component analysis of genotype characteristics, the first five accounted for 80.81% of the variation. Trait patterns were shown by factor loadings and PCT-40, PCT-13 and PCT-41 genotypes performed well in PC1 and PC2.

Keywords: Diversity, Evaluation, Genotype, Yield, Quality, Principal Component Analysis

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Introduction

Cherry tomatoes (*Solanum lycopersicum* (L.) var. *cerasiforme* Mill.) represent a cultivated variety of garden tomatoes known for their comparably smaller size and are regarded as likely precursors to modern-day tomatoes. Belonging to the Solanaceae family, cherry tomatoes are diploid with a chromosome number of 2n = 2x = 24. Highly sought after in the market for exotic vegetables, they hold considerable potential for the organic vegetable sector. The wild cherry tomato, originating from regions such as Peru and Central America, serves as the ancestor of the modern-day tomato. The cherry tomatoes bear fruits in clusters (Thamburaj & Singh, 2015). Cherry tomatoes exhibit a closer genetic relationship to wild tomatoes, such as *S. cheesmaniae*, *S. peruvianum* and *S. pimpinellifolium*. Notably, they are reported to have higher concentrations of beta-carotene compared to lycopene (Potaczek & Michalak, 1994). Cherry tomatoes are widely cultivated in Central American regions and have gained popularity across various locations, including California, Korea, Germany, Mexico, and Florida (Renuka et al., 2014). Globally, tomatoes are cultivated across an expansive area of 50.52 lakh hectares, resulting

in a total production of 1868.21 lakh tonnes. The average productivity is recorded at 36.97 tonnes per hectare. (FAOSTAT, 2020). In India, tomato cultivation spans an area of approximately 8.12 lakh hectares, yielding a total production of 205.73 lakh tonnes. However, it's noteworthy that cherry tomatoes constitute a relatively small proportion of these overall statistics. Tomatoes are warm-season crops that thrive in a lengthy growing season, ensuring abundant harvests. The cultivation of tomatoes is feasible both in open field settings and under protective structures such as polyhouses, net houses, greenhouses, walk-in tunnels, etc. In contemporary agriculture, tomatoes, especially cherry tomatoes, are considered one of the most promising crops under protected structures. The rising popularity of cherry tomatoes in the market allows them to command a premium price (Vidyadhar et al., 2014). The escalating demand for cherry tomatoes in the domestic market underscores the need to develop high-yielding and good-quality varieties with enhanced quality. Consequently, the evaluation and comparison of cherry tomato genotypes become imperative to identify superior varieties, facilitating their incorporation into future breeding programs. The identification of genetic variability among these genotypes is a valuable outcome, providing crucial insights for informed decision-making in breeding programs.

Cherry tomatoes are cultivated for their small, edible fruits. The size of the fruit holds particular significance for many consumers, highlighting the importance of cultivating cherry tomato varieties that meet the desired size preferences (Dhaliwal & Jindal, 2017). Their versatile and flavourful characteristics make them a valuable ingredient in a wide range of culinary applications. Cherry tomatoes are considered as high-value crop as it is in high demand among high-end restaurants. According to the USDA, cherry tomatoes (1 cup = 152 g) contain 47.1 calories, 1.26 g of protein, 4.5 mg of omega-3 fatty acids, 119 mg of omega-6 fatty acids, 1241 IU of vitamin A, 18.9 mg of vitamin C, 353 mg potassium, 35.8 mg phosphorus and 14.9 mg calcium (USDA, 2019). Cherry tomatoes stand out as a rich source of lycopene and carotene, contributing significantly to positive health effects. With their nutrient-rich profile, cherry tomatoes can be deemed as protective foods. The current demand for cherry tomatoes is notably high in urban and metropolitan areas, although it remains relatively limited in peri-urban and rural regions. The organic cultivation of tomatoes, free from chemical pesticides, is particularly sought after. Cherry tomatoes are recognized for their blood-purifying properties and possess antibacterial qualities, aiding in the prevention of intestinal infections (Ramya et al., 2016).

Materials and Methods

Experimental Site and Climate

The current research was conducted at the Vegetable Research Farm, Department of Vegetable Science, PAU, Ludhiana. The temperatures range from extremely high at peak summers to very low (near freezing) in the winters. The rainfall is moderate and occurs in the month of July-August. The highest temperature reaches above 40°C in the summers and is below 10°C on average in winters. The precipitation may reach near 300mm in peak rainy season (Figure 1).

Experimental Materials

The experimental material consisted of 60 genotypes of cherry tomato collected and maintained by the Department of Vegetable Science, PAU, Ludhiana, with Punjab Red Cherry, Punjab Sona Cherry and Punjab Kesar Cherry as checks for yield and quality characters. The selected genotypes, including checks, were evaluated. The plants were grown and evaluated in the field during the years 2021-22 and 2022-23. The seedlings were transplanted on ridges at row × plant spacing of 75 × 45 cm. Agronomic practices, as recommended in the Package of Practices for Vegetable Crops, were followed to raise the crop (Devi, 2023). The research trial was situated in the humid sub-tropical climate zone.

Traits Evaluated

Morphological as well as biochemical traits were studied and evaluated for cherry tomato genotypes. Morphological traits studied were total yield (kg/plant), number of fruits per plant, average fruit weight (g), pericarp thickness (mm), fruit shape, fruit color, fruit diameter (mm) and fruit length (mm). Traits are responsible for quality like TSS (°Brix), ascorbic acid (mg/100 mL fruit juice), titrable acidity (g/100 mL fruit juice), lycopene (mg/100 g of fruit weight) and beta-carotene (mg/100 g of fruit weight). The quality parameters were estimated according to the procedure given by Harris & Ray (1935) and Srivastava & Kumar (2006).

Data Analysis

The collected data was analyzed using R software version 2023.06.2 Build 561 and the significant difference was checked at 1 and 5% level of significance. The data was subjected to Principal Component Analysis (PCA) and ANOVA (Analysis of Variances).

