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Performance assessment of various chilli species grown under shade net for growth, yield and quality characters in Coimbatore region, India

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Abstract

Chilli is a vegetable and spice crop grown all over the world that belongs to the Solanaceae family and the genus *Capsicum*. Commercial farming of chilli has been highly successful because of its high market value in both national and international markets. It can be grown successfully in pots, backyard, containers, open field, green houses, polyhouses and under shade nets. This study was conducted to assess the performance of chilli genotypes belonging to different chilli species for growth, yield and quality characters under shade net condition in the Coimbatore region. The experiment was conducted in Randomized Block Design with two replications. A total of 14 chilli genotypes belonging to *Capsicum annum* (CA-CBE-199, CA-CBE-200, CA-CBE-201, CA-CBE-202), *Capsicum frutescense* (CF-CBE-004, CF-CBE-005, CF-CBE-006, CF-CBE-007) and *Capsicum chinense* (CC-CBE-001, CC-CBE-002, CC-CBE-003, CC-CBE-004, CC-CBE-005, CC-CBE-016) were included in the study. Observation on 13 characters viz., plant height (cm), stem girth (cm), number of leaves per plant, number of branches per plant, number of fruits per plant, fruit length (cm), fruit girth (cm), individual fresh fruit weight (g), individual dry fruit weight (g), fresh fruit weight per plant (g), dry fruit weight per plant (g), number of seeds per fruit, and ascorbic acid content (mg) were recorded. From the overall result of the experiment, it is concluded that the genotypes CA-CBE-199, CA-CBE-202, CC-CBE-001, CC-CBE-002, CC-CBE-005 and CC-CBE-016 performed well in terms of growth, yield and quality characters under shade net in the Coimbatore region.

Keywords: chilli, genotypes, growth, yield, quality

Introduction

The chilli (*Capsicum sp.*) originated in South Central America and belongs to Solanaceae family. It is utilised not only in cooking but also in processing industries for its pungency and colour, as well as in pharmaceutical industries for medicinal applications in ayurveda and allopathic medications. It is high in vitamin A, C, E (Durust *et al.*, 1997) [8] and P, which helps to prevent heart disease. A hundred gram of edible capsicum offers 24 kcal of energy, 1.3 g of protein. (Anon. 2001) [2].

Because of the world's growing population and increasing demand, it is important to undertake efforts to boost chilli production. One method of improving productivity is to expand the area under chilli cultivation throughout the world and carefully choosing chilli varieties or genotypes suited for the area under cultivation to obtain higher yield.

Keeping this in view, the present study was conducted to evaluate the performance of 14 chilli genotypes in terms of yield and yield-attributing characters under shade net condition in an effort to select the best genotype for future breeding programmes.

Materials and Methods

During the year 2020-21, an experiment entitled "Performance assessment of various chilli species under shade net for growth, yield and quality characters in Coimbatore region, India" was carried out in the College Orchard, Department of Vegetable Science, Horticultural College and Research Institute, TNAU, Coimbatore to evaluate the performance of 14 chilli genotypes belonging to *Capsicum annum*, *Capsicum frutescense* and *Capsicum chinense* viz., CA-CBE-199, CA-CBE-200, CA-CBE-201, CA-CBE-202, CF-CBE-004, CF-CBE-005, CF-CBE-006, CF-CBE-007, CC-CBE-001, CC-CBE-002, CC-CBE-003, CC-CBE-004, CC-CBE-005, CC-CBE-016 for growth, yield and quality characters. The experiment was conducted under shade net in a Randomized Block Design (RBD) with two replications and observations were recorded on five tagged plants in each replication.

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Fourteen observations were recorded *viz.*, plant height (cm), stem girth (cm), number of leaves per plant, number of branches per plant, number of fruits per plant, fruit length (cm), fruit girth (cm), individual fresh fruit weight (g), individual dry fruit weight (g), fresh fruit weight per plant (g), dry fruit weight per plant (g), number of seeds per fruit, and ascorbic acid content (mg). The data obtained were subjected to statistical analysis using analysis of variance (ANOVA) as suggested by Panse and Sukhatme (1985) [20].

