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Evaluation of Sapota (*Achras sapota* L.) Varieties for Yield and Quality Attributes under Coastal Plain Zone of Odisha

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ABSTRACT: The relative performance of twelve sapota varieties were evaluated at the Horticulture Research Station, Odisha University of Agriculture & Technology (OUAT), Bhubaneswar during 2022-23. The study revealed that the vegetative growth was maximum in (6.46 m \times 6.36 m) in E-W and N-S directions in the variety Kirthi Bharati while the highest (4.70m) plant height with stem girth of 69.83cm was noticed in PKM-4. The PKM-1 and PKM-2 were found to be semi-dwarf types. The maximum number of fruits (520.60/tree) with pulp weight (22.97g) was recorded in Kalipati. The maximum T.S.S (22.40°Brix) was observed in DSH-2 whereas the highest total sugar (11.95 %) was in Kalipatti. The highest fruit yield of 32.10 kg/tree was recorded significantly in Kalipatti variety followed by Murabba (28.20kg/tree) and PKM-1(25.30 kg/tree). These three varieties are performing well under coastal plain zone of Odisha.

Keywords: Sapota, varietal performance, yield, quality attributes, coastal plain zone.

INTRODUCTION

Sapota (Achras sapota L.) commonly known as chiku in India, is a prominent fruit species belonging to the family Sapotaceae. Sapota is also known as sapodilla. The name "sapodilla" was derived from a Latin word "zapotilla," which means small sapote. The crop is native to Mexico and Central America and commercially cultivated in the West Indies, India, Mexico, Philippines, Malaysia, Indonesia and SriLanka. Now, it is a popular fruit crop and is widely cultivated in tropical countries across the globe. This crop is mainly cultivated for fruits, latex and timber. The latex (chickle) produced from unripe fruit and bark has commercial value as it is the prime ingredient in making chewing gum. Being a tropical crop, it thrives well in the warm and humid climates. It is hardy alongwith moderately high productivity and is free from biotic and abiotic stress. In India, the crop is commercially grown in States like Karnataka, Andhra Pradesh, Gujarat, Maharashtra and Odisha. As per NHB (1st Adv. Estimate 2021-22) report, Gujarat is the leading state in the production of sapota (2,73,870 t/ha), followed by Andhra Pradesh (2,02,200 t/ha). The production in Odisha is around 1,32,000 t/ha occupying the 9th position in India. There are more than 100 germplasm that belong to this genus and vary greatly concerning shape, size and weight. Fruits can be large or medium or small in size, round to egg-shaped or oval in shape, 5 to 9 cm in diameter, weighing between 75 gm and 200 gm and containing 1-8 seeds per fruit. The sweetness in fruit is due to the presence of simple sugars like fructose, glucose, and sucrose (Tulloch et al., 2020). Sapota is rich in essential nutrients considered as natural energy booster as it contains fructose and sucrose. The fruits also contain high levels of polysaccharides and phytochemical constituents like myricetin-3-O-a- L-rhamnoside, ascorbic acid. polyphenols and other secondary metabolites, which have high medicinal value. It can be used as medicine for fever and has antimicrobial activities (Chanda and Nagani 2010). Traditionally, it is used as a diuretic. expectorant and in ophthalmology. Popular varieties grown in India are kalipatti, cricket ball, kirthi bharti, murabba, etc. This crop is commercially propagated by grafting. Sapota is a climacteric fruit and it should only be picked when fully grown. In general, thefruit requires from 100 to 165 days to mature after flower opening, depending on the cultivar, the agro-climatic region and the environmental condition.

Very few research work has been done in the evaluation of sapota varieties under local agro-climatic conditions especially in the coastal zones of Odisha. Therefore, the major objective of the present experiment is to undertake a systematic evaluation to find out the suitable sapota varieties which would be of paramount importance for successful commercial cultivation for fetching higher production and good yield. Characterization of genotypes will help to improve quality and yield attributing characters.