Results and Discussion

Analysis of Variance

In agricultural research, ANOVA (Analysis of Variance) is essential for examining many factors that affect crop quality and production. ANOVA is a vital analytical method in the field of agricultural germplasm screening, helping to assess how well different plant types perform under varied circumstances. Table 1 shows the analysis of variance analyzed on 63 cherry tomato genotypes, including three checks for 15 quality and morphological parameters for the year 2021-22 and 2022-23. The analysis of variance showed

Table 1: Analysis of variance (ANOVA) for yield and related traits

Trait	*2021-22*		*2022-23*		*Pooled*	
	SS	*MSS*	*SS*	*MSS*	*SS*	*MSS*
Total Yield	47.89	0.77**	48.18	0.78**	46	0.74**
Number of fruits/plants	270541.53	4363.57**	259295.2	4182.18**	251130	4050.5**
Average fruit weight	2759.005	44.50**	2756.77	44.46**	2756.08	44.45**
Pericarp thickness	152.52	2.46**	158.8	2.56**	155.2	2.50**
Fruit diameter	2715.98	43.81**	2830.43	45.65**	2761.51	44.54**
Fruit length	13120.93	211.63**	12172.68	196.33**	12595.5	203.15**
TSS	269.29	4.34**	274.56	4.43**	271.58	4.38**
Ascorbic acid content	23251.64	375.03**	23454.14	378.29**	23329.2	376.28**
Titrable acidity	5.77	0.09**	5.64	0.088**	5669669	91446.27**
Lycopene content	183.72	2.96**	213.49	3.44**	195.9	3.16**
Beta-carotene content	2920.38	47.1**	2916.69	47.04**	2906.66	46.88**

*,** Significant at $p \leq 0.05$ and 0.01 levels respectively.

that there was a significant difference among the genotypes for all the traits studied. All the traits showed significant differences at $p = 0.05$ and 0.01, which are considered appropriate for further examination. This shows that there is sufficient variability among all the genotypes that can be further exploited in breeding programs.

Yield and Yield-related Parameters

The variables influencing plant yield encompassed parameters such as number of fruits per plant, fruit weight, fruit diameter, fruit length, and pericarp thickness. In Table 2, comprehensive data is presented for these observed traits, providing mean values, value ranges, and critical differences (CD) at a 5% significance level for the years 2021-22 and 2022-23. The pooled data for both years is also delineated. Genotypes exhibited considerable variation in total yield, ranging from 0.73 to 2.88 kg/plant, with an average of 1.46 kg/plant. Notably, PCT-40 demonstrated the highest total yield, while the lowest was recorded in PCT-10. The current findings align with those reported by Ramya et al. (2016), who observed yields ranging from 0.89 to 2.84 kg/plant. Additionally, our research results are consistent with the observations made by Omprasad et al. (2018), with documented in the range of 1.06 to 3.70 kg/plant.

Various factors directly influencing fruit yield include the number of fruits per plant, average fruit weight, fruit diameter, fruit length and pericarp thickness. The cherry tomato genotypes exhibited significant variability in these traits. Notably, the number of fruits per plant ranged from 62.50 to 215, while average fruit weight varied between 4.51 to 20.23 g, with genotype PCT-13 displaying the highest fruit count (215) and genotype PCT-40 demonstrating the highest average fruit weight. The results concorded with the findings of Venkadeswaran et al. (2018) observed an average of 183 fruits/plant, while for average fruit weight, Omprasad et al. (2018) reported a range of 10.50 to 28.52 g and Anwazrai et al. (2020) calculated lowest fruit weight (3.50 g) which was close to our findings.

The fruit diameter ranged from 19.06 (PCT-34) to 32.91 mm (PCT-36), with a pooled mean of 25.33 mm across genotypes. Fruit length exhibited a range of 18.44 to 67.77 mm, averaging 33.25 mm. PCT-43 displayed the highest fruit length, while PCT-44 had the lowest. The considerable variation in both diameter and length can be attributed to the diverse shapes present in the screened germplasm. These findings align with previous studies; Prema et al. (2011) reported 28.30 mm for fruit diameter, while Anwarzai et al. (2020) noted a maximum width of 40 mm. Similarly, the current results are consistent with the research conducted by Omprasad et al. (2018), where the fruit diameter range was documented as 25.9 to 41.2 mm. The thickness of the pericarp significantly contributes to fruit firmness. The calculated population mean for pericarp thickness was 3.59 mm. Among the genotypes, PCT-33 exhibited the highest pericarp thickness at 5.58 mm, while PCT-29 had the lowest at 1.21 mm. These observations align with the results reported by Renuka et al. (2017), where the mean pericarp thickness was documented as 3.66 mm.

Fruit Shape and Fruit Color

The cherry tomato genotypes exhibited a diverse array of colors, ranging from red, orange, yellow, and green to pink. Importantly, the fruit color demonstrated remarkable stability and consistency over the course of both observed years. The fruit shape and fruit color were studied as per distinctness, uniformity and stability (DUS) guidelines given by PPV&FRA, New Delhi (Protection of Plant Varieties and Farmers' Right Authority). Furthermore, the fruit shapes of these genotypes remained uniform and stable throughout

Table 2: Mean performance of cherry tomato genotypes for total yield, number of fruits plant^{-1}, average fruit weight, fruit diameter, fruit length and pericarp thickness

