

# Evaluation of Summer Squash Genotypes for Growth and Yield Parameters

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## Abstract

The investigation was conducted in 2022 at the Department of Horticulture, Annamalai University, Vegetable Unit, Faculty of Agriculture. The experimental design used was randomized block layout with three replications comprising of twenty genotypes. The genotypes differed significantly in terms of growth and yield metrics. According to the mean data, the long type genotype Cp13 showed the best performance for thirteen characters among the fourteen summer squash characters, significantly greater than the grand mean in terms of plant height (66.54 cm), number of primary branches (3.17), number of nodes (14.72), days to first bud initiation (20.69 days), days to first male flower (31.44 days), days to first female flower (34.16 days), number of male flower (16.50), number of female flower (11.03), fruit length (40.82 cm), fruit diameter (32.76 cm), fruit weight (1200.18 g), number of fruits per plant (8.11), and fruit yield per plant (7.48 kg/plant). Therefore, this best genotype can be chosen for future crop management techniques in summer squash.

**Key words:** Genotype, Growth, Long type, Summer squash, Yield

Summer squash (*Cucurbita pepo* L.,  $2n=2x=40$ ), an economically important member of the gourd family, Cucurbitaceae. Summer squash is a warm season, New World vegetable crop, well adapted to temperate and sub-tropical region. It is a quick growing and early yielding cucurbit which performs well in cool and moist weather conditions and require approximately 16-27°C temperature for its normal growth and development. Plant produce stem with greatly shortened internodes in close succession. It is a compact bushy plant with reduced size tendrils. Summer squash is also known as bush squash, vegetable marrow, Vilayati Kaddu / Chappan Kaddu / Safed Kaddu. Summer squash ranks high in economic importance among vegetable crops [1-2]. In the hills of Northern India, its cultivation is mostly confined to mid-hills where summers are mild, the sowing season starts from March-April and the crop matures in May-June, whereas in lower hills where summers are a bit harsh and the crop is attacked severely by fruit fly and other insect pest and diseases. Therefore, this problem can be coped up by adopting protected cultivation and using short duration vegetable crops like cucurbits for the horticultural production. In spite of favorable climatic condition in Tamil Nadu, early growing season encounters with low temperature, frost etc. and later on unexpected drought, rainfed conditions and biotic stresses are some of the major constraints, which restrict vegetable grower to cultivate summer squash commercially in Tamil Nadu by adversely affecting crop growth and yield [3]. Though state has a wide range of diverse agro climatic conditions but vegetable cultivation practices

have generally been restricted to limited region and seasonal needs and the lack of awareness about technological advancement like protected cultivation and use of poor quality of planting material even in poly house are also responsible for low productivity of state as compared to national level. A number of improved cultivars have been recently developed in the country in this crop but no effort has been made so far to evaluate them for their suitability of growing and crop management practices [4-5]. In coastal regions, there is a greater fluctuation in climatic conditions as well as the soil properties. As most of the summer squash cultivars are suitable for dry conditions, a variety which tolerates this varied climate and grows up well to give maximum yield is the need of the hour. Research conducted in this crop is limited. Hence, to select genotype suitable for coastal areas of Cuddalore district. This study was conducted to evaluate the performance of summer squash genotypes and recommend better growth and yield variety for production.

## MATERIALS AND METHODS

The experiment was conducted in 2022 at the Vegetable Unit, Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar. For the experiment, 20 summer squash genotypes were gathered from various Tamil Nadu districts and Indian states. Three replications of each genotype were used in the experiment, which was conducted using a randomized block design. Pits that are 45 x 45 x 45 cm

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in size can be excavated using a 1 x 1 m spacing. Five seeds were planted in each pit. One row of two plants per accession was sown in each replication of the experiment. The agronomic and management practices were adopted in this study. Five plants from each genotype were selected randomly and the averages from these plants were worked out. Observations such as plant height, number of primary branches per plant, number of leaves, number of nodes, days to 1<sup>st</sup> bud initiation, days to first male flowering, days to first female flowering, number of male flowering, number of female flowering, fruit length, fruit diameter, fruit weight, number of fruits per plant, fruit yield per plant were estimated as follows.

## RESULTS AND DISCUSSION

### *Mean performance for vegetative characters*

In this study, 20 summer squash genotypes have been characterized according to morphological traits. Although morphological characteristics depend on external factors, it is also important to support these morphological variations. Results of the mean performance of different summer squash genotypes based on different growth and yield-contributing traits indicated that there was a significant difference in mean performance among most of the genotypes. This difference could result from the mean performance among the studied squash genotypes, which is also supported by the results of other previous studies on squash [6].