MATERIALS AND METHODS

The present experiment was carried out from September, 2022 to May, 2023 at the Horticultural Research Station of the Department of Fruits Science and Horticulture Technology of Odisha University and

Nag et al.,

Biological Forum – An International Journal 16(2): 171-175(2024)

Agriculture and Technology, Bhubaneswar, Odisha. The soil of the experimental site was red lateritic, highly acidic and with significant organic carbon. The soil contains high nitrogen, medium phosphorus and low potassium. Bhubaneswar has a tropical climate with hot summers and mild winters.

The investigation was conducted on twelve different varieties of sapota i.e., DHS 1, DHS 2, PKM 1, PKM 2, PKM 3, PKM 4, PKM 5, Pilipatti, Kalipatti, Murabba, Cricket Ball, and Kirthi Bharti. The trees were 11 years old, planted at a spacing of 8m x 8m and maintained under uniform cultural practices. The experiment was designed using a randomized block design (RBD) with three replications. Six uniform trees of each variety were marked for data recording and collection of fruit samples. Observations were recorded on the plant height (m), stem girth (cm), canopy spread (m), shoot length (cm), shoot girth (cm), number of leaves per shoot, number of fruits per tree, fruit weight(g), fruit length (cm), fruit breadth (cm), number of seeds per fruit, seed weight (mg), pulp weight (g), seed: pulp ratio and yield per tree (kg per tree). The fruit samples were subjected to chemical analysis to find quality traits. The quality analysis was conducted in the laboratory of the Department of Fruits Science and Horticultural Technology, O.U.A.T, Bhubaneswar. Chemical analysis of fruit was done and recorded for biochemical characteristics like total soluble solids (°Brix), ascorbic acid content (mg per 100gm), total sugar content (%), reducing sugar content (%) and non-reducing sugar content (%).

RESULTS AND DISCUSSION

The data on growth parameters of different sapota cultivars are presented in Table 1. There was a

significant variation among the cultivars. The maximum plant height was recorded in PKM-4 (4.7 m), followed by Cricket Ball (4.5 m), and Murabba (4.3 m). On the other hand, minimum plant height was recorded in PKM-2 (2.5 m). Maximum stem girth was recorded in PKM-4 (69.83 cm), followed by DHS-1 (60.56 cm), and PKM-1 (57.23 cm). Whereas, minimum stem girth was recorded in Murabba (27.09 cm). The canopy spread was measured in the East-West and North-South directions. The maximum canopy spread from the eastwest direction was recorded in Kirthi Bharti (6.46 m) followed by Kalipatti (6.36 m) and DHS-1 (5.93 m). On the other hand, the maximum canopy spread in northsouth direction was recorded in Kirthi Bharti (6.36 m), followed by DHS-2 (5.82 m) and PKM-4 (5.35 m). PKM-2 had the minimum canopy spread recorded for east-west direction (1.52 m) and north-south direction (1.98 m). Significantly, the highest shoot length was found in Murabba (24.55 cm), followed by Kalipatti (24.03 cm) and PKM-3 (23.47 cm). The minimum shoot length was recorded in PKM-1 (20.67 cm). Among the twelve cultivars, DHS-1 was recorded as maximum shoot girth of 4.17 cm and minimum was recorded in Murabba (2.31 cm). The variety Cricket Ball (27.77) recorded the highest number of leaves per shoot, followed by DHS-1 (27.75) and PKM-1 (26.50). On the other hand, the variety Pilipatti had the lowest(14.75) number of leaves per shoot. The variations in vegetative growth parameters among the twelve varieties depend on the genetic makeup of individual variety, environmental factors like soil, temperature, rainfall, etc and their interaction. The findings collaborate with the findings of Ghosh et al. (2014); Bhalekar and Chalak (2016); Vikram et al. (2020) in sapota.

