'Pink Pulped' Nuvalur Guava (*Psidium guajava* L.): Evaluation and Characterization

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ABSTRACT

Guava (Psidium guajava L.) is an important tropical fruit crop and ranks fourth with respect to area (2.04 lakh ha) and production (227.00 lakh tonnes) in India. It is well known that lycopene content of pink guava not only adds in its attractiveness offers protection from prostate cancer. The present study evaluates 'pink pulped' Navalur guava: an excellent eco-type from Navalur region, Dharwad district, Karnataka. Navalur guava selections were evaluated for the yield and quality parameters including genotypes with high lycopene content and soft and less number of seeds. Among seven pink pulped Navalur guava selections, Selection-5 was produced the highest number of fruits (809), yield per plant (101 kg) as well as yield per ha (28 tonnes per ha). Selection-3 was found superior in total sugar (9.37%), reducing sugar (4.76%) and non-reducing sugar (4.61%) content, highest number of seeds per fruit but with soft seeds as they were light in weight and highest total soluble solids (12.87°B). Maximum lycopene content (5.10 mg/100 g pulp) was recorded in Selection-3 which recorded strawberry coloured pulp. Selection-7 recorded maximum content of ascorbic acid (232.02 mg/100 g of pulp). Sugar-acid ratio a criteria for taste was found to be highest (32.96) in Selection-1. It is inferred from the present study that Selection-3, selection-1 and selection-7 found to be the best in terms of physical and biochemical quality parameters, and Selection-5 was best with respect to yield. Therefore, selection-1, selection-3, selection-5 and selection-7 could be used for further breeding programmes to improve the quality and yield.

Keywords: Guava, pink pulp and lycopene

INTRODUCTION

Guava (*Psidium guajava* L.) is the most important and commercially cultivated fruit crop belonging to the family *Myrtaceae*. It is originated in tropical America, stretched from Mexico to Peru, and gradually became a crop of commercial significance in several countries like Brazil, Mexico, China, Malaysia, the Hawaiian Islands, Cuba and India. It was introduced to India during 17th century by Portuguese [1]. Guava stands fourth important fruit crop with respect to production and area in India with total guava production of 227.00 lakh tonnes and area 2.04 lakh ha [2]. Ample genetic variability exists among the guava genotypes with respect to nutritional quality of the fruits. Pinkish colouration is an attractive characteristic and nutritionally appreciable feature observed in pink pulped guava. Lycopene present in pulp results in pinkish colouration of pulp. Lycopene is a key intermediate in the biosynthesis of many important carotenoids such as beta-carotene and xanthophylls. In the recent past years, researchers come up with understanding that lycopene, vitamine A,

vitamine B, vitamine C, potassium and soluble fiber. Thus, nutritionally it is a fruit of good choice and aptly known as 'Poor man's apple'. Therefore, in this study, pink pulped Navalur guava: an excellent eco-type from Navalur region of Dharwad district (Karnataka, India) was assessed for its fruit yield and quality characters.

MATERIALS AND METHODS

Clonally propagated seven pink pulped Navalur guava selections viz. Selection-1, Selection-3, Selection-5, Selection-6, Selection-7, Selection-9 and Selection-11 were planted at New block of Navalur guava in the Silver Jubilee Orchard, MARS, UAS Dharwad in randomized block design (RBD) with three replications each in the year 1997. The plants were maintained under recommended package of practice during the entire period of investigation. The data on growth (tree height and canopy spread (N-S and E-W) and time taken from flowering to maturity), yield (number of fruits/plant, yield kg/tree and q/ha) and quality parameters of fruits (physical and bio-chemical) was recorded. Ten mature fruits were sampled from each tree to record physical parameters of fruits while four ripe fruits were analysed for chemical parameters of fruit. Length of fruit (cm), diameter of fruit (cm), fruit volume (ml), weight fruit and pulp (g) were recorded. The fruit shape at stalk end was described with the help of standard descriptor for guava prescribed by UPOV (International Union for the Protection of new Varieties of plants) [5]. The pulp colour was described with the help of Exotica horticultural colour guide [6]. The seeds were separated by using ordinary sieve (< 20 mm) after boiling the pulp in hot water for 15 minutes and were counted. 100 separated seeds were weighed by electronic balance. Seed hardness was observed organoleptically. TSS was measured by Erma Hand Refractometer (0-32⁰B). Titrable acidity was estimated by titrimetric method and expressed as per cent citric acid. Ascorbic acid content was measured by volumetric method by using 2, 6-dichlorophenol indophenol dye as per the procedure and expressed as mg/100g pulp [7]. The reducing sugars and total sugars were estimated by following Shaffer Somogi method [7]. Lycopene was estimated by squeezing the fruit pulp in a muslin cloth by adding repeatedly acetone to extract the juice. One ml of extracted juice was then taken in 100 ml stoppered conical flask and 20 ml acetone was added and kept on mechanical shaker for 30 minutes. Forty ml of petroleum ether was added to this mixture and the absorbance was measured at 503 nm. Lycopene content (mg / 100 g) was calculated by using the formula given by [7]. The data was subjected to statistical analysis of variance technique as given by [8].

