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Research Article

Evaluation of pumpkin genotypes (*Cucurbita moschata*) suitable for summer season

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Abstract: The phantasy research was conducted at Department of Horticulture, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai. The trial was taken up during summer 2016 with 32 pumpkin (*Cucurbita moschata* Duch. ex. Poir) genotypes collected at different regions of Tamil Nadu with the objective to identify small fruited high-quality genotypes for summer season. The genotypes CM-9, CM 3, CM 14 (3.40) found a greater number of primary branches, the highest vine length was seen in CM18, CM10, CM15 (10.66m, 10.50m, 9.67m) genotypes. The higher petioles were recorded in CM21, CM18, CM4 (26.63, 24.77, 24.50cm). The more leaf length was found in CM5, CM11, CM1, CM9, CM8, CM23, CM2, CM31 (14.03 to 14.93cm) genotypes. The leaf breadth was highest in CM15, (22.00cm) and the gusty inter nodal distance in CM17 (13.53cm) was recorded. The earliest male flower in seventh node was noticed in CM23, CM1, CM32, CM30, CM4, the first female flower emerged early in CM12, CM26, (20 and 21st node), the period taken for male flowering was ranged from 47.20 to 54.20 days and for female flowering varied from 51.73 to 63.27 days. The early days to female flowering was noticed in CM29, CM20 and CM17. The least sex ratio was seen in CM30 (13.58). The days to fruit maturity less in CM29, CM28 and CM5 (83.47, 87.27 and 87.53 days). The genotypes CM29, CM28 recorded maximum fruits per plant (4.40 and 3.13) and narrow fruit diameter (17.80 and 18.33cm), fruit length (44.40 and 49.73 cm), fruit weight (0.97 and 1.11kg), 100 seed weight (10 and 15g). The highest yield per plant was registered in CM12, CM23, CM3 (9.48, 8.54 and 7.60kg). The maximum TSS content (10 brix) in CM13, acidity (0.78) in CM27, ascorbic acid (10mg) in CM23, moisture level (99%) in CM30, CM31, beta carotene level in CM29, and CM28 (0.99 and 0.89 mg). The CM29 and CM28 genotypes were distinguished as small fruited kind among the genotypes studied.

Key words: Pumpkin; *Cucubita moschata*; genotypes; evaluation; carotene; summer.

Introduction

Pumpkin (*Cucurbita moschata* Duch. ex. Poir) is one of the important commercially cultivated vegetable. It is cultivated in tropical regions of India. It has commercial significance because it is having high productivity, nutritive values, good storability and better transport quality. It is also extensively cultivated in sub-tropical and tropical regions of the world. It is being used both immature and mature stages as vegetable. In India, it is cultivated in an area of 11,060 hectares with an yearly production of 2.77 Lakh tonnes with the mean productivity of 25.10 tonnes per hectare. In Tamil Nadu, it is cultivated in an extent of 1,530 hectares with an yearly total production of 37,340 tonnes and the average productivity is 24.41 tonnes per hectare during 2011-2012 (Saxena and Chander, 2014) Pumpkin fruit has good source of beta carotene which is the major precursor for provitamin A. The carotenoids found in pumpkin fruits are α - carotene, β-carotene and lutein, which gives colour to the fruits. The total carotenoids content of pumpkin was 12.12 mg/100g of pulp. The concentrations of these major carotenoids were α-carotene 5.15 mg/100g, β-carotene 3.10 mg/100g and lutein 1.50 mg/100g. The major quantum of fruits contains 92.6 per cent moisture, 4.6 per cent carbohydrates, 25 kcal, 1.4 g protein, 0.1g fat, 0.06 mg thiamine, 0.04 mg riboflavin, 2 mg vitamin C, 10 mg calcium and

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0.7 mg iron in one hundred grams of (**Anon.,** 2007). The higher dietary intake of carotenoids offers protection against vitamin A insufficiency related health issues (**Roy**, 1973). The World Health Organization (WHO)has reported that nearly 112 million population in 108 countries together with South Africa and South East Asia are agonize due to Vitamin A deficiency. Much prominence to relieve Vitamin A deficiency via vegetables like pumpkin, as a inexpensive source of carotene rich vegetable is for bye recommended World Health Organization.

India is the center of origin for many cucurbitaceous vegetables, where the cucurbits are capable of thriving and performing well throughout the year. The vegetables of the family Cucurbitaceae represent the largest group of cultivated vegetables, most of them are cultivated during *kharif, rabi* and summer seasons. Most of the pumpkin varieties and hybrids available in India are more suitable for growing from June toJanuary. The crop also affected by viral disease and other pest which lead to low productivity. Only very less yield obtained. During the period of summer the market price is very high. The availability of other vegetables in the market is also very limited. Hence, the present study was taken up to identify genotypes suitable for summer season.