Varieties	Plant height (m)	Stem girth	Canopy spread (m)		Shoot length	Shoot girth	Number of leaves
		(cm)	E-W	N-S	(cm)	(cm)	per shoot
DHS-1	3.60	60.56	5.93	4.26	22.43	4.17	27.75
DHS-2	3.50	42.78	5.15	5.82	23.18	3.57	19.25
PKM-1	2.60	57.23	4.46	4.71	20.67	4.12	26.50
PKM-2	2.50	38.97	1.52	1.98	22.50	3.00	20.75
PKM-3	3.10	40.21	4.52	5.23	23.47	3.51	24.25
PKM-4	4.70	69.83	4.75	5.35	21.63	2.50	16.50
PKM-5	3.20	38.39	3.82	3.31	21.05	3.02	21.00
Pilipatti	3.30	29.55	4.27	4.73	21.50	4.00	14.75
Kalipatti	3.40	40.93	6.36	4.46	24.03	2.46	20.23
Murabba	4.30	27.09	4.57	4.53	24.55	2.31	22.23
Kirthi Bharti	3.10	27.93	6.46	6.36	20.93	3.57	21.77
Cricket Ball	4.50	38.50	5.06	4.87	21.60	3.28	27.77
$SE(m) \pm$	0.148	1.10	0.129	0.126	0.712	0.134	0.894
CD% (5%)	0.436	3.22	0.380	0.369	2.087	0.393	2.622

Table 1: Vegetative parameter of sapota varieties.

The data on reproductive and yield-attributing parameters of different varieties of sapota are given in Table 2 and 3.

A significant difference in the number of flowers per shoot was observed among different sapota varieties. The maximum number of flowers per shoot was recorded in PKM-1 (8.00), followed by Kalipatti (7.77) and Cricket Ball (7.53), whereas PKM-3 had the lowest

(3.00) number of flowers per shoot. The maximum number of days to flower opening was observed in PKM-3 (39.10 days), it was minimum in PKM-5 (33.50 days). The variety Kalipatti took the longest time to fruit set (30.0 days) whereas the shortest time was taken by PKM-1 (23.00 days). Kalipatti had the maximum (37.50) fruit set (%) followed by PKM-2 (33.33) and Kirthi Bharti (31.27), while Murabba showed the

lowest fruit set (16.63%). The highest number of fruits per shoot was observed in Kalipatti (3.00), followed by PKM-1 (2.50), Pilipatti (2.05) and minimum in DHS-2 (1.00). The maximum number of fruits per tree was found in Kalipatti (520.60), followed by PKM-1 (420.65) and Murabba (400.30) and the minimum was found in DHS-2 (135.30) which displayed a significant variation in the number of fruits per tree among various sapota varieties. The maximum yield per tree was

recorded in Kalipatti (32.10 kg per tree) followed by Murabba (28.20 kg per tree) PKM-1 (25.30 kg per tree) while PKM-3 recorded the minimum yield per tree (7.20 kg per tree). Based on the reproductive and yieldattributing parameters of these twelve varieties PKM-1, PKM-2, PKM-5, Murabba, Kalipatti and Cricket Ball were found best. Similar results were also found to be the for Bhubaneswar agroclimatic condition reported by Nagargoje *et al.* (2007); Meena *et al.* (2019).

Varieties	Number of flowers per shoot	Days taken from bud stage to flower opening	Days taken to fruit set	Fruit set%	
DHS-1	6.00	37.13	28.33	16.67	
DHS-2	5.75	36.77	25.00	17.39	
PKM-1	8.00	34.48	23.00	26.13	
PKM-2	6.00	37.61	25.46	33.33	
PKM-3	3.00	39.10	25.00	31.10	
PKM-4	4.50	36.86	25.00	22.22	
PKM-5	5.00	33.50	25.98	26.43	
Pilipatti	4.50	36.51	24.78	22.22	
Kalipatti	7.77	36.27	30.00	37.50	
Murabba	6.00	34.50	28.67	16.63	
Kirthi Bharti	4.00	34.27	25.67	31.27	
Cricket Ball	7.53	37.07	27.23	17.77	
$SE(m) \pm$	0.239	0.936	1.014	1.311	
CD% (5%)	0.703	2.746	2.973	3.844	

 Table 2: Reproductive characters of sapota varieties.

Table 3: Yield and yield attributing characters of sapota varieties.