Results and Discussion

Plant height (cm)

The plant height was measured from ground level to the terminal growing point of the main stem at 190 days after transplanting. In the present study, among the fourteen genotypes studied, the accession CC-CBE-002 recorded the maximum plant height of 171.68 cm followed by CC-CBE-001 (160.49 cm) and the minimum plant height was observed in the genotype CA-CBE-202 (62.38 cm) (Table 1, Figure 1). The height of *Capsicum* plants varies greatly, which has an impact on their eventual performance as inferred by Hosmani (1982) [9], Chopra *et al.* (2005) [5] and Jyothi *et al.* (2011) [13]. Prasad Basavaraj Purad *et al.* (2019) [21] reported that plant height of different genotypes showed significant difference and the plant with highest height was observed in Sankaran kovil local (75.43 cm).

Stem girth (cm)

At 190 days after transplanting, the stem girth of the genotypes were measured, and the genotype CC-CBE-005 had the greatest stem girth of 7.93 cm followed by CA-CBE-199 (6.16 cm) while the minimum stem girth was observed in CA-CBE-200 (3.46 cm). (Table 1, Figure 1). The difference in stem diameter across chilli genotypes might be due to

genetic interaction. Chowdhury *et al.* (2015) [6] reported that variable stem diameter generated by chilli genotypes under identical environmental conditions may be attributed to the genetic variation.

Number of leaves per plant (cm)

The number of leaves per plant was recorded 190 days after transplanting and it varied significantly across chilli genotypes studied (Table 1, Figure 2). The maximum number of leaves per plant (540.77) was observed in the accession CA-CBE-202 followed by CC-CBE-004 (493.11) while a lesser number of leaves per plant (157.14) was recorded by the genotype CA-CBE-201 (Table 1, Figure 1). This variation in number of leaves might be related to hereditary factors. This is in accordance with the findings of Mehraj *et al.* (2014) [18] in chilli.

Number of branches per plant

In chilli, the maximum number of branches per plant is considered as a desirable feature since it increases the yield per plant by directly contributing to the photosynthesis. The highest number of branches per plant (12.17) was recorded in CA-CBE-202 genotype followed by the accession CF-CBE-004 (8.55) and the least (3.80) number of branches per plant was observed in the genotype CA-CBE-201 (Table 1, Figure 2). Prasad Basavaraj Purad *et al.* (2019) [21] reported that among the different genotypes studied, the genotype CA-45 reported to have maximum number of branches per plant (14.02). Such variation for number of branches per plant were also noticed by Jamal *et al.* (2015) [11] and Srinivas *et al.* (2017) [12]. According to Sha. K *et al.* (2016), the variation in the number of branches per plant might be due to differences in plant height as well as photosynthetic potential of each genotype.