Materials and Methods

The study was taken up at Department of Horticulture, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai duringsummer 2016. Thirty-two genotypes collected from different regions of Tamil Nadu were used for this study. The seventeen genotypes *viz.* CM2, CM3, CM5, CM6, CM7, CM8, CM9, CM10, CM11, CM12, CM13, CM14, CM15, CM17, CM18, CM20, CM21 were maintained in the department of horticulture, Fifteen genotypes were collected from different places areCM1 from Attur, Salem district, CM4 from Melur, Madurai district, CM16 from Olakkur, Villupuram district, CM19 from Gudalur, Theni district, CM22 from Gudiyatham, Vellore district, CM23 from Thirumangalam, Madurai district, CM24 from Natham, Dindugal district, CM25 from Vikravandi, Villupuram District,CM26 from Arani, Thiruvanamalai district, CM27 from Sempatti, Dindugal district, CM28 from Ottamchatram, Dindugal district, CM29 from Rajapalayam, Virdhunagar district, CM30 from Tholudur, Perambalur District, CM31 from Harur, Dharmapuri district and CM 32 is Co1 variety. The experiment was laid out in randomized block design with three replications. The seed was sown by taking 30 cubic cm pits at a spacing of 2m between rows and plants. The plants were grow on the ground. The growth, yield and quality traits like number of primary branches, vine length petiole length, leaf length, leaf breadth, inter node length, first male flower node, first female flower node, days of first male flowering, days to first female flowering, sex ratio, days to fruit maturity, number of fruits per plant, fruit length (cm), fruit diameter, flesh thickness, fruit weight, 100 seed weight, yield per plant, total soluble solids (^{o}brix), acidity (%), ascorbic acid, moisture content and beta carotene content.The data recorded were subjected to standard statistical analysis (**Panse and Sukhatme**, 1967).

Result and Discussion

The results of the experiment showed that the genotypes CM-17 (3.40), CM-10 (3.33), CM-4 (3.47) recorded more number of primary branches and the similar results are reported by **Rad *et al.*,** (2010) in melon. Among the 32 genotypes, CM-18 (10.70m) and CM-10 (10.73m) recorded maximum vine length and the results are in line with the findings of Hossain ***et al.*,** (2010) in cucumber. The petiole length among the 32 genotypes was recordedmaximum values in CM-21 (26.27 cm) and CM-18 (24.63 cm) genotypesand the similar results found by Dhillon ***et al.*,** (2007) in snap melon. The leaf lengthamong the 32 genotypes, CM-8 (15.07 cm) and CM-1 (14.33 cm) recorded maximum values and CM-15 (22.00 cm) and CM-18 (19. 64 cm) recorded maximum leaf breadth. The results are in corroboration with the findings of Shanthipriya *et al.,* (2010) in cucumber. Among the 32 genotypes the shortest inter node length was recorded in CM-6 (5.47), and CM-25 (6.67cm) recorded.