S. No.	Genotype	Total yield (kg/plant)			Number of fruits/plants			Average fruit weight (g)			Fruit Diameter (mm)			Fruit length (mm)			Pericarp thickness (mm)		
		Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean
1	PCT-1	1.41	1.46	1.43	106.67	110.00	108.33	13.22	13.06	13.14	28.14	28.10	28.12	31.61	31.27	31.44	4.16	4.20	4.18
2	PCT-2	1.66	1.59	1.62	131.67	126.67	129.17	12.63	12.76	12.70	27.89	27.80	27.84	33.09	33.09	33.09	4.93	4.98	4.95
3	PCT-3	2.41	2.46	2.43	190.00	193.33	191.67	12.66	12.30	12.48	28.96	28.78	28.87	25.53	25.49	25.51	4.05	4.09	4.07
4	PCT-4	2.74	2.41	2.58	200.00	176.67	188.33	13.69	13.31	13.50	20.71	20.79	20.75	33.06	32.50	32.78	3.78	3.85	3.81
5	PCT-5	1.10	1.40	1.25	71.67	91.67	81.67	15.41	15.06	15.23	24.29	24.35	24.32	37.95	38.14	38.05	2.78	2.78	2.78
6	PCT-6	1.61	1.95	1.78	111.67	136.67	124.17	14.41	14.02	14.21	26.57	27.90	27.24	37.08	36.65	36.87	3.52	3.64	3.58
7	PCT-7	1.27	1.20	1.23	145.00	138.33	141.67	8.73	8.08	8.40	22.21	21.92	22.07	33.01	32.88	32.95	2.59	2.70	2.64
8	PCT-8	1.18	1.06	1.12	108.33	95.00	101.67	10.85	10.44	10.65	24.20	24.68	24.44	35.26	34.99	35.13	3.28	3.37	3.33
9	PCT-9	0.87	1.15	1.01	120.00	158.33	139.17	7.24	7.19	7.22	21.66	22.06	21.86	30.56	31.06	30.81	3.00	2.98	2.99
10	PCT-10	0.75	0.70	0.73	151.67	138.33	145.00	4.97	4.91	4.94	19.93	20.19	20.06	21.76	21.88	21.82	2.78	2.76	2.77
11	PCT-11	0.95	0.79	0.87	171.67	143.33	157.50	5.51	5.40	5.46	22.13	22.04	22.08	23.57	24.01	23.79	2.60	2.63	2.62
12	PCT-12	1.03	1.01	1.02	131.67	125.00	128.33	7.84	8.04	7.94	23.79	23.98	23.89	28.85	29.08	28.97	2.60	2.65	2.62
13	PCT-13	2.41	2.26	2.34	223.33	206.67	215.00	10.81	11.09	10.95	27.14	27.35	27.25	29.09	29.08	29.09	2.08	2.13	2.11
14	PCT-14	2.57	2.14	2.36	146.67	125.00	135.83	17.53	17.66	17.60	30.77	30.93	30.85	41.98	41.78	41.88	4.49	4.53	4.51
15	PCT-15	1.61	1.71	1.66	130.00	138.33	134.17	12.42	12.26	12.34	27.13	28.10	27.62	32.65	32.92	32.79	3.40	3.51	3.46
16	PCT-16	1.32	1.46	1.39	118.33	131.67	125.00	11.13	11.06	11.09	21.14	21.68	21.41	40.90	41.24	41.07	3.64	3.53	3.59
17	PCT-17	1.79	1.82	1.81	133.33	131.67	132.50	13.46	13.36	13.41	26.44	26.64	26.54	32.55	33.07	32.81	3.52	3.65	3.59
18	PCT-18	0.84	0.91	0.87	158.33	170.00	164.17	5.32	6.53	5.92	21.05	21.25	21.15	27.30	27.90	27.60	4.45	4.59	4.52
19	PCT-19	1.17	1.21	1.19	161.67	165.00	163.33	7.25	7.09	7.17	21.24	21.15	21.19	30.24	29.39	29.81	3.56	3.72	3.64
20	PCT-20	1.30	1.29	1.30	73.33	73.33	73.33	17.78	17.77	17.77	28.44	28.04	28.24	33.49	33.63	33.56	4.57	4.67	4.62
21	PCT-21	1.54	1.50	1.52	108.33	105.00	106.67	14.22	13.97	14.09	27.06	27.06	27.06	36.65	35.70	36.18	3.53	3.59	3.56
22	PCT-22	1.18	1.20	1.19	155.00	158.33	156.67	7.59	7.21	7.40	21.86	22.06	21.96	28.22	28.32	28.27	4.24	4.45	4.34
23	PCT-23	1.08	1.18	1.13	85.00	93.33	89.17	12.65	12.63	12.64	23.05	23.14	23.10	40.93	41.10	41.02	3.55	3.57	3.56
24	PCT-24	1.10	1.23	1.17	146.67	163.33	155.00	7.53	7.48	7.50	19.97	19.47	19.72	30.46	30.66	30.56	3.54	3.51	3.53
25	PCT-25	1.99	2.49	2.24	140.00	176.67	158.33	14.22	13.99	14.11	26.64	26.91	26.78	38.43	37.75	38.09	4.41	4.56	4.49
26	PCT-26	1.50	1.69	1.60	176.67	201.67	189.17	8.50	8.50	8.50	19.86	19.86	19.86	34.27	34.41	34.34	3.67	3.76	3.72
27	PCT-27	1.11	1.18	1.15	161.67	171.67	166.67	6.89	6.57	6.73	24.89	25.16	25.03	32.21	32.65	32.43	3.38	3.39	3.39
28	PCT-28	1.64	1.75	1.70	191.67	206.67	199.17	8.53	8.29	8.41	20.84	20.92	20.88	34.18	34.10	34.14	3.42	3.50	3.46

Cont....