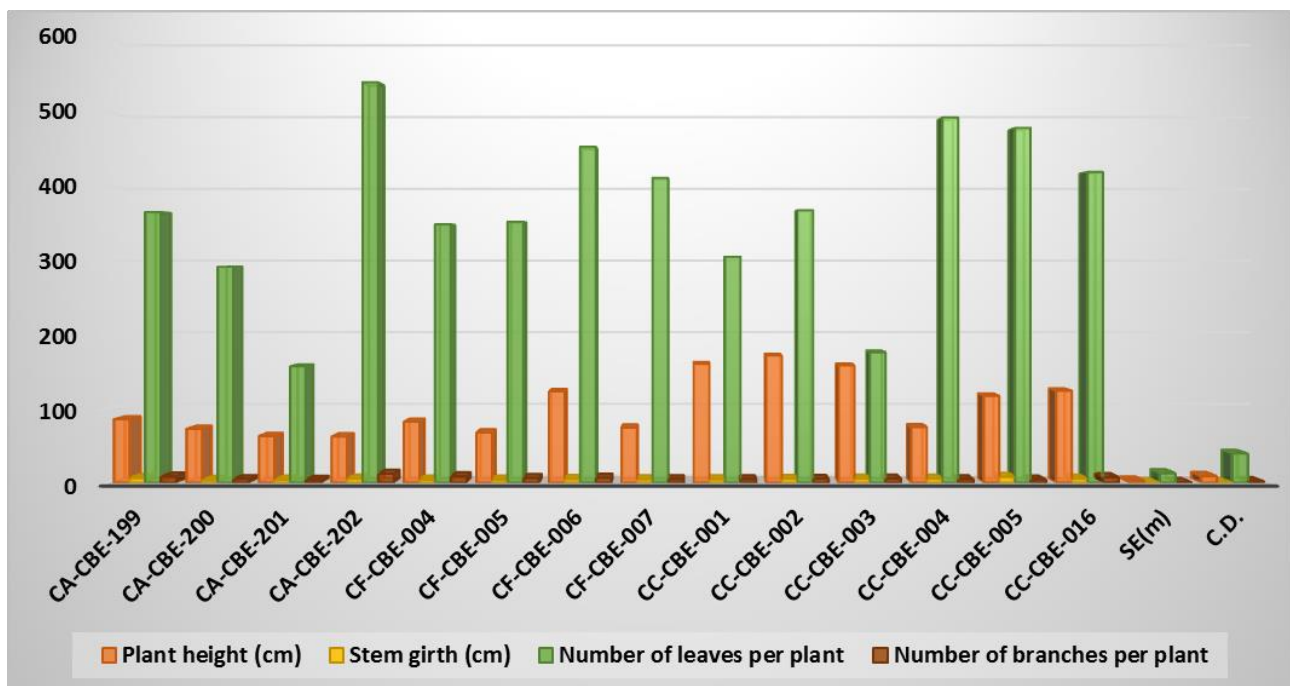


Fig 1: Graph showing plant height (cm), stem girth (cm), number of leaves per plant and number of branches per plant of chilli genotypes

Table 1: Plant height (cm), stem girth (cm) and number of leaves per plant and number of branches per plant of different chilli genotypes

Genotypes	Plant height (cm)	Stem girth (cm)	Number of leaves per plant	Number of branches per plant
CA-CBE-199	85.69	6.16	365.40	8.15
CA-CBE-200	72.75	3.46	291.60	4.7
CA-CBE-201	63.05	3.99	157.14	3.8
CA-CBE-202	62.38	5.16	540.77	12.1
CF-CBE-004	82.40	4.03	349.05	8.55
CF-CBE-005	67.94	3.98	352.35	6.25
CF-CBE-006	123.27	5.00	453.62	6.4
CF-CBE-007	74.36	4.55	411.64	4.65
CC-CBE-001	160.49	4.61	304.99	4.6
CC-CBE-002	171.68	5.09	368.00	5.1
CC-CBE-003	158.42	5.30	176.09	5.4
CC-CBE-004	75.02	5.14	493.11	4.6
CC-CBE-005	117.22	7.93	478.96	3.9
CC-CBE-016	124.28	5.29	419.62	7.5
SE(m)	2.88	0.12	12.76	0.68
C.D.	8.90	0.37	39.38	2.09

Number of fruits per plant

Among the genotypes studied, the highest number of fruits per plant was more in CA-CBE-202 (58.83) followed by the genotype CF-CBE-004 with 45.14 fruits. In contrast, fewer number of fruits were recorded in CA-CBE-201 (2.9). Sandeep *et al.*, (2008) [23] and Chattopadhyay *et al.*, (2011) [4] observed similar variation in chilli genotypes for number of fruits per plant. Fruit production per plant is directly proportional to the number of branches with a large number of nodes. Similar results were reported by Kumar *et al.* (2009) and Mantano Mata *et al.* (2002) [16] (Table 2, Figure 2).

Fruit length (cm) and Fruit girth (cm)

The genotype CA-CBE-199 had the longest fruit length (15.62 cm), followed by the genotype CC-CBE-004 (11.56 cm), while the accession CF-CBE-006 had the smallest fruit length (4.65 cm). The genotype CC-CBE-005 registered the largest fruit girth (11.56 cm), followed by the genotype CC-CBE-002 (6.65 cm), while the genotype CF-CBE-006 had the smallest fruit girth (1.90 cm) (Table 2, Figure 2). According

to Sha. K *et al.*, (2016), variation in fruit length may be due to genotype varietal character. Vijaya *et al.*, (2014) [26] and Rohini and Lakshmanan (2014) [22] also reported on the variation in chilli fruit length.