Table 1. Mean performance of pumpkin genotypes for vegetative traits

S.No.	Genotypes	Number of primary branches per plant	Vine length (m)	Petiole length (cm)	Leaf length (cm)	Leaf breadth (cm)	Inter node Length (cm)	First male flower node	First female flower node	Days to first male flowering	Days to first female flowering	Sex ratio
1	**CM-1**	2.67	3.98	19.97	14.33	18.82	8.90	7.27	23.40	52.07	58.07	17.31
2	**CM-2**	3.13	5.83	22.57	14.07	17.10	6.80	10.13	24.73	53.13	58.53	18.21
3	**CM-3**	3.20	5.22	17.87	13.93	17.10	6.67	7.60	24.27	49.60	60.80	25.36
4	**CM-4**	3.27	7.55	23.63	13.81	18.60	8.00	7.20	23.93	52.07	58.47	26.67
5	**CM -5**	3.27	7.79	20.73	14.87	16.33	6.67	9.40	23.00	51.07	57.87	23.62
6	**CM -6**	3.07	8.32	20.13	11.80	16.87	5.47	10.53	24.33	52.00	59.87	18.81
7	**CM -7**	3.20	6.94	20.13	13.13	16.64	10.27	11.53	23.60	51.40	59.87	21.25
8	**CM -8**	3.07	4.12	20.47	15.07	16.13	8.27	11.93	23.80	50.60	56.40	22.87
9	**CM -9**	3.20	9.03	22.00	14.75	17.04	7.80	9.07	22.53	50.00	62.80	23.65
10	**CM -10**	3.33	10.74	21.77	13.29	16.70	8.53	8.67	21.60	50.00	58.87	21.88
11	**CM -11**	3.20	7.83	21.67	14.83	16.73	8.27	8.13	23.33	50.13	58.80	14.00
12	**CM -12**	3.07	7.81	18.63	12.73	13.80	8.07	8.80	20.73	52.47	60.47	27.43
13	**CM -13**	2.47	5.72	19.47	13.87	16.07	8.40	9.53	22.80	50.27	57.93	18.89
14	**CM -14**	3.13	5.29	19.17	13.37	16.97	7.80	10.80	24.00	51.00	57.53	14.12
15	**CM -15**	2.67	9.10	24.40	13.97	22.09	8.00	10.47	26.80	54.20	62.40	23.22
16	**CM -16**	2.53	6.82	21.83	12.37	16.10	8.27	8.27	25.07	49.40	57.33	19.34
17	**CM -17**	3.40	4.04	21.20	12.97	19.03	12.60	11.07	28.67	50.13	56.73	25.77
18	**CM -18**	3.07	10.79	24.63	14.23	19.64	10.37	39.00	22.87	54.40	58.40	17.13
19	**CM -19**	3.07	7.70	18.27	12.57	16.97	8.73	7.80	25.00	51.93	56.87	21.67
20	**CM -20**	3.07	5.35	22.83	13.87	18.87	10.57	7.40	24.87	49.20	56.07	22.45
21	**CM -21**	2.67	5.27	26.27	11.91	16.77	9.70	7.47	26.33	53.00	58.80	16.21
22	**CM -22**	2.20	5.12	23.20	13.37	18.00	9.53	9.80	25.00	54.07	59.87	24.76
23	**CM -23**	2.60	8.55	18.53	14.17	17.37	9.63	6.93	24.87	53.20	57.47	18.23
24	**CM -24**	2.53	5.97	19.57	12.53	18.50	10.93	8.93	25.93	52.07	58.13	18.33
25	**CM -25**	2.27	6.20	22.87	11.48	16.03	11.20	10.07	26.20	53.13	58.27	22.21
26	**CM -26**	2.80	8.69	22.09	12.20	15.30	8.87	9.60	21.60	52.07	58.07	26.32
27	**CM -27**	2.07	5.05	19.63	11.87	16.60	7.93	9.93	23.93	53.33	57.87	24.12
28	**CM -28**	2.07	4.56	17.73	11.50	14.47	8.00	8.33	24.40	49.67	56.27	19.44
29	**CM -29**	2.67	3.64	16.67	13.50	15.50	9.40	8.80	23.93	48.27	52.93	16.23
30	**CM -30**	2.80	6.25	20.60	13.43	17.00	9.17	6.87	29.93	53.93	59.20	18.43
31	**CM -31**	2.93	4.88	16.67	14.00	19.23	7.90	9.73	28.47	52.87	57.47	14.34
32	**CM -32**	2.60	7.89	16.87	13.47	19.30	8.60	7.87	25.20	54.00	57.73	23.43
	Mean	**2.85**	**6.63**	**20.69**	**13.35**	**17.24**	**8.73**	**9.97**	**24.54**	**51.71**	**58.32**	**20.80**
	SEd	**0.28**	**0.30**	**0.72**	**0.70**	**1.21**	**0.60**	**1.20**	**0.97**	**1.41**	**1.45**	**0.40**
	CD (P=0.05)	**0.56**	**0.60**	**1.44**	**1.41**	**2.42**	**1.19**	**2.41**	**1.93**	**2.83**	**2.89**	**0.79**