RESULTS AND DISCUSSION

The results on growth and yield parameters are tabulated in table 1. Plant height varied significantly among the selections and it was observed maximum in Selection-5 (5.29 m) which was on par with Selection-3 (4.74 m), while dwarf plant stature was found in Selection-11 (3.90m). Selection-3 recorded wider spread (6.40 m) in E-W direction, but Selection-5 showed more spread in account of both (N-S and E-W) directions (6.34 m and 6.22 m respectively). So the spread was found uniform in Selection-5. Whereas, the plants of Selection-11 were found to have minimum plant spread. Selection-6 recorded the least number of days from flowering to fruit maturity (107.68) whereas Selection-5 took maximum days to attain fruit maturity i.e. 135.72 days from flowering to fruit maturity. The highest number of fruit per plant was recorded in Selection-11(192.67). The maximum fruit yield in terms of weight of fruits per plant and per ha was recorded by Selection-5 (101.19 kg and 280.30 q respectively), which was on par with Selection-3 (91.62 kg and 253.78 q respectively). Selection-11 recorded the minimum fruit yield with only 21.17 kg fruits per plant and 58.63 q/ha.

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The results on physical quality parameters of fruits harvested from the various selections under the present study are presented in table 2. The maximum fruit length and fruit diameter was observed in Selection-5 (7.73 cm) and Selection-3 (6.37 cm) respectively. Selection-11 recorded minimum fruit length (6.62 cm), while Selection-6 noticed minimum fruit diameter (4.94 cm).



Figure 1. Photograph showing comparative pink colour in fruit pulp of Navalur guava selections.

Selection-5 recorded significantly higher fruit weight (125.08 g) and fruit volume (124.63 ml) while these were at lowest in Selection-6 (84.34 g and 82.57 ml respectively). The highest pulp weight (58.27 g) was recorded by the fruits born by Selection-7. Selection-3 recorded the highest number of seeds per fruit (424.40) but seeds were lighter *i.e.* minimum weight of 100 seeds (0.92 g) with soft texture, whereas Selection-5 produced least number of seeds per fruit (210.39) which were heavy (1.63 g) and of hard texture. Fruits were round shaped in Selection-3, Selection-7 and Selection-9, necked in Selection-1 and Selection-5 and pointed in Selection-6 and Selection-11. The pulp colours exhibited by the fruits among the selections were strawberry (dark pink) colour in Selection-3 and Selection-6, shell pink (faint pink) in Selection-9.

The results on bio-chemical parameters of fruits harvested from the various selections under the present study are tabulated in table 3. The content of total soluble solids (TSS) was highest in Selection-3 (12.87^{0} Brix) and was lowest in Selection-9 (9.70^{0} Brix). Significantly minimum titrable acidity was recorded in Selection-1 (0.22%) and highest content of titrable acidity was noticed in Selection-6 (0.41%). Selection-7 recorded maximum content of ascorbic acid per 100 g of pulp (232.02 mg). The minimum ascorbic acid content (109.26 mg per 100 g pulp) was recorded in Selection-5. Selection-3 was found superior in total, reducing and non-reducing sugars content (9.37%, 4.76% and 4.61% respectively), whereas lower amount of total sugars, reducing sugars and non-reducing sugars were recorded by Selection-11 (5.80%), Selection-9 (3.15%) and Selection-6 (2.51%) respectively. Sugar-acid ratio was found to be highest in Selection-1(32.96). The minimum value of sugar-acid ratio was recorded by the fruits of Selection-6 (14.18).