Individual fresh fruit weight (g) and dry fruit weight (g)

Since, chilli is grown for its fruit, the quality and quantity of fruit assumes greater importance. The weight of a single fruit varies greatly between genotypes, ranging from 0.49 to 8.14 g. The genotype CC-CBE-005 had the highest single fruit weight (8.14g), followed by CA-CBE-201 (7.79 g), and the genotype CF-CBE-006 recorded the lowest fresh fruit weight (0.49 g). Prasad Basavaraj Purad *et al.* (2019) [21] reported that among the different genotypes studied, single fruit weight was found to be maximum in M-106 (17.88 g/ fruit).

The single dry fruit weight was found to be high (1.54g) in CC-CBE-005, while the minimum weight (0.09 g) was observed in CF-CBE-006 (Table.2, Figure.2). The weight of a single fresh and dry fruit varies highly as inferred by Jogdhande Srinivas *et al.*, 2017 [12].

Table 2: Number of fruits per plant, fruit length (cm), fruit girth (cm), individual fresh fruit (g) and dry fruit weight (g) of chilli genotypes

Genotypes	Number of fruits per plant	Fruit length (cm)	Fruit girth (cm)	Individual fresh fruit weight (g)	Individual dry fruit weight (g)
CA-CBE-199	26.47	11.61	3.51	5.71	0.53
CA-CBE-200	12.72	4.31	4.45	2.44	0.53
CA-CBE-201	2.90	7.51	5.57	7.79	0.90
CA-CBE-202	58.83	7.86	4.93	2.41	0.68
CF-CBE-004	45.14	3.12	3.73	0.97	0.23
CF-CBE-005	11.17	4.52	3.67	2.28	1.09
CF-CBE-006	19.00	1.58	1.90	0.49	0.09
CF-CBE-007	15.44	2.45	2.42	0.58	0.17
CC-CBE-001	40.15	3.20	6.27	2.83	0.48
CC-CBE-002	38.00	3.42	6.65	3.71	0.66
CC-CBE-003	33.50	3.24	6.41	3.81	1.09
CC-CBE-004	15.58	6.55	6.08	7.43	1.35
CC-CBE-005	15.33	4.67	11.56	8.14	1.54
CC-CBE-016	31.00	5.73	7.54	4.92	0.59
SE(m)	1.69	0.05	0.10	0.19	0.123
C.D.	5.23	0.01	0.31	0.60	0.379