Table 2. Mean performance of pumpkin genotypes for yield and quality traits

S.No.	Genotypes	Days to fruit maturity	No of fruits per plant	Fruit length (cm)	Fruit diameter (cm)	Flesh thickness (cm)	Fruit weight (kg)	100 seed weight (g)	Yield per plant (kg)	Total soluble solids (°brix)	Acidity (%)	Ascorbic acid (mg $100g^{-1}$)	Moisture content (%)	Beta-carotene (mg $100g^{1}$)
1	**CM-1**	85.67	1.80	26.60	66.93	2.73	2.21	14.74	3.167	9.04	0.33	11.60	93.23	0.359
2	**CM-2**	89.93	2.00	25.27	60.80	3.10	2.25	25.64	3.680	7.81	0.23	7.93	92.40	0.491
3	**CM-3**	88.20	1.93	32.27	76.80	2.40	4.05	15.89	5.934	6.97	0.29	10.34	99.56	0.511
4	**CM-4**	86.80	1.93	29.60	62.47	3.17	2.63	14.74	4.066	6.96	0.38	12.96	87.55	0.572
5	**CM -5**	86.13	1.53	27.47	72.20	2.60	2.34	16.84	2.993	8.17	0.39	13.63	95.23	0.413
6	**CM -6**	89.00	1.80	21.33	62.60	2.50	1.99	13.84	2.814	7.93	0.21	9.53	96.62	0.582
7	**CM -7**	90.73	2.27	27.93	65.27	3.17	3.41	13.97	6.191	7.13	0.21	14.83	93.80	0.736
8	**CM -8**	87.80	1.53	28.73	62.27	2.60	2.96	11.04	3.627	8.95	0.31	13.33	91.04	0.580
9	**CM -9**	89.87	2.00	25.20	62.67	3.20	3.68	14.96	5.892	5.73	0.24	10.22	92.54	0.458
10	**CM -10**	89.00	2.20	24.87	61.20	3.23	3.02	15.74	5.314	7.96	0.41	13.73	84.12	0.732
11	**CM -11**	89.93	1.60	29.10	57.63	2.93	3.22	18.35	4.137	6.96	0.18	9.13	87.83	0.311
12	**CM -12**	90.27	2.47	23.77	60.43	2.73	4.22	14.87	8.357	8.10	0.32	12.91	96.80	0.816
13	**CM -13**	88.60	1.80	27.57	62.64	3.17	2.29	14.97	3.302	8.85	0.17	11.49	88.27	0.342
14	**CM -14**	88.53	2.13	28.87	58.27	3.13	2.61	14.08	4.404	10.58	0.23	8.68	97.59	0.677
15	**CM -15**	90.40	2.20	28.67	62.77	3.37	3.19	14.10	5.585	8.91	0.43	13.74	92.60	0.719
16	**CM -16**	88.27	2.33	23.47	58.80	3.00	2.83	15.47	5.327	5.79	0.52	9.61	84.48	0.640
17	**CM -17**	89.20	1.80	26.73	60.53	3.10	2.39	12.58	3.427	9.32	0.24	9.17	86.63	0.733
18	**CM -18**	90.33	2.07	25.20	59.07	3.00	2.03	13.58	3.376	8.03	0.22	10.32	94.98	0.751
19	**CM -19**	88.33	2.33	28.07	59.99	2.70	3.42	14.46	6.337	8.26	0.33	11.44	89.06	0.740
20	**CM -20**	89.13	1.67	28.73	70.51	2.87	3.72	17.57	4.963	9.14	0.12	10.83	91.80	0.911
21	**CM -21**	91.60	1.53	26.23	60.73	3.43	2.35	14.69	2.898	8.18	0.41	8.66	96.62	0.460
22	**CM -22**	91.27	1.73	27.85	75.77	2.90	3.56	19.56	4.869	6.99	0.19	15.13	89.89	0.806
23	**CM -23**	90.40	1.80	30.30	67.80	2.97	6.56	22.58	9.475	8.15	0.32	9.29	94.80	0.751
24	**CM -24**	86.93	2.20	30.20	64.33	2.70	3.11	11.68	5.449	7.97	0.45	10.18	91.10	0.589
25	**CM -25**	90.73	1.80	24.80	61.37	3.20	2.23	16.56	3.200	8.16	0.34	13.73	97.94	0.643
26	**CM -26**	90.53	1.67	32.20	60.60	2.87	2.70	14.67	3.591	7.02	0.64	6.78	90.19	0.655
27	**CM -27**	90.13	2.07	31.73	60.67	2.70	4.34	22.65	7.166	7.95	0.76	12.24	88.96	0.600
28	**CM -28**	87.40	3.13	17.87	53.80	2.47	1.04	10.75	2.622	8.09	0.34	6.86	99.26	0.891
29	**CM -29**	78.60	4.67	16.33	44.80	2.10	0.987	17.75	3.671	8.34	0.40	11.81	99.05	0.976
30	**CM -30**	91.87	1.93	21.13	56.20	3.10	1.91	16.55	2.999	6.33	0.32	10.16	98.98	0.463
31	**CM -31**	91.40	3.00	20.87	61.13	3.13	2.06	15.59	4.930	7.56	0.44	9.47	85.99	0.860
32	**CM -32**	93.20	1.47	35.93	69.33	3.53	7.59	18.54	8.952	7.89	0.23	11.46	95.93	0.653
	Mean	**89.07**	**2.08**	**26.72**	**62.51**	**2.93**	**3.03**	**15.91**	**4.772**	**7.91**	**0.33**	**6.82**	**93.17**	**0.63**
	SEd	**1.57**	**0.34**	**1.40**	**2.51**	**0.03**	**9.64**	**0.33**	**2.49**	**0.18**	**0.02**	**0.39**	**0.80**	**0.03**
	CD(P=0.05)	**3.14**	**0.69**	**2.80**	**5.02**	**0.07**	**4.99**	**0.65**	**1.744**	**1.02**	**0.14**	**2.21**	**4.53**	**0.19**