The mean values (Table 1) for plant height exhibited a range from 26.04 cm to 96.53 cm, with a grand mean of 61.36 cm. The highest plant height was recorded in Cp2 (96.53 cm), and the minimum plant height (26.04 cm) was recorded in Cp20 among the 20 genotypes. Cp4 (92.61 cm) recorded statistically significant values with the higher value of Cp2 (96.53 cm). Nine

genotypes were significantly taller than the grand mean of 61.36 cm. Among the long genotypes, the best plant height was found to be Cp2 (96.53 cm). Among the round genotypes, the highest value was recorded in Cp18 (49.30 cm), but this was on par with the grand mean.

The mean values for the number of primary branches per plant ranged from 0.81 to 4.86, with a mean of 2.85. The maximum number of primary branches was recorded in genotype Cp10 (4.86), followed by Cp3 (4.65), while the lowest value was found to be in Cp20 (0.81). Nine genotypes were found to have greater values than the grand mean of 2.85. Among the long genotypes, the maximum number of branches per plant was found to be in Cp10 (4.86). In respect to round genotype, the best value was recorded in Cp14 (2.12), but this was on par with the grand mean.

The mean values for the number of leaves ranged from 24.13 to 12.49, with a mean grand mean of 17.23. The maximum number of leaves was recorded for Cp10 (24.13), followed by Cp3 (23.39), while the genotype Cp20 (12.49) recorded a lower number of leaves. Seven genotypes recorded significantly higher values than the grand mean of 17.23. In the long genotype, the maximum number of leaves was recorded in Cp10 (24.13). Among the round genotypes, the maximum number of leaves was found to be Cp14 (14.51). This genotype was on par with other genotypes and the grand mean.

The mean values for the number of nodes ranged from 7.27 to 14.72, with a grand mean of 11.04. Eight genotypes were found to be significantly higher than the grand mean of 11.04. The genotype Cp10 recorded the highest number of nodes (14.72), followed by the genotype Cp3 (14.37), while the genotype Cp20 recorded the lowest number of nodes (7.27). Among the long genotypes, the maximum number of nodes was found to be Cp10 (14.72). In round genotype Cp14 (9.78).

Table 1 Mean performance of summer squash genotypes for vegetative characters

Genotypes	Plant height (cm)	Number of primary branches plant <sup>-1</sup>	Number of leaves	Number of nodes
Cp <sub>1</sub>	76.61	4.22	21.52	13.62
Cp <sub>2</sub>	96.53	3.38	18.38	12.08
Cp <sub>3</sub>	80.56	4.65	23.39	14.37
Cp <sub>4</sub>	92.61	3.80	20.03	12.92
Cp <sub>5</sub>	64.88	2.33	14.86	10.54
Cp <sub>6</sub>	68.79	2.96	17.69	11.44
Cp <sub>7</sub>	60.99	3.59	19.03	12.51
Cp <sub>8</sub>	57.08	4.04	20.63	13.26
Cp <sub>9</sub>	84.55	4.43	22.50	13.98
Cp <sub>10</sub>	88.50	4.86	24.13	14.72
Cp <sub>11</sub>	72.71	2.75	16.02	11.14
Cp <sub>12</sub>	53.19	2.54	15.48	10.82
Cp <sub>13</sub>	66.54	3.17	16.84	11.80
Cp <sub>14</sub>	41.55	2.12	14.51	9.78
Cp <sub>15</sub>	45.42	1.69	13.86	8.03
Cp <sub>16</sub>	29.91	1.25	13.00	8.28
Cp <sub>17</sub>	37.66	1.03	12.76	9.03
Cp <sub>18</sub>	49.30	1.90	14.05	7.49
Cp <sub>19</sub>	33.78	1.47	13.47	7.85
Cp <sub>20</sub>	26.04	0.81	12.49	7.27
Grand mean	61.36	2.85	17.23	11.04
S.Ed	1.93	0.10	0.61	0.37
CD	3.86	0.20	1.21	0.74

### *Mean performance for flowering characters*

The mean values (Table 2) for days to 1<sup>st</sup> bud initiation ranged from 20.69 to 29.46 days, with a mean of 25.10. Eight genotypes were found to have statistically significant values, higher than grand mean of 25.10. The genotype Cp13 initiated buds earlier (20.69 days), whereas the genotype Cp1 were the

last to initiate first flower buds with 21.35 days. Among the long genotypes of Cp13, earlier flower bud initiation was recorded. In round genotype of Cp14 (25.79 days) earlier flower bud and non-significant with grand mean and other characters. The mean values for days to first male flower ranged from 31.44 to 42.23 days, with a mean of 1.90. The late days taken for the

first male flower of genotype Cp20 (42.23) were followed by Cp19 (40.29 days). While earlier days of male flower occur in genotype Cp13 (31.44 days), followed by Cp4 (33.39 days), five genotypes were found to be on par with grand mean of 36.27 days. The long genotype (Cp 13) was earlier to produce first male flowers. In the round genotype, earlier male flower was recorded in Cp18; which was on par with the grand mean and other round genotypes.