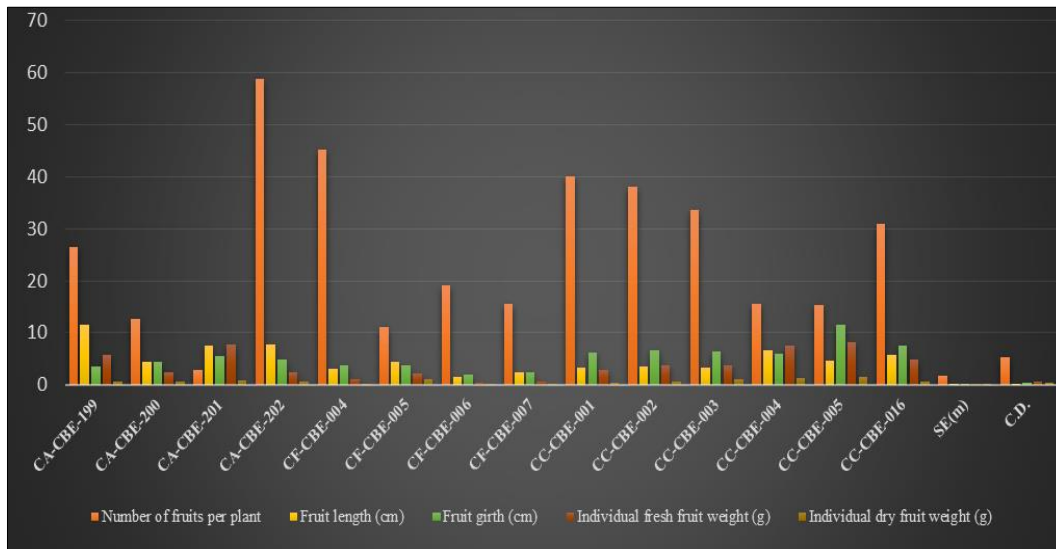


Fig 2: Graph showing number of fruits per plant, fruit length (cm), fruit girth (cm), individual fresh fruit (g) and dry fruit weight (g) of chilli genotypes.

Fresh fruit yield per plant (g) and dry fruit yield per plant (g).

The fresh fruit yield per plant showed significant variation among the different chilli genotypes. The fresh fruit yield per plant varied from 9.03 g to 156.08g. Jogdhande Srinivas *et al.*, (2017) [12] reported a highly significant variance in fresh fruit yield per plant (g) of the chilli genotypes assessed, with the highest fresh fruit yield per plant (g) in Warangal Chapata (600.00 g). The genotype CA-CBE-202 recorded the highest dry fruit yield per plant (38.44 g) followed by the genotype CC-CBE-003 with 36.16 g. The lowest dry fruit yield per plant (1.70 g) was observed in CC-CBE-006 (Table.3, Figure.3). Such variation in chilli genotypes for fresh and dry fruit yield per plant was observed by Amit *et al.* (2014) [1] and Jaisankar *et al.* (2015) [10].

Number of seeds per fruit

Among the genotypes studied, the genotype CC-CBE-004 recorded the highest number of seeds per fruit (71.7), followed by CF-CBE-007 with 70.73, while the genotype CF-CBE-007 showed the lowest number of seeds per fruit (17.2) (Table.3, Figure. 3). Such variation in chilli genotypes for

number of seeds per fruit was registered by Daniel Andrawus Zhigila *et al.*, 2014 [7].

Ascorbic acid content (mg)

Vitamin C is the most important vitamin in fruits and vegetables, contributing 90 percent of the ascorbic acid content in the human diet. There was an increase in ascorbic acid concentration from green to red ripening as given in (Table.3 and Figure.4). At the green mature stage of chilli, the ascorbic acid concentration was high (100.35 mg/100 g of fruit fresh weight) in CC-CBE-001, while at the red ripe stage, the genotype CC-CBE-005 recorded the highest ascorbic acid content (226.30 mg/100g of fresh fruit weight). The genotype CF-CBE-007 showed the lowest ascorbic acid concentration in both the green mature stage (25.10 mg/100 g fresh fruit weight) and the red ripe stage (50.26 mg/100g fresh fruit weight) of chilli. Manju *et al.* (2002) [15] and Antonious *et al.* (2006) [3] observed large varietal differences in ascorbic acid concentration. Ascorbic acid concentration increased with fruit ripening (Martinez *et al.*, 2005, Owk Aniel Kumar *et al.*, 2009) [19, 17].

Table 3: Fresh fruit yield per plant (g), dry fruit yield per plant (g), number of seeds per fruit and ascorbic acid content (mg/100g of fresh fruit weight) of different chilli genotypes at different stages of ripening.

Genotypes	Fresh fruit yield per plant (g)	Dry fruit yield per plant (g)	Number of seeds per fruit	Ascorbic acid content (mg/100g of fresh fruit weight) at different stages of ripening	
				Mature green stage	Red ripe stage
CA-CBE-199	131.91	13.98	50.99	25.20	100.34
CA-CBE-200	32.01	6.36	43.92	25.40	125.87
CA-CBE-201	24.00	2.55	31.25	25.20	101.70
CA-CBE-202	139.18	38.44	70.73	75.30	125.30
CF-CBE-004	44.51	10.25	25.78	25.30	100.75
CF-CBE-005	22.57	12.09	38.31	25.40	101.25
CF-CBE-006	9.99	1.70	17.23	50.32	125.40
CF-CBE-007	9.03	2.87	17.20	25.10	50.26
CC-CBE-001	41.30	18.61	26.48	100.35	175.40
CC-CBE-002	135.81	24.62	36.40	25.30	175.32
CC-CBE-003	118.56	36.16	25.00	75.40	201.23
CC-CBE-004	107.32	20.27	71.7	25.41	125.17
CC-CBE-005	116.79	22.59	20.41	25.30	226.30
CC-CBE-016	156.08	18.42	24.65	75.34	175.70
SE(m)	6.02	0.49	1.41	0.20	0.47
C.D.	18.61	1.52	4.36	0.639	1.47