Selections	Plant height	Plant spread (m)		Number of	Fruit yield per plant		Fruit yield
	(m)	N-S	E-W	days from flowering to maturity	Number	Weight (kg)	per ha (q)
Selection-1	3.99	5.55	4.83	124.42	563.33	53.12	147.14
Selection-3	4.74	6.11	6.40	133.83	752.67	91.62	253.78
Selection-5	5.29	6.34	6.22	135.72	809.00	101.19	280.30
Selection-6	4.49	5.92	6.10	107.68	744.67	62.78	173.91
Selection-7	4.66	4.78	4.58	125.30	228.33	23.81	65.96
Selection-9	4.37	4.72	4.99	120.40	512.33	53.42	147.98
Selection-11	3.90	3.96	4.33	124.70	192.67	21.17	58.63
S.E. $m \pm$	0.19	0.30	0.26	2.45	24.13	3.79	10.49
CD (5%)	0.57	0.93	0.81	7.53	74.35	11.67	32.31

Table 1. Growth and yield parameters of pink pulped Navalur guava selections.

Selections	Fruit lengt h	Fruit diameter (cm)	Fruit volume (ml)	Fruit weigh t (g)	Pulp weigh t (g)	Numbe r of Seeds	Weight of 100 seeds (g)	Seed Hardness	Fruit shape at stalk end	Pulp colour
	(cm)	. ,			(C)	per fruit				
Selection-1	7.10	5.85	97.76	94.29	57.42	235.11	1.45	Medium hard	Necked	Light pink
Selection-3	6.70	6.37	122.76	121.7 1	45.64	424.40	0.92	Soft	Rounded	Strawberry
Selection-5	7.73	6.20	124.63	125.0 8	57.84	210.39	1.63	Hard	Necked	Clear pink
Selection-6	6.70	4.94	82.57	84.34	26.42	272.11	0.99	Soft	Pointed	Strawberry
Selection-7	6.88	5.77	99.23	104.1 3	58.27	259.99	1.59	Hard	Rounded	Deep pink
Selection-9	6.96	5.71	104.78	103.4 8	51.34	235.07	1.60	Hard	Rounded	Shell pink
Selection-11	6.62	5.40	107.00	109.6 7	52.33	212.07	1.02	Medium hard	Pointed	Carmine
$S.E.m \pm$	0.19	0.10	5.09	3.32	2.78	6.49	0.06			
CD (5%)	0.58	0.32	15.69	10.22	8.57	19.99	0.19			

Table 2. Physical quality parameters of pink pulped Navalur guava selections.

Selections	TSS (⁰ B)	Acidity (%)	Ascorbic Acid (mg/100g)	Reducin g sugars (%)	Non- reducing sugars (%)	Total sugars (%)	Sugar/Aci d Ratio	Lycopene (mg /100 g)
Selection-1	10.19	0.22	143.05	3.72	3.21	6.93	32.96	1.84
		(0.27)		(1.10)	(1.03)	(1.51)		
Selection-3	12.87	0.37	137.49	4.76	4.61	9.37	25.51	5.10
		(0.35)		(1.25)	(1.23)	(1.75)		
Selection-5	11.67	0.36	109.26	4.61	4.10	8.71	24.07	2.52
		(0.35)		(1.23)	(1.16)	(1.69)		
Selection-6	11.05	0.41	218.05	3.31	2.51	5.82	14.18	3.72
		(0.37)		(1.04)	(0.91)	(1.38)		
Selection-7	11.38	0.36	232.02	3.92	3.72	7.64	21.54	2.83
		(0.34)		(1.13)	(1.10)	(1.58)		
Selection-9	9.70	0.38	165.27	3.15	3.25	6.40	16.78	1.70
		(0.35)		(1.02)	(1.03)	(1.45)		
Selection-11	11.21	0.33	208.25	3.16	2.64	5.80	17.55	3.14
		(0.33)		(1.02)	(0.93)	(1.38)		
$S.E.m \pm$	0.29	0.01	4.70	0.01	0.02	0.02	1.08	0.09
CD (5%)	0.90	0.02	14.47	0.02	0.05	0.05	3.33	0.28

Table 3. Bio-chemical parameters of pink pulped Navalur guava selections (figures in parenthesis are arcsine values).

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The main constituent responsible for pink colouration in pulp is lycopene which was found maximum in Selection-3 (5.10 mg per 100 g of pulp). Selection-9 (1.84 mg per 100 g of pulp) recorded the minimum lycopene content.

Therefore, it is understand from the present study that Selection-3, selection-1 and selection-7 found to be the best in terms of physical (yield, number of fruits, size and shape of fruit) and biochemical quality parameters (sugar content, acidity, sugar-acid ratio and lycopene content.) while selection-5 was best with respect to yield. Further, selection-1, selection-3, selection-5 and selection-7 could be used for further breeding programmes to improve the quality and yield.

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