The mean values for days to first female flower ranged from 32.19 to 42.64 days, with a mean of 39.43. The late days taken for the first female flower of genotype Cp16 (42.64) were followed by Cp20 (42.15). While earlier days to female flower occurred in genotype Cp13 (32.19 days), three genotypes were found to have par values with grand mean of 39.43 days. The

earlier days to the first female flower were recorded in long-type genotype Cp13. In the round genotypes, Cp19 recorded earlier flower, the 1<sup>st</sup> female flower took 40.77 days, but this was on par with the grand mean. The mean values for the number of male flowers exhibited a range from 16.50 to 23.47, with a grand mean of 1.17. Seven genotypes were recorded statistically at par values with grand mean (20.03). The highest number of male flowers was recorded in Cp15 (23.47). Whereas, the genotype with the lowest number of male flowers was found to be Cp13 (16.50), followed by Cp11 (16.87). In round genotype, the highest number of males was recorded in Cp15 (23.47), which was significant with the grand mean. The long genotype with the highest number of male flowers was recorded in Cp13.

Table 2 Mean performance of summer squash genotypes for various flowering characters

Genotypes	Days to 1 <sup>st</sup> bud initiation	Days to first male flowering	Days to first female flowering	Number of male flowers	Number of female flowers
Cp1	21.35	34.46	39.05	19.89	11.48
Cp2	29.21	35.86	40.61	21.00	9.55
Cp3	23.49	34.11	36.13	20.79	12.43
Cp4	29.46	33.39	38.63	20.19	10.99
Cp5	25.44	35.42	40.39	19.03	7.66
Cp6	22.79	34.93	39.51	19.51	9.08
Cp7	22.52	35.06	40.12	17.86	10.51
Cp8	22.25	36.02	39.90	18.76	11.07
Cp9	21.69	34.00	39.74	18.44	11.95
Cp10	23.75	33.57	38.11	16.50	12.03
Cp11	23.05	34.59	38.85	16.87	8.61
Cp12	24.57	36.47	32.19	17.49	8.14
Cp13	20.69	31.44	34.16	17.02	10.03
Cp14	25.79	38.43	41.32	21.82	6.30
Cp15	26.94	37.64	41.53	23.47	5.09
Cp16	27.91	41.28	42.64	22.84	5.49
Cp17	28.42	39.32	40.96	21.50	5.70
Cp18	26.36	36.86	41.86	22.41	5.21
Cp19	27.39	40.29	40.77	22.03	5.83
Cp20	28.85	42.23	42.15	23.09	4.98
Grand mean	25.10	36.27	39.43	20.03	7.80
S.Ed	0.74	0.95	0.98	0.59	0.23
CD	1.47	1.90	1.96	1.17	0.46

The mean values for the number of female flowers exhibited a range from 4.98 to 12.43, with a grand mean of 7.80. Eleven genotypes were recorded statistically at par values with the higher value of the grant mean (7.80). The highest number of female flowers was recorded in Cp3 (12.43). Whereas, the lowest number of female flowers was found in the genotype Cp20 (4.98). In the long genotype, the highest number of females was recorded in Cp3, which was significant with the grant mean. The round genotype with the highest values of female flowers was recorded in Cp14, par with the grand mean [12-16].

#### Mean performance for yield character

In (Table 3), the mean values for fruit length ranged from 16.40 cm to 45.40 cm, with a grand mean of 28.85. Ten genotypes recorded significant values with higher values than the grant mean (28.85). The highest fruit length was recorded in the genotype Cp11 (45.40 cm), followed by Cp5 (45.05 cm). Whereas the lowest fruit length was found at Cp20 (16.40 cm). In long genotypes, fruit length was found to be highest at Cp11; this was on par with the grant mean. In the round genotype, the highest value of fruit length was recorded in Cp16, but this was on par with the grant mean.