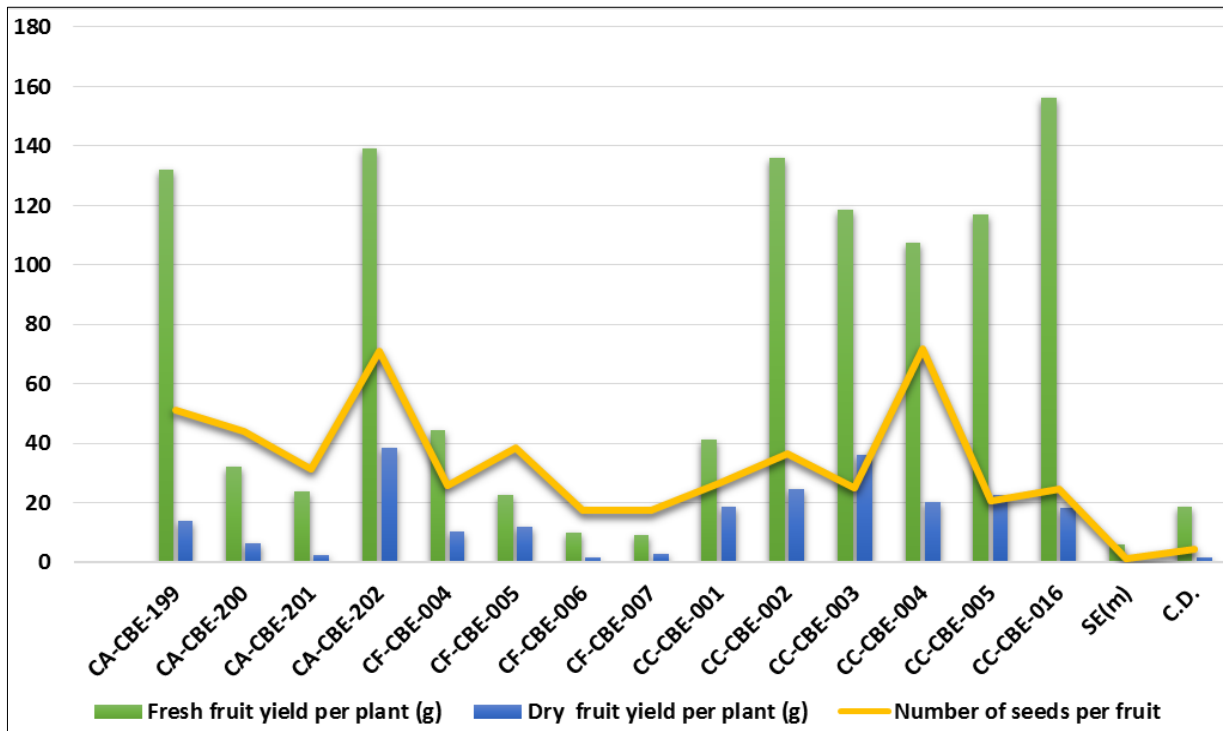


Fig 3: Graph showing fresh fruit yield per plant (g), dry fruit yield per plant (g) and number of seeds per plant of chilli genotypes.