Varieties	Number of fruits per shoot	Number of fruits per tree	Yield per tree (Kg)	
DHS-1	1.09	161.85	9.80	
DHS-2	1.00	135.30	9.00	
PKM-1	2.50	420.65	25.30	
PKM-2	1.17	229.63	9.20	
PKM-3	1.05	194.31	7.20	
PKM-4	1.50	165.94	10.00	
PKM-5	1.90	230.81	11.10	
Pilipatti	2.05	250.65	12.10	
Kalipatti	3.00	520.60	32.10	
Murabba	2.00	400.30	28.20	
Kirthi Bharti	1.47	190.90	13.50	
Cricket Ball	1.27	165.20	10.09	
$SE(m) \pm$	0.073	10.588	0.591	
CD% (5%)	0.216	31.054	1.733	

The data on quality parameters of different sapota varieties are given in Table 4 and 5. The fruits of Cricket Ball are round in shape whereas in Kirthi Bharti has egg-shaped. The varieties PKM-1, PKM-5, Pilipatti and Kalipatti have oval-shaped fruits. On the other hand, PKM-4 had spindle-shaped fruits while PKM-2 variety fruits were oblong to oval in shape. DHS-1 fruits are round to oblong in shape whereas Murabba fruits are oblong-to-round shaped. The fruit weight varied from 38.24 g to 73.13 g. The maximum fruit weight was recorded in Murabba (73.13 g), followed by Kirthi Bharti (72.50 g) and DHS-2 (69.54 g) whereas minimum fruit weight was recorded in PKM-3 (38.24 g). A significant variation in the length and breadth of fruits across different was noticed sapota varieties. The maximum fruit length was found in variety Murabba (6.20 cm), followed by PKM-2 (5.80 cm) and PKM-4

(5.47 cm), while the minimum fruit length was found in Cricket Ball (4.60 cm). The highest fruit breadth was recorded in DHS-2 (5.63 cm), whereas PKM-2 had the minimum (3.80 cm). Such variation in size and shape of fruits of different varieties was also reported by Rokhade et al. (1989). A significant variation in seedto-fruit ratio among different sapota varieties was revealed. DHS-1 had the maximum number of seeds per fruit (6.40), followed by Cricket Ball (5.50) and DHS-2 (4.67) while PKM-5 had the minimum (2.10). Similar results were also found by Nagargoje et al. (2007) in sapota. The seed weight of sapota varieties varied significantly. Among all the varieties, PKM-2 recorded the highest (1.65 mg) seed weight, followed by PKM-1 (0.92 mg) and Kirthi Bharti (0.83 mg) whereas DHS-1 recorded the lowest weight (0.36 mg). The pulp weight of Kalipatti was recorded as maximum (22.97 g), followed by Murabba (21.17 g) and Cricket Ball (18.30 g). On the other hand, the minimum was recorded in PKM-2 (8.85 g). Among all the varieties, Kalipatti was recorded maximum (57.42) in pulp: seed ratio, followed by DHS-1 (42.46) and Cricket Ball (34.75). Whereas, the minimum was recorded in PKM-2 (5.35). The maximum TSS was recorded in DHS-2 (22.40°Brix), followed by Murabba (21.83°Brix) and Pilipatti (21.45°Brix). On the other hand, it was the minimum TSS in PKM-3 (13.30°Brix).The ascorbic acid content varied significantly among sapota varieties. The highest ascorbic acid content was observed in Cricket Ball (9.63 mg per 100 g), followed by PKM-1 (9.60 mg per 100 g) and PKM-4 (9.44 mg per 100 g). The lowest ascorbic acid content was observed in PKM-5 (7.89 mg per 100 g). The total sugar content was recorded maximum in Kalipatti (11.95 %). The minimum total sugar content was recorded in Kirthi Bharti (9.50 %). A significant variation in the reducing sugar and non-reducing sugar content among the sapota varieties. The maximum reducing sugar content was found in PKM-2 (7.40%) whereas the minimum was found in PKM-4 (5.20 %). On the other hand, PKM-4 was found to have the maximum (5.64 %) non-reducing sugar whereas, the minimum was recorded in Pilipatti (2.68 %). The variation in the physico-chemical quality of fruits is probably due to genetic composition of the different varieties. Similar results were also found by Saraswathy *et al.* (2012) in sapota and Kaur *et al.* (2011) in guava.