S. No.	Genotype	Total yield (kg/plant)			Number of fruits/plants			Average fruit weight (g)			Fruit Diameter (mm)			Fruit length (mm)			Pericarp thickness (mm)		
		Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean
29	PCT-29	0.82	0.85	0.84	163.33	168.33	165.83	5.05	5.26	5.16	20.96	21.01	20.98	20.85	20.72	20.79	1.26	1.16	1.21
30	PCT-30	0.97	0.91	0.94	128.33	120.00	124.17	7.56	7.53	7.55	21.02	20.95	20.98	31.87	32.09	31.98	2.21	2.20	2.21
31	PCT-31	0.94	1.00	0.97	60.00	65.00	62.50	15.69	15.76	15.72	32.78	32.70	32.74	38.87	35.56	37.21	5.01	5.05	5.03
32	PCT-32	1.19	1.96	1.57	108.33	178.33	143.33	10.95	10.85	10.90	23.30	23.58	23.44	36.21	36.19	36.20	3.26	3.42	3.34
33	PCT-33	0.91	1.03	0.97	80.00	90.00	85.00	11.33	11.35	11.34	31.98	32.36	32.17	46.99	46.11	46.55	5.64	5.51	5.58
34	PCT-34	0.78	0.82	0.80	171.67	185.00	178.33	4.53	4.49	4.51	18.92	19.20	19.06	22.94	23.33	23.14	2.88	2.95	2.92
35	PCT-35	1.18	1.46	1.32	66.67	81.67	74.17	17.63	17.43	17.53	27.04	27.25	27.15	51.31	51.13	51.22	5.52	5.48	5.50
36	PCT-36	1.67	1.74	1.70	83.33	86.67	85.00	20.04	20.43	20.23	32.55	33.27	32.91	47.80	47.28	47.54	4.44	4.57	4.50
37	PCT-37	1.80	1.66	1.73	123.33	115.00	119.17	14.58	14.30	14.44	29.74	29.89	29.81	27.26	26.86	27.06	2.84	2.82	2.83
38	PCT-38	1.09	1.07	1.08	118.33	116.67	117.50	9.20	9.16	9.18	22.53	22.28	22.40	31.67	31.34	31.51	3.03	3.07	3.05
39	PCT-39	0.95	1.11	1.03	168.33	200.00	184.17	5.61	5.50	5.56	21.59	22.16	21.88	25.60	25.42	25.51	2.95	2.86	2.91
40	PCT-40	2.49	3.26	2.88	140.00	180.00	160.00	17.82	17.82	17.82	31.42	31.62	31.52	33.37	33.13	33.25	4.80	4.79	4.80
41	PCT-41	2.50	2.74	2.62	151.67	166.67	159.17	16.50	16.41	16.46	29.84	29.93	29.89	32.13	32.49	32.31	4.72	4.90	4.81
42	PCT-42	1.64	1.75	1.69	123.33	128.33	125.83	13.28	13.15	13.21	30.51	30.51	30.51	27.10	26.30	26.70	2.52	2.53	2.52
43	PCT-43	1.76	1.86	1.81	110.00	116.67	113.33	16.00	15.56	15.78	25.18	25.24	25.21	67.83	67.71	67.77	4.49	4.68	4.58
44	PCT-44	1.07	1.23	1.15	108.33	123.33	115.83	9.86	9.56	9.71	21.21	20.20	20.71	32.94	33.97	33.46	3.84	3.89	3.86
45	PCT-45	1.01	1.33	1.17	63.33	83.33	73.33	15.97	15.95	15.96	26.11	26.24	26.18	44.46	44.69	44.58	4.65	4.90	4.78
46	PCT-46	1.57	1.68	1.63	83.33	88.33	85.83	18.84	18.29	18.56	26.63	24.23	25.43	45.27	45.55	45.41	4.68	4.65	4.66
47	PCT-47	1.20	1.20	1.20	93.33	93.33	93.33	12.81	12.87	12.84	21.74	21.89	21.82	15.07	21.80	18.44	3.22	3.15	3.18
48	PCT-48	1.38	1.52	1.45	121.67	131.67	126.67	11.37	11.15	11.26	19.70	19.83	19.77	52.78	51.48	52.13	2.58	2.65	2.61
49	PCT-49	1.25	1.46	1.36	91.67	106.67	99.17	13.68	13.73	13.71	28.46	28.19	28.32	27.90	28.01	27.96	4.45	4.42	4.43
50	PCT-50	1.80	1.89	1.84	100.00	105.00	102.50	17.99	17.63	17.81	30.55	32.12	31.33	35.81	36.05	35.93	4.67	4.68	4.68
51	PCT-51	1.97	1.59	1.78	153.33	118.33	135.83	12.85	12.87	12.86	26.51	27.01	26.76	32.11	32.08	32.10	3.25	3.37	3.31
52	PCT-52	1.15	1.17	1.16	105.00	110.00	107.50	10.97	10.94	10.96	28.76	28.95	28.86	27.40	27.04	27.22	2.94	2.97	2.96
53	PCT-53	1.11	1.23	1.17	78.33	86.67	82.50	14.23	14.13	14.18	29.57	29.27	29.42	28.13	28.25	28.19	3.63	3.78	3.71
54	PCT-54	1.07	1.29	1.18	86.67	103.33	95.00	12.30	12.23	12.27	30.09	29.76	29.92	30.09	29.97	30.03	3.80	3.85	3.82
55	PCT-55	1.07	1.21	1.14	91.67	105.00	98.33	11.66	11.73	11.70	28.80	29.10	28.95	26.93	27.04	26.98	2.91	2.93	2.92
56	PCT-56	1.23	1.45	1.34	158.33	181.67	170.00	7.77	7.41	7.59	21.01	21.11	21.06	35.02	35.03	35.03	1.98	2.01	2.00
57	PCT-57	1.01	1.19	1.10	131.67	145.00	138.33	7.71	7.91	7.81	24.76	24.86	24.81	22.51	22.29	22.40	2.19	2.17	2.18

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S. No.	Genotype	Total yield (kg/plant)			Number of fruits/plants			Average fruit weight (g)			Fruit Diameter (mm)			Fruit length (mm)			Pericarp thickness (mm)		
		Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean
58	PCT-58	1.03	1.09	1.06	93.33	100.00	96.67	11.01	10.81	10.91	23.94	23.94	23.94	32.60	32.18	32.39	3.82	3.96	3.89
59	PCT-59	1.22	1.48	1.35	88.33	105.00	96.67	13.79	13.14	13.46	29.34	29.65	29.49	29.34	29.41	29.37	4.42	4.49	4.46
60	PCT-60	1.25	1.16	1.21	130.00	125.00	127.50	9.59	9.64	9.61	26.70	26.17	26.44	27.17	27.01	27.09	3.17	3.15	3.16
61	Pb. Kesar Cherry (Check-1)	2.13	2.05	2.09	180.00	171.67	175.83	11.86	11.71	11.78	22.77	22.95	22.86	31.84	32.05	31.95	3.01	3.53	3.27
62	Pb. Red Cherry (Check-2)	2.48	2.25	2.37	195.00	173.33	184.17	12.74	12.54	12.64	26.76	26.79	26.78	28.27	28.20	28.24	3.03	2.98	3.01
63	Pb. Sona Cherry (Check-3)	1.92	1.84	1.88	171.67	173.33	172.50	11.19	11.03	11.11	22.20	22.23	22.22	33.16	31.76	32.46	2.81	2.82	2.81
Range		0.75-2.74	0.70-3.26	0.73-2.88	60-223.33	65-206.67	62.50-215	4.53-20.04	4.49-20.43	4.51-20.23	18.92-32.78	19.20-33.27	19.06-32.91	15.07-67.83	20.72-67.71	18.44-67.77	1.26-5.64	1.16-5.51	1.21-5.58
Mean		1.42	1.50	1.46	128.12	134.60	131.36	11.70	11.59	11.64	25.29	25.38	25.33	33.26	33.24	33.25	3.56	3.61	3.59
CD (5%)		0.21	0.22	0.17	16.88	17.65	13.47	0.63	0.59	0.54	1.21	1.53	1.19	2.71	2.28	2.07	0.32	0.30	0.28

the initial and subsequent years, showcasing a significant variation that included circular, cylindrical, rectangular, heart-shaped, obovoid, ovoid and pear-shaped forms. These results are in concordance with the findings presented by Shiksha & Sharma (2018). The variability in fruit color and fruit shape can be seen in Figures 2 and 3, respectively.

Quality Traits

Quality traits for sixty-three cherry genotypes were evaluated, encompassing total soluble solids (TSS), ascorbic acid, titratable acidity, lycopene content, and beta-carotene content. The data detailing the values of these quality traits can be found in Table 3.

Total soluble solids (°Brix)

Total Soluble Solids (TSS) significantly contribute to the taste and flavor of cherry tomatoes. The TSS values ranged between 3.83 to 9.70 °Brix, with a mean TSS of 6.57 °Brix. PCT-44 performed the best and minimum TSS was recorded in PCT-20. These findings closely align with the results reported by Najeema et al. (2018), where the range was 5.24-8.02 °Brix and Anwarzai et al. (2020), with an observed range of 4.2 to 8.55 °Brix.

