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Research Article

Evaluation of Sapota genotypes for growth, yield and quality attributes

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Abstract:
A study on evaluation of sapota genotypes collected from different parts of India was carried out at the Department of Fruit Crops, Horticultural College and Research Institute, Periyakulam during the year 2008-2009. Observation on quantitative traits *viz*., tree height (m), canopy spread (m^2), number of fruits/tree, mean fruit weight (g) and yield of fruits/tree (kg) were recorded. In addition, data on the qualitative traits viz., total soluble solids (°Brix), total sugars (%) and ascorbic acid content (mg/100g) were recorded. The highest tree height (11.2 m) and canopy spread (116.8 m^2) was recorded by the hybrid CO1 followed by the variety Cricket Ball. PKM1 had more number of fruits/tree (1690); Cricket Ball registered the highest mean fruit weight of 135 g. The highest yield of 139 kg/tree was recorded by PKM4 followed by Virudhunagar local which recorded an yield of 135.75 kg/tree. Correlation analysis revealed that there was a positive correlation between tree height and canopy spread. The attributes like number of fruits per tree and canopy spread had positive correlation with fruit yield per tree. The quality traits, viz., total sugars and ascorbic acid content had negative correlation with fruit yield indicating that simultaneous improvement of yield and quality was not possible.

Key words: Canopy spread in Sapota, Total soluble solids, Correlation analysis, Path analysis

Introduction

Sapota (*Manilkara archas* (Mill) Forb.) also called chickoo or sapota is an evergreen tree known for producing fruits of delicate flavor, melting pulp with sweet taste. It produces crop continuously in warm and moist tropical climate. It is hardy, highly productive and generally free from major pests, diseases and physiological disorders. Hence it has emerged as an important fruit crop widely cultivated in India. The area under sapota in India is around 6.8 lakh hectares with a production of 6.7 lakh tonnes.

Most of the present day sapota cultivars are the result of seedling selection and its cultivation is based on a narrow genetic base. Therefore, attempts are necessary for improvement of sapota by utilizing and selecting the variability. Gene pools are the reservoirs of variation which is the basis of improvement and essential for successful breeding programme. However collection, conservation, characterization and documentation of genetic resources in sapota have not received any attention until recently. With increased emphasis on sapota due to wide adaptability, ability to stand stress, high and continuous production and freedom from major pest and diseases, characterization, evaluation and documentation of sapota germplasm has been receiving attention.

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Material and methods

The present investigation was carried out at the Department of Fruit Crops, Horticultural College and Research Institute, Periyakulam during 2008-09 with an aim to study the extent of variability among sapota genotypes and to identify the better performing genotypes. A total of 19 sapota genotypes maintained at the central farm was used for the study. Observation on growth parameters *viz*., tree height (metre), canopy spread (m^2), number of fruits per tree, mean fruit weight (g) and yield of fruits per tree (kg) and quality parameters *viz*., total soluble solids (TSS)(°Brix), total sugars (%) and ascorbic acid (mg/100 g) were recorded. The data were subjected to statistical analysis to obtain information on the mean performance and variability existing among the genotypes. To access the association among the different yield

attributing traits, correlation and path analysis were done using GENRES package.

Results and discussions

Development of high yielding varieties of crops requires information about the nature and magnitude of variability present in the available stock and selection depends on judicious assessment of available data on phenotypic characters that are connected with yield. Nineteen sapota genotypes were evaluated for growth and yield attributes (Table 1). The findings revealed that tree height ranged from 3.5 m to 11.2 m. Among the genotypes CO 1 recorded the highest tree height of 11.2 m, while CO3 recorded the lowest tree height. Number of fruits per tree ranged from 300 (Kalipatti) to 1690 (PKM 1). PKM 1 recorded the highest fruits per tree followed by Virudhunagar (1495) and PKM 4 (1490). With regard to fruit weight, Cricket Ball recorded the highest fruit weight of 135 g, followed by CO3 (129 g) and Virudhunagar (126 g). Dorairaj (1985) and Dorairaj *et al.* (1991) evaluated ten sapota cultivars and found CO 2 to be the best followed by Cricket Ball. He found gavarayya to be a poor yielder. Oval, Badam, Guthi and Long Oval were also poor yielders. In our study, PKM 1 recorded the highest yield of 139 kg per tree followed by Virudhunagar (135.75 kg per tree). Wide variation was observed among the different genotypes with respect to growth and yield traits and this may be attributed to their genotypic differences. In addition, age of the tree is also an important factor which influences the yield. Kadam *et al*. (2005) reported that yield increased in sapota trees up to 30 years of age. Attempts have been made to evaluate the sapota germplasm for different agronomic traits. These studies indicated great variation in fruit size, production and quality of fruits (Chundawat and Bhuva, 1982; Rokhade *et al*., 1989). Chundawat and Bhuva (1982) evaluated the performance of five sapota cultivars and found Kalipatti to be the best in terms of yield and quality.