Varieties	Fruit shape	Fruit weight (g)	Fruit length (cm)	Fruit breadth (cm)	Number of Seeds per fruit	Seed weight (mg)	Pulp weight (g)	Pulp: Seed Ratio
DHS-1	DHS-1 Round to oblong		4.73	5.17	6.40	0.36	15.29	42.46
DHS-2	Round	69.54	5.00	5.63	4.67	0.63	18.27	28.99
PKM-1	Oval	63.21	5.30	3.87	3.43	0.92	15.16	16.42
PKM-2	Oblong to oval	44.26	5.80	3.80	2.77	1.65	8.85	5.35
PKM-3	Oval	38.24	4.67	3.93	3.03	0.60	14.38	23.97
PKM-4	Spindle	60.95	5.47	4.47	2.70	0.65	16.08	24.61
PKM-5	PKM-5 Oval		5.00	4.60	2.10	0.45	14.36	31.90
Pilipatti	Pilipatti Oval		5.07	4.70	2.57	0.52	17.30	33.28
Kalipatti	Kalipatti Oval		5.17	4.83	4.43	0.40	22.97	57.42
Murabba	Oblong to round	73.13	6.20	4.77	2.83	0.70	21.17	30.24
Kirthi Bharti	Egg-shaped	72.50	5.20	4.90	2.80	0.83	18.23	21.91
Cricket Ball	Cricket Ball Round		4.60	4.73	5.50	0.53	18.30	34.75
SE(m) ±		2.288	0.217	0.193	0.184	0.042	0.717	0.704
CD% (5%)		6.711	0.636	0.567	0.539	0.124	2.102	2.066

 Table 4: Fruit character of sapota varieties.

Table 5: Quality parameters of sapota varieties.

Varieties	TSS(°Brix)	Ascorbic acid content (mg per 100g)	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)
DHS-1	20.50	8.96	11.04	5.50	5.54
DHS-2	22.40	8.83	10.62	6.23	4.12
PKM-1	19.87	9.60	10.43	5.76	4.67
PKM-2	16.03	9.00	10.25	7.40	2.77
PKM-3	13.30	9.01	10.95	6.50	4.45
PKM-4	21.05	9.44	10.84	5.20	5.64
PKM-5	17.74	7.89	10.50	6.90	3.90
Pilipatti	21.45	8.71	9.78	7.10	2.68
Kalipatti	20.00	8.64	11.95	6.60	5.35
Murabba	21.83	8.61	9.55	6.70	2.85
Kirthi Bharti	19.63	9.10	9.50	6.67	2.83
Cricket Ball	13.90	9.63	9.75	6.25	3.50
$SE(m) \pm$	0.78	0.17	0.27	0.24	0.23
CD% (5%)	2.31	0.51	0.80	0.71	0.70

CONCLUSIONS

Twelve sapota varieties were evaluated under coastal plain zone of Odisha, in which the variety PKM-4 and Kirthi Bharti showed better vegetative growth. The PKM-1 and PKM-2 were found to be semi-dwarf types with moderate fruit set % and that can be used for crop improvement programs. Among twelve varieties of sapota, it was observed that Kalipatti, Murabba and PKM-1 are performing well under coastal plain zone of Odisha and can be used for commercial cultivation.

FUTURE SCOPE

Although, sapota has gained popularity in the Indian market yet not been commercialized like other fruit crops. Growing of these varieties under different agroclimatic zone will give a clear picture regarding performance of these varieties. Selection of suitable **16(2): 171-175(2024)** 174

Nag et al., Biological Forum – An International Journal 16(2): 171-175(2024)

parents for hybridization programme to develop dwarf varieties with higher yield potential that can be accommodated under adverse climatic conditions.

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