Titrable acidity (g/100 mL)

Titratable acidity holds significance, particularly in fruit juice processing. Across diverse genotypes, titratable acidity ranged from 0.34 to 1 g/100 mL, with a calculated pooled mean of 0.63 g/100 mL. PCT-2 displayed the highest titratable acidity at 1 g, while PCT-18 exhibited the minimum at 0.34 g. These findings closely parallel the research by Kerketta & Bahadur (2019), where the reported range was 0.28 to 1.13 g and the mean was 0.64 g/100 mL.

Ascorbic Acid (mg/100 mL)

The content of ascorbic acid is a critical factor influencing the taste of fruits. Across cherry tomato genotypes, it ranged from 24.10 mg/100 mL (PCT-36) to 63.82 mg/100 mL (PCT-2) of fruit juice, with a calculated mean ascorbic acid content of 42.92 mg/100 mL. These results align closely with the findings of Ramya et al. (2016), where the reported minimum and maximum values were 26.76 mg to 61.45 mg/100 mL.

Lycopene Content (mg/100 g fresh weight)

Lycopene, the predominant carotenoid pigment in cherry tomatoes responsible for their red color, also serves as an antioxidant, contributing to increased disease resistance in the body (Arab & Steck, 2000). The considerable variation observed among the genotypes is attributed to the diverse range of colors present. Lycopene content spanned from 0.12 to 4.59 mg/100 g of fruit weight, averaging at 1.73 mg/100 g. PCT-41 exhibited the highest lycopene content, while PCT-60 showed the lowest. These findings align with the results reported by Kerketta & Bahadur (2019), who noted a range of 1.78 to 4.23 mg/100 g.

Table 3: Mean performance of cherry tomato genotypes for TSS, ascorbic acid, titrable acidity, lycopene content and beta-carotene

S. No.	Genotype	Total soluble solids (°Brix)			Ascorbic Acid (mg/ 100ml)			Titrable acidity (g/100ml)			Lycopene content (mg 100g/ fresh weight)			Beta-carotene (mg/100g fresh weight)		
		Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean
1	PCT-1	6.80	6.80	6.80	61.23	61.70	61.47	0.85	0.85	0.85	0.74	0.73	0.74	5.33	5.40	5.36
2	PCT-2	6.93	6.97	6.95	63.43	64.21	63.82	0.98	1.01	1.00	0.85	0.83	0.84	5.55	5.54	5.55
3	PCT-3	6.17	6.13	6.15	49.93	50.24	50.08	0.59	0.53	0.56	0.86	0.86	0.86	4.76	4.76	4.76
4	PCT-4	5.60	5.50	5.55	32.97	32.50	32.73	0.78	0.76	0.77	2.02	2.88	2.45	4.96	5.03	5.00
5	PCT-5	6.43	6.53	6.48	35.17	35.48	35.33	0.37	0.36	0.37	2.26	3.35	2.81	5.10	5.00	5.05
6	PCT-6	6.20	6.23	6.22	39.41	39.25	39.33	0.43	0.43	0.43	1.94	2.01	1.97	5.93	6.20	6.06
7	PCT-7	6.30	6.53	6.42	53.07	53.69	53.38	0.51	0.48	0.50	1.05	1.01	1.03	9.41	9.52	9.46
8	PCT-8	5.80	5.77	5.78	34.23	32.97	33.60	0.36	0.33	0.35	0.88	0.89	0.89	7.77	7.87	7.82
9	PCT-9	6.57	6.60	6.58	39.09	39.88	39.49	0.45	0.45	0.45	0.66	0.73	0.70	5.55	8.62	7.09
10	PCT-10	7.23	7.20	7.22	38.47	39.25	38.86	0.71	0.71	0.71	0.44	0.38	0.41	1.50	1.34	1.42
11	PCT-11	5.23	5.37	5.30	30.93	31.87	31.40	0.78	0.79	0.78	0.35	0.35	0.35	1.05	1.03	1.04
12	PCT-12	6.17	6.00	6.08	51.81	51.50	51.65	0.54	0.57	0.55	1.47	2.03	1.75	5.98	6.19	6.09
13	PCT-13	6.97	7.07	7.02	61.39	60.45	60.92	0.90	0.91	0.90	3.63	4.08	3.86	4.44	4.48	4.46
14	PCT-14	5.30	5.40	5.35	30.62	30.62	30.62	0.78	0.77	0.77	0.78	1.13	0.95	2.69	2.66	2.67
15	PCT-15	6.17	6.27	6.22	37.99	37.99	37.99	0.53	0.55	0.54	0.49	0.63	0.56	5.20	5.28	5.24
16	PCT-16	6.27	6.37	6.32	39.88	40.04	39.96	0.59	0.59	0.59	1.43	1.75	1.59	2.30	2.46	2.38
17	PCT-17	6.57	6.47	6.52	44.27	43.80	44.04	0.58	0.55	0.57	1.20	1.63	1.42	6.90	6.84	6.87
18	PCT-18	5.37	5.50	5.43	26.06	25.43	25.75	0.34	0.33	0.34	4.46	4.53	4.49	4.11	4.13	4.12
19	PCT-19	6.87	6.87	6.87	25.12	24.81	24.96	0.37	0.36	0.37	1.54	1.53	1.53	4.46	4.49	4.48
20	PCT-20	3.83	3.83	3.83	35.48	35.01	35.25	0.48	0.48	0.48	3.01	3.32	3.17	11.91	12.95	12.43
21	PCT-21	5.50	5.23	5.37	55.74	55.42	55.58	0.73	0.73	0.73	1.41	1.53	1.47	6.53	6.63	6.58
22	PCT-22	5.60	5.67	5.63	30.30	30.62	30.46	0.44	0.43	0.43	1.78	1.81	1.79	9.08	9.39	9.24
23	PCT-23	23.05	23.14	23.10	52.12	51.50	51.81	0.78	0.76	0.77	1.48	1.49	1.48	2.18	2.62	2.40
24	PCT-24	19.97	19.47	19.72	26.69	27.48	27.08	0.48	0.49	0.49	1.34	1.33	1.33	7.28	7.75	7.51
25	PCT-25	26.64	26.91	26.78	51.50	53.38	52.44	0.73	0.75	0.74	1.52	1.53	1.53	4.19	4.18	4.19
26	PCT-26	19.86	19.86	19.86	58.88	58.72	58.80	0.47	0.46	0.46	2.81	2.89	2.85	10.60	10.73	10.66
27	PCT-27	24.89	25.16	25.03	61.39	64.06	62.72	0.51	0.50	0.51	1.46	1.52	1.49	5.50	5.45	5.48
28	PCT-28	20.84	20.92	20.88	40.04	39.72	39.88	0.52	0.51	0.52	1.41	1.46	1.43	6.13	6.24	6.18

Cont....