Quality parameters like TSS, total sugars and ascorbic acid were evaluated in all the 19 genotypes and the results presented in table 2. The genotype Virudhunagar Local registered the highest values for TSS (25.5° Brix), total sugars (10.9 %) and ascorbic acid (3.55 mg/100 g). Wide variation in physiochemical quality of sapota was observed from comparative evaluation at Coimbatore (Shanmugavelu and Srinivasan, 1973) and Periyakulam (Ponnuswami and Irulappan, 1989) who found hybrids 2/4 and 7/1 to be better in terms of total soluble solids and 2/2 and 2/4 in terms of overall quality.

Yield being a complex character is influenced by many yield components. A knowledge on the impact of various components on yield is essential before selection of desirable trees. In this context, correlation analysis will indicate possible association between any two characters which would be useful although it is influenced by environment to a certain extent. This is unavoidable in a perennial crop like sapota wherein systematic progeny trials with sufficient replication to eliminate the influence of the environment cannot be taken up. Association analysis was worked out between the characters like tree height, canopy spread, number of fruits per tree, mean fruit weight, fruit yield per tree and biochemical characters like TSS, total sugars and ascorbic acid (Table 3). Correlation analysis clearly brought out that number of fruits per tree had significant positive correlation with yield indicating that during selection of high yielding trees in sapota, due weightage should be given to trees bearing more number of fruits. Among growth characters canopy spread showed significant positive correlation with number of fruits per tree and fruit yield per tree. Biochemical characters like total sugars and ascorbic acid content had significant negative correlation with fruit yield per tree indicating simultaneous improvement of yield and quality is difficult. For path analysis, fruit yield per tree was taken as dependent variable and the rest of the seven traits were considered as independent variables (Table 4). Canopy spread had positive direct effect on fruit yield per tree. Therefore due importance should be given to canopy spread during yield improvement programmes.

Based on the present study, among the 19 genotypes evaluated Virudhunagar Local appeared to be the best genotype based on fruit yield per tree, fruit weight and quality attributes.

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Table 1. Growth and yield characters of sapota germplasm under Periyakulam conditions

Sl. No.	Varieties	Tree height (m)	Spread (m)		No. of fruits/ tree	Mean fruit weight (g)	Yield of fruits/tree (kg)
			EW	NS			
1.	PKM 1	6.65	6.52	6.45	1690	84.00	98.50
2.	PKM 2	6.70	6.55	6.50	1440	90.00	110.65
3.	PKM 3	6.71	6.61	6.52	1250	93.50	109.00
4.	PKM 4	6.62	6.53	6.50	1490	110.00	139.00
5.	CO 1	11.20	11.18	10.45	780	121.00	91.00
6.	CO 2	9.20	9.25	9.01	1040	96.00	98.50
7.	CO 3	3.50	2.95	2.93	360	129.00	45.00
8.	Guthi	6.50	6.52	6.50	1290	78.00	94.25
9.	Oval	6.45	6.51	6.49	1090	59.00	64.25
10.	Pala	6.75	6.85	6.75	1190	56.50	66.15
11.	Kirthabarthi	7.39	7.29	7.20	1010	71.50	70.30
12	Cricket Ball	10.59	10.49	10.05	795	135.00	96.00
13.	Dwarapudi	6.82	6.63	6.76	799	94.50	73.00
14.	Thagarampudi	6.62	6.62	6.40	825	85.00	68.50
15.	Gavarayya	6.60	6.45	6.52	750	88.00	64.50
16.	Virudhunagar	6.58	6.42	6.45	1495	126.00	135.75
17.	DHS 1	3.50	3.35	3.10	350	91.00	29.00
18.	DHS 2	3.90	3.60	3.50	344	91.75	29.50
19.	Kalipati	3.70	3.45	3.29	300	76.00	22.50
	SE(d)	0.31	0.40	0.34	34.15	5.20	4.68
	CD (0.05)	0.65	0.79	0.69	69.20	11.03	8.20
	CV	4.75	5.20	5.50	6.19	5.75	4.75