The genotype CM-1 (7.40) produced male flower at lowest node and the genotype CM-30 (6.87) produced female flower at lowest node. Similar trend of earliness was reported by Pandey ***et al.,*** (2010) in muskmelon. Earliness is considered as one of the most important character for getting early crop. The earliness was identified by days to first male and female flower opening. The genotype CM-10 (47.20 days) had the earliest male flower opening. The genotype CM-29 (52.93 days) had the earliest female flower and male flower opening (48.27). The results are in accordance with the reports of Yadav *et al.,* (2008) in bitter gourd. The narrow sex ratio was recorded in CM-11 (14.0), CM-14 (14.12) and CM-31(14.34).

The genotypes *viz.* CM-29 (78.60 days) and CM-1 (85.67 days) was found to be significantly early harvest. This is in accordance with the findings of Singh and Ram (2003) in muskmelon. The genotypes CM-11 (29.10 cm) and CM-19 (28.07 cm) recorded long fruit length and short fruit length was observed in the CM-29 (16.23 cm) and CM-28 (17.87 cm). Similar trend of results were reported by **Rai *et al.,*** (2006) in chow chow and **Rakhi and Rajamony** (2005) in culinary melon. Greater fruit diameter was recorded in the genotype CM-3 (76.80 cm) and CM-22 (75.77) and lesser fruit diameter was recorded in the genotype CM-29 (44.80 cm) and CM-28 (53.80 cm). Similar trend of results were reported by **Pandey *et al.,*** (2010) in muskmelon. The higher flesh thickness was observed in the genotype CM-32 (3.53 cm), followed by CM-21 (3.43 cm) and CM-15 (3.37 cm). This is in accordance with the results of Maurya *et al.,* (2003) in bottle gourd. The highest fruit weight was observed in the genotypes CM-23 (9.48 kg) followed by CM-32 (8.95 kg) and CM-27 (4.34 kg) and lowest was shown by CM-29 (0.99 kg) and CM-28 (1.04 kg). The wide variation in fruit size was also reported by **Singh and Ram** (2003) in musk melon. The number of fruits per plant was high in the genotypes CM-29 (4.67) and CM-28 (3.13) which were recorded small fruit size among 32 genotypes. Similar kind of results was observed by **Shanmuga sundaram** (2006) in water melon. Among the 32 genotypes evaluated the genotypes CM-23 (9.48 kg) and CM-32 (8.95 kg) recorded higher yield per plant during summer season compared with all other genotypes. It may due to the presence of maximum number of fruits per plant and maximum average fruit weight. Maurya *et al.,* (2003) in bottle gourd also reported similar results.

The genotypes CM-14 (10.58^{o} brix) and CM-17 (9.32^{o} brix) recorded higher total soluble solids, followed by CM-20 (9.14^{o} brix) and CM-1 (9.04^{o} brix). The results are in accordance with the reports of Zinash *et al.,* (2013) in pumpkin. In the present study, the genotypes CM-27 (0.76 percent) and CM-26 (0.64 percent) recorded high acidity content. The genotypes CM-22 (10.13) and CM-7 (14.83) recorded high ascorbic acid content, the genotypes CM-3 (99.56 percent) and CM-28 (99.26 percent) recorded high moisture content. the genotypes CM-29 (0.98 mg/100 g) and CM-20 (0.91 mg/100 g) and CM-28 (0.89 mg/100 g) recorded high beta carotene content. Singh and Ram (2003) in muskmelon reported similar results.

In the present investigation, based on performance of genotypes during summer, accession CM-23 was adjudged as the best one as evidenced by superior performance for nine characters out of the 24 characters studied *viz.,* days to first male flowering, days to first female flowering, days to fruit maturity, number of fruits per plant, fruit length, fruit diameter, flesh thickness, fruit weight, yield per vine and beta - carotene content. Another genotype *viz.,* CM-32 was superior for three characters out of 24 characters.

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