S. No.	Genotype	Total soluble solids (°Brix)			Ascorbic Acid (mg/ 100ml)			Titrable acidity (g/100ml)			Lycopene content (mg 100g/ fresh weight)			Beta-carotene (mg/100g fresh weight)		
		Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean
29	PCT-29	20.96	21.01	20.98	31.24	31.71	31.48	0.48	0.49	0.49	2.33	2.58	2.46	12.87	13.58	13.23
30	PCT-30	21.02	20.95	20.98	35.33	35.80	35.56	0.74	0.76	0.75	0.70	0.74	0.72	7.93	8.67	8.30
31	PCT-31	32.78	32.70	32.74	29.67	29.36	29.52	0.78	0.80	0.79	3.13	3.59	3.36	4.60	4.60	4.60
32	PCT-32	23.30	23.58	23.44	38.15	38.62	38.39	1.02	0.91	0.97	1.65	1.63	1.64	4.46	4.50	4.48
33	PCT-33	31.98	32.36	32.17	34.07	33.91	33.99	0.79	0.69	0.74	1.52	1.48	1.50	4.45	4.42	4.43
34	PCT-34	18.92	19.20	19.06	30.30	30.30	30.30	0.47	0.46	0.46	1.41	1.41	1.41	5.66	6.92	6.29
35	PCT-35	27.04	27.25	27.15	39.72	39.88	39.80	0.66	0.67	0.67	1.53	1.53	1.53	2.09	2.32	2.21
36	PCT-36	32.55	33.27	32.91	24.18	24.02	24.10	0.49	0.50	0.50	1.43	2.49	1.96	2.69	2.89	2.79
37	PCT-37	29.74	29.89	29.81	44.27	44.27	44.27	0.63	0.65	0.64	1.25	1.32	1.28	14.95	14.50	14.73
38	PCT-38	22.53	22.28	22.40	45.69	46.79	46.24	0.82	0.83	0.83	1.18	1.10	1.14	12.71	13.25	12.98
39	PCT-39	21.59	22.16	21.88	44.59	44.75	44.67	0.87	0.85	0.86	1.03	1.07	1.05	5.44	5.48	5.46
40	PCT-40	31.42	31.62	31.52	60.13	59.97	60.05	0.61	0.61	0.61	1.95	2.07	2.01	14.54	14.54	14.54
41	PCT-41	29.84	29.93	29.89	57.31	58.25	57.78	0.86	0.84	0.85	4.50	4.68	4.59	14.15	14.01	14.08
42	PCT-42	30.51	30.51	30.51	38.94	39.56	39.25	0.68	0.71	0.70	1.81	1.74	1.77	6.63	6.68	6.65
43	PCT-43	25.18	25.24	25.21	32.34	32.50	32.42	0.39	0.39	0.39	1.50	1.46	1.48	3.61	3.73	3.67
44	PCT-44	21.21	20.20	20.71	50.24	51.18	50.71	0.45	0.45	0.45	2.06	2.03	2.04	15.09	14.71	14.90
45	PCT-45	26.11	26.24	26.18	31.40	32.19	31.79	0.52	0.52	0.52	2.18	2.17	2.18	14.68	14.63	14.65
46	PCT-46	26.63	24.23	25.43	40.35	40.51	40.43	0.87	0.86	0.87	1.47	1.49	1.48	1.69	1.70	1.69
47	PCT-47	21.74	21.89	21.82	46.00	45.69	45.84	0.51	0.48	0.50	1.81	1.92	1.86	4.16	4.17	4.16
48	PCT-48	19.70	19.83	19.77	29.36	29.83	29.59	0.50	0.49	0.50	1.69	1.71	1.70	8.09	8.27	8.18
49	PCT-49	28.46	28.19	28.32	57.15	57.62	57.38	0.98	0.92	0.95	3.48	3.63	3.55	3.20	3.18	3.19
50	PCT-50	30.55	32.12	31.33	48.98	49.14	49.06	0.58	0.53	0.55	1.78	1.79	1.79	5.40	5.57	5.49
51	PCT-51	26.51	27.01	26.76	61.70	59.82	60.76	0.79	0.80	0.79	0.76	0.76	0.76	4.01	4.28	4.14
52	PCT-52	28.76	28.95	28.86	54.32	52.60	53.46	0.82	0.80	0.81	1.97	2.02	1.99	14.00	12.96	13.48
53	PCT-53	29.57	29.27	29.42	32.50	32.50	32.50	0.80	0.80	0.80	2.50	2.53	2.51	3.27	3.23	3.25
54	PCT-54	30.09	29.76	29.92	29.83	29.99	29.91	0.77	0.80	0.78	1.43	1.45	1.44	4.43	4.40	4.41
55	PCT-55	28.80	29.10	28.95	37.99	38.78	38.39	0.77	0.77	0.77	4.21	4.29	4.25	7.02	7.08	7.05
56	PCT-56	21.01	21.11	21.06	32.03	32.19	32.11	0.50	0.50	0.50	0.60	0.67	0.64	8.65	8.65	8.65
57	PCT-57	24.76	24.86	24.81	39.88	40.04	39.96	0.81	0.82	0.82	2.36	2.35	2.35	8.10	8.00	8.05

S. No.	Genotype	Total soluble solids (°Brix)			Ascorbic Acid (mg/100ml)			Titrable acidity (g/100ml)			Lycopene content (mg 100g/ fresh weight)			Beta-carotene (mg/100g fresh weight)		
		Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean	Y1	Y2	Mean
58	PCT-58	23.94	23.94	23.94	51.97	51.34	51.65	0.42	0.43	0.42	0.70	0.74	0.72	9.44	9.49	9.46
59	PCT-59	29.34	29.65	29.49	52.75	53.22	52.99	0.70	0.71	0.71	0.85	0.85	0.85	3.73	3.74	3.73
60	PCT-60	26.70	26.17	26.44	49.46	49.61	49.53	0.45	0.46	0.45	0.12	0.13	0.12	0.34	0.28	0.31
61	Pb. Kesar Cherry (Check-1)	22.77	22.95	22.86	54.48	54.95	54.71	0.53	0.53	0.53	0.68	0.83	0.76	14.25	14.17	14.21
62	Pb. Red Cherry (Check-2)	26.76	26.79	26.78	59.03	59.35	59.19	0.61	0.60	0.60	3.58	3.69	3.63	3.78	4.88	4.33
63	Pb. Sona Cherry (Check-3)	22.20	22.23	22.22	46.94	47.10	47.02	0.54	0.53	0.54	0.72	0.78	0.75	13.62	14.29	13.95
Range		18.92-32.78	19.20-33.27	19.06-32.91	24.18-63.43	24.02-64.21	24.10-63.82	0.34-1.02	0.33-1.01	0.34-1.00	0.12-4.50	0.13-4.68	0.12-4.59	0.34-15.09	0.28-14.71	0.31-14.90
Mean		25.29	25.38	25.33	42.85	43.00	42.92	0.63	0.63	0.63	1.67	1.79	1.73	6.67	6.83	6.75
CD (5%)		1.21	1.53	1.19	3.60	3.17	2.88	0.06	0.05	0.04	0.11	0.13	0.10	0.63	0.63	0.54