The mean values for fruit diameter ranged from 15.50 to 40.50. The highest value of fruit diameter was recorded in genotype Cp18 (40.50 cm). While the lowest value of fruit diameter was recorded in Cp8, six genotypes were recorded statistically at par values with the grant mean (30.40). In round genotypes, fruit diameter was found to be highest at Cp19; this was significant for the grant mean. In the long genotype, the highest value of fruit diameter was recorded in Cp18, but this was on par with the grant mean.

The mean values for fruit weight ranged from 216.05 g to 1600.18 g. The highest value of fruit weight was recorded in genotype Cp13 (1600.18 g). While the lowest values of the grant mean (216.05g). Nine genotypes recorded significant values higher than the grant mean (838.06g). Among the long genotypes, the maximum fruit weight was recorded in Cp13; this was significant for the grant mean. Among the round genotypes, the maximum fruit weight was found to be Cp14 (577.23g), but this was non-significant with the grand mean [17]. These results corroborated the findings of Akhter *et al.* [18] in squash and Abdein *et al.* [19] in sweet gourd. Uddain *et al.* [20] also observed significant variation among the different genotypes of Zucchini squash (*Cucurbita pepo* L.) in respect of the weight of fruits per plant.

Table 3 Mean performance of summer squash genotypes for various yield characters

Genotypes	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Number of fruits per plant	Fruit yield per plant (kg)
Cp1	40.50	29.80	1285.41	9.33	11.99
Cp2	19.50	18.21	734.55	7.97	5.85
Cp3	34.10	27.12	970.54	10.41	10.10
Cp4	16.50	29.76	655.86	8.94	5.86
Cp5	45.05	29.34	1521.62	4.53	6.89
Cp6	40.07	23.50	813.21	7.11	5.78
Cp7	30.50	28.41	1127.92	7.89	8.90
Cp8	32.12	15.50	891.89	9.04	8.06
Cp9	36.20	26.50	1049.23	9.62	10.09
Cp10	34.50	30.80	1206.61	10.11	12.20
Cp11	45.40	29.08	1364.16	6.58	8.98
Cp12	43.12	27.09	1443.03	6.05	8.73
Cp13	40.82	32.76	1600.18	8.40	13.44
Cp14	17.14	39.50	577.23	4.01	2.31
Cp15	18.32	37.46	419.90	3.09	1.30
Cp16	18.70	38.17	498.57	3.35	1.67
Cp17	14.23	31.50	282.72	3.48	0.984
Cp18	17.50	40.50	350.31	2.76	0.967
Cp19	17.30	39.80	216.05	2.94	0.635
Cp20	16.40	36.73	250.69	2.58	0.647
Grand mean	28.85	30.40	838.06	6.41	5.87
S.Ed	1.14	1.02	39.20	0.26	0.34
CD	2.27	2.03	78.40	0.52	0.67

The mean values for the number of fruits per plant ranged from 2.58 to 10.41, with a grand mean of 6.41. The genotype Cp3 recorded the highest number of fruits per plant (10.41), while the genotype Cp20 recorded the lowest number of fruits per plant (2.58). Ten genotypes were recorded statistically at par values with the higher value of the grant mean (6.41). Among the long genotypes, the highest number of fruits per plant was recorded in Cp3, which was par with the grant mean. Among the round genotypes, the highest number of fruits per plant was found to be Cp14 (4.01), but this was non-significant with the grand mean. The mean values for fruit yield per plant ranged from 0.635 kg to 13.44 kg, with a grand mean of 5.87. The genotype Cp13 recorded a maximum fruit yield per plant of 13.44 kg, while the genotype Cp19 recorded the lowest fruit yield per plant of 0.635 kg. Ten genotypes were recorded statistically at par values with the higher value of the grant mean (5.87). Among the round types, the best value of fruit yield per plant was recorded in Cp14 (0.635), which was on par with the grant mean. Among the long genotypes, the best value of fruit

yield per plant was found to be Cp13 (13.44 kg), but this was significant with the grand mean [21-24].

## CONCLUSION

The study found that among the 20 genotypes tested, the long type Cp13 summer squash genotype had significantly higher plant height (66.54 cm), number of primary branches per plant (3.17), number of nodes (11.80), number of female flowers (10.03), fruit length (40.82 cm), fruit diameter (32.76 cm), fruit weight (1600.18 g), number of fruits per plant (8.40), and fruit yield per plant (13.44 kg). Therefore, these best genotypes can be chosen for future crop management techniques in summer squash. Therefore, based on the current results, it can be said that the summer squash genotype 'Cp13' is approved for release due to its superior fruit weight, fruit length, fruit diameter, number of fruits per plant and greatest production potential. Therefore, it should be explained to both small-scale and large-scale farmers about the cultural practices for crop production.

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