Table 2. Quality parameters of sapota germplasm under Periyakulam conditions

Sl. No.	Varieties	TSS (°Brix)	Total sugars (%)	Ascorbic acid (mg/100 g)
1.	PKM 1	24.00	10.40	2.83
2.	PKM 2	24.50	9.60	2.80
3.	PKM 3	23.50	9.30	1.98
4.	PKM 4	25.20	10.40	2.84
5.	CO 1	18.00	8.35	2.72
6.	CO 2	22.50	8.20	3.20
7.	CO 3	23.75	10.50	3.19
8.	Guthi	21.00	9.75	3.20
9.	Oval	22.00	8.40	1.85
10.	Pala	22.50	7.50	3.21
11.	Kirthabarthi	21.50	9.00	3.52
12	Cricket Ball	21.50	7.03	2.15
13.	Dwarapudi	22.00	7.35	2.16
14.	Thagarampudi	21.50	7.25	3.00
15.	Gavarayya	21.25	8.90	3.19
16.	Virudhunagar	25.50	10.90	3.55
17.	DHS-1	22.50	8.60	2.62
18.	DHS-2	21.50	8.80	2.69
19.	Kalipatti	22.00	8.50	2.43
	SE(d)	0.90	0.30	0.09
	CD (0.05)	2.10	0.63	0.20
	CV	5.10	3.40	3.59

Table 3. Correlation coefficients among yield and quality characters in sapota

	Tree height	Canopy spread	Number of fruits per tree	Mean Fruit weight	TSS	Total sugars	Ascorbic acid	Yield of fruits per tree
Tree height	1.000	-0.696	-0.684	0.439	0.533	0.752	0.619	-0.673
Canopy spread		1.000	0.987**	-0.630	-0.770	-0.970**	-0.940**	0.980**
Number of fruits per tree			1.000	-0.667	-0.782	-0.957**	-0.920**	0.977**
Mean Fruit weight				1.000	0.483	0.697	0.671	-0.675
TSS					1.000	0.788	0.798*	-0.785
Total sugars						1.000	0.940**	-0.950**
Ascorbic acid							1.000	-0.913**
Yield of fruits per tree								1.000

* Significant at 5% level ** Significant at 1% level

Table 4. Path coefficient analysis of various yield contributing characters and quality characters towards fruit yield in sapota

	Tree height	Canopy spread	Number of fruits per tree	Mean Fruit weight	TSS	Total sugars	Ascorbic acid
Tree height	**-0.0148**	-1.0110	0.1353	-0.0817	-0.0904	0.2470	0.1425
Canopy spread	0.0104	**1.4522**	-0.1954	0.1173	0.1306	-0.3186	-0.2165
Number of fruits per tree	0.0102	1.4338	**-0.1979**	0.1240	0.1326	-0.3141	-0.2119
Mean Fruit weight	-0.0065	-0.9158	0.1319	**-0.1860**	-0.0819	0.2289	0.1546
TSS	-0.0079	-1.1184	0.1547	-0.0899	**-0.1696**	0.2587	0.1839
Total sugars	-0.0112	-1.4093	0.1893	-0.1297	-0.1336	**0.3283**	0.2166
Ascorbic acid	-0.0092	-1.3647	0.1821	-0.1248	-0.1354	0.3088	**0.2303**

Residual effect = 0.15186