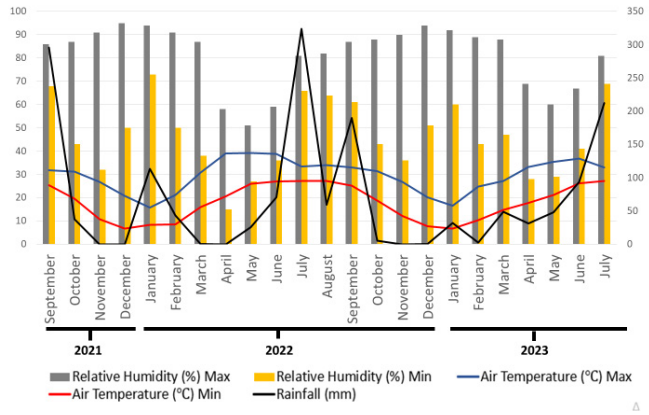

Figure 1: Meteorological data from September 2021-July 2023 (Relative humidity and Air temperature shown on primary axis while rainfall shown on secondary axis)

Figure 2: Variability in fruit color among cherry tomato genotypes

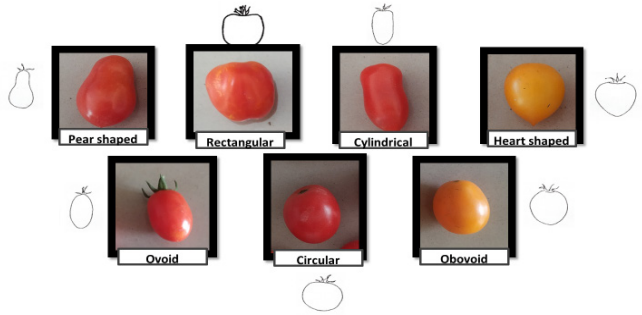

Figure 3: Variability in fruit shape among cherry tomato genotypes

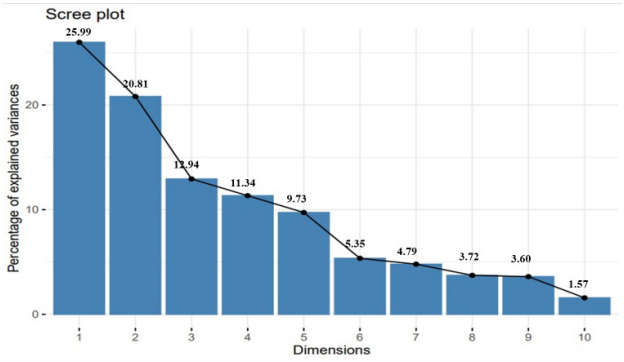

Figure 4: Scree plot depicting various principal components and their variance

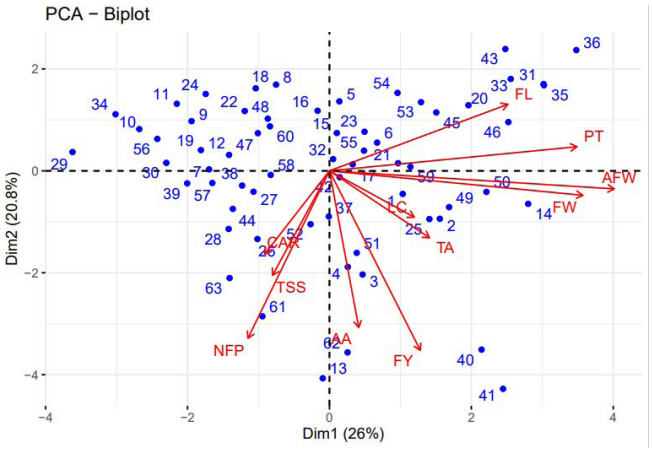

Figure 5: Principal component biplot for first two principal components

Table 4: Eigen values, Percent variance and Cumulative variance of the various principal components under study

S. No.	*Principal components*	*Eigen value*	*Variance percent*	*Cumulative variance percent*
1	PC1	2.86	25.99	25.99
2	PC2	2.29	20.81	46.81
3	PC3	1.42	12.94	59.74
4	PC4	1.25	11.34	71.08
5	PC5	1.07	9.73	80.81
6	PC6	0.59	5.35	86.16
7	PC7	0.53	4.79	90.95
8	PC8	0.41	3.72	94.67
9	PC9	0.40	3.60	98.28
10	PC10	0.17	1.57	99.85
11	PC11	0.02	0.15	100.00

Table 5: Factor loadings of various principal components

Traits	*PC1*	*PC2*	*PC3*	*PC4*	*PC5*
Total Yield	0.172	-0.529	0.366	0.024	0.213
Number of fruits/ plants	-0.154	-0.493	0.433	0.136	0.236
Average fruit weight	0.539	-0.053	0.027	-0.153	-0.020
Pericarp thickness	0.469	0.071	0.050	-0.131	0.081
Fruit diameter	0.480	-0.072	-0.189	0.117	-0.178
Fruit length	0.338	0.196	0.187	-0.384	0.345
TSS	-0.108	-0.308	-0.447	-0.428	0.081
Ascorbic acid content	0.055	-0.461	-0.373	-0.020	0.092
Titrable acidity	0.189	-0.197	-0.428	0.487	0.013
Lycopene content	0.161	-0.137	0.288	0.160	-0.714
Beta-carotene content	-0.123	-0.246	-0.001	-0.578	-0.464

Beta-carotene (mg/100g fresh weight)

Beta-carotene is responsible for the color expression in yellow and orange tomatoes. Beta-carotene content varied from 0.31 mg to 14.90 mg/100 g of fresh fruit weight, with an average of 6.75 mg/100 g. The top-performing genotype was PCT-44, while the lowest levels were observed in PCT-60. These findings are consistent with the results reported by Venkadeswaran et al. (2018), where the range was documented as 6.48 to 18.13 mg/100 g.