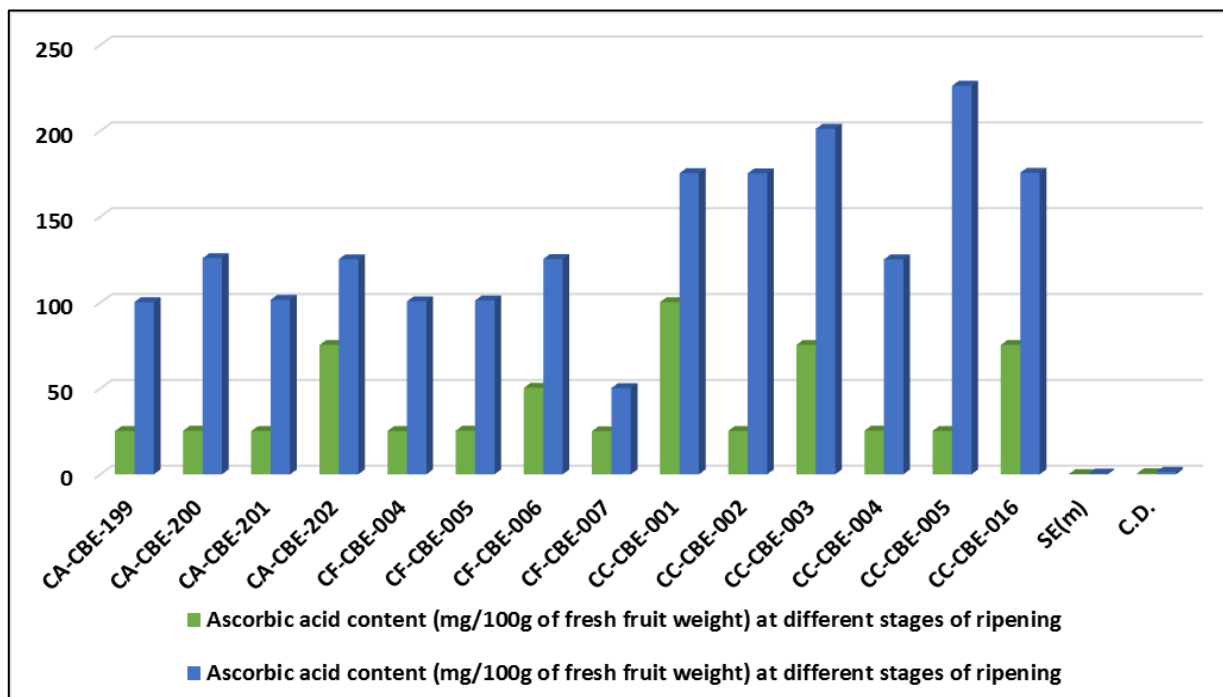


Fig 4: Graph showing ascorbic acid content (mg/100g of fresh fruit weight) at different stages of ripening.

Conclusion

From the experiment, it can be concluded that the genotype CA-CBE-199 recorded the maximum fruit length of 11.61 cm. Whereas the number of leaves per plant (540.77), number of branches per plant (12.1), number of fruits per plant (58.83), dry fruit yield per plant (38.44 g) and number of seeds per fruit (70.73) were recorded high in CA-CBE-202.

The highest ascorbic acid content was recorded in mature green stage (100.35 mg/100 g fresh fruit weight) was recorded in CC-CBE-001 and the maximum plant height (171.68 cm) was observed in CC-CBE-002. The maximum stem girth (7.93 cm), fruit girth (11.56 cm), individual fresh fruit weight (8.14 g), individual dry fruit weight (1.54 g), ascorbic acid

content in red ripe stage (226.30 mg/100 g fresh fruit weight) was observed in CC-CBE-005 and the highest fresh fruit yield per plant (156.08 g) was found in CC-CBE-016.

Among the different species studied *Capsicum annuum* and *Capsicum chinense* performed well under shade net in Coimbatore condition and among the 14 genotypes studied six genotypes viz., CA-CBE-199, CA-CBE-202 (*Capsicum annuum*), CC-CBE-001, CC-CBE-002, CC-CBE-005 and CC-CBE-016 (*Capsicum chinense*) were found to be promising based on the growth, yield and quality characters. Hence, these genotypes might be used in future breeding programmes for evolving varieties / hybrids.

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