Principal Component Analysis

Principal component analysis is an important estimate that gives a very clear idea about complex multi-trait relationships between the variables by reducing dimensionality in a dataset. Principal component analysis was conducted on the genotypes for all the evaluated traits. A total of eleven principal components were observed and are given in Table 4. The first five principal components showed an eigenvalue greater than one and a cumulative variation of 80.81%. The first Principal component imparted maximum variability at 25.99% followed by PC2 at 20.81%, PC3 (12.94%), PC4 (11.34%) and PC5 (9.73%). The variation of various principal components was plotted on a scree plot and is shown in Figure 4. The variability decreases with each successive principal component. Similarly, an examination of the factor loadings for principal components revealed distinct patterns. The first principal components exhibited positive factor loadings for total yield, average fruit weight, pericarp thickness, fruit diameter, fruit length, ascorbic acid content, titrable acidity, and lycopene content. Conversely, negative factor loadings were observed for traits such as the number of fruits per plant, total soluble solids (TSS) and beta-carotene content. For PC2, traits like pericarp thickness and fruit length show positive factor loadings and all the other traits presented negative factor loadings (as shown in Table 5). The first two principal components exhibited a cumulative variance of 46.81%. A bi-plot for the first two principal components was plotted wherein PC1 was plotted on the x-axis and PC2 was plotted on the y-axis. The bi-plot was depicted in Figure 5. Chernet et al. (2014) and Sinha et al. (2021) obtained comparable results in determining principal components, noting eigenvalues greater than one in the initial six principal components. The genotypes PCT-40, PCT-41, PCT-13, PCT-1, PCT-2, PCT-25, PCT-62, PCT-51 and PCT-37 were on the better sides of PC1 and PC2. Similar results were also concluded by Sinha et al. (2021) and Ullah et al. (2022).

Conclusion

The present study revealed substantial variation among the genotypes for all the studied traits, indicating diversity within the germplasm. Genotypes differed across various traits, underscoring the potential for leveraging this diversity in future breeding endeavors for cherry tomato

improvement. Notably, genotype PCT-40 demonstrated the highest overall yield at 2.88 kg. PCT-13 exhibited the highest number of fruits per plant (215), while PCT-36 displayed the highest average fruit weight at 20.23 g. PCT-33 recorded the maximum pericarp thickness at 5.58 mm. In terms of fruit diameter and fruit length, the top performers were PCT-36 (32.91 mm) and PCT-43 (67.77 mm). Regarding quality traits, specific genotypes stood out. PCT-44 emerged as the superior performer for Total Soluble Solids (TSS) at 9.7 °Brix. PCT-2 demonstrated excellence in both titrable acidity (1 g/100 mL) and ascorbic acid content (63.82 mg/100 g). PCT-41 showcased the highest lycopene content at 4.59 mg/100 g, while PCT-44 exhibited the highest beta-carotene content at 14.89 mg/100 g. Principal component analysis of the traits identified 11 principal components, with the first five responsible for 80.81% variance. Critical traits impacting variability were identified by factor loadings, with genotypes such as PCT-40, PCT-13 and PCT-41 showcasing favorable performance in PC1 and PC2.

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सारांश

वर्तमान अध्ययन 2021-22 और 2022-23 के दौरान सब्जी अनुसंधान फार्म, पंजाब कृषिविश्वविद्यालय, लुधियाना में बेहतर उपज और बेहतर गुणवत्ता वाले जीनोटाइप की पहचान करने के लक्ष्य के साथ तीन जांच सहित 63 चेरी टमाटर जीनोटाइप की स्क्रीनिंग के लिए आयोजित किया गया था। षोध ने निकर्ा निकाला कि अध्ययन किए गए सभी लक्षणों के लिए जीनोटाइप काफी भिन्न थे। इस परिवर्तनषीलता का उपयोग भविय में लक्षण-विषिट प्रजनन कार्यक्रमों के लिए किया जा सकता है। जीनोटाइप पीसीटी-40 ने 2.88 किलोग्राम पर उच्चतम समग्र उपज का प्रदर्षन किया। जीनोटाइप पीसीटी-13 ने प्रति पौधे सबसे अधिक फल (215) दिए, जबकि पीसीटी-36 ने सबसे अधिक औसत फल वजन 20.23 ग्राम प्रदर्षित किया। उल्लेखनीय रूप से, पीसीटी-33 ने अधिकतम पेरिकारप मोटाई (5.58 मि.मी.) प्रदर्षित की। फल के व्यास और फल की लंबाई के लिए सबसे अच्छा प्रदर्षन करने वाले जीनोटाइप क्रमषः पीसीटी-36 (32.91 मि.मी.) और पीसीटी-43 (67.77 मि.मी.) थे। गुणवत्ता लक्षणों के संदर्भ में, विषिट जीनोटाइप के बीच उल्लेखनीय प्रदर्षन देखा गया। पीसीटी-44 9.7 डिग्री ब्रिक्स की माप के साथ कुल घुलनषील ठोस (टीएसएस) के लिए बेहतर प्रदर्षनकर्ता के रूप में उभरा। पीसीटी-2 ने अनुमापनीय अम्लता (1 ग्राम प्रति 100 मि.ली.) और एस्कॉर्बिक एसिड सामग्री (63.82 मि.ग्रा. प्रति 100 ग्राम) दोनों में उत्कृटता प्रदर्षित की। पीसीटी-41 ने उच्चतम लाइकोपीन सामग्री 4.59 मिलीग्राम. प्रति 100 ग्राम प्रदर्षित की, जबकि पीसीटी-44 ने उच्चतम बीटा-कैरोटीन सामग्री 14.89 मिलीग्राम. प्रति 100 ग्राम प्रदर्षित की। इसके अतिरिक्त, फलों के रंग और फलों के आकार, दोनों में पर्याप्त भिन्नताएं स्पट थीं, जो चेरी टमाटर की आबादी के भीतर विविध विषेाताओं को रेखांकित करती हैं। जीनोटाइप विषेाताओं के प्रमुख घटक विष्लेाण द्वारा ग्यारह घटक पाए गए, पहले पांच में 80.81 प्रतिषत भिन्नता थी। कारक लोडिंग द्वारा लक्षण पैटर्न दिखाए गए और पीसीटी-40, पीसीटी-13 और पीसीटी-41 जीनोटाइप ने प्रमुख घटक 1 और प्रमुख घटक 2 में अच्छा प्रदर्षन किया।