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Characterization and Evaluation of Different Cultivars of Sapota (*Manilkara achras* L.) under the Gangetic Plain of West Bengal

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ABSTRACT

The present experiment was carried out in Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal during April to June of 2022 to find out the best cultivars of this region. The experiment was laid out in Randomized Block Design (RBD) with seven treatments each replicated thrice. The ten years old seven cultivars (Cricket Ball, PKM-1, PKM-2, PKM-3, CO-1, CO-2 and CO-3) are planted in a square system in a spacing of 5×5 m^2. The maximum fruit weight was found in CO-1 (73.86 g) and followed by CO-2 (73.53 g). The longest fruit length and dimension were observed from CO-2 (7.00 cm and 5.07 cm respectively). The maximum pulp contains in the cultivar is CO-2 (69.58 g) followed by CO-1 (68.96 g). The maximum value of TSS was found in CO-2 (25.17 °Brix) followed by Cricket Ball (21.22 °Brix) and CO-3 (20.28 °Brix). The lowest acidity was recorded in CO-2 (0.12%) followed by CO-3 (0.16%) and CO-1 (0.20%). The cultivar CO-2 registered the highest values of ascorbic acid (62.85 mg 100 g^{-1}), total sugar (16.78%), non-reducing sugar (6.44%) and TSS: acid ratio (209.72). It can be concluded that CO-2 appeared to be the best variety based on the fruit's physical and quality attributes. As this experiment was carried out based on a limited number of varieties, more research was required on the existing germplasm of India. That might be supported in sapota's future production, processing, and marketing.

KEYWORDS: Fruit yield, fruit quality, Sapota

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1. INTRODUCTION

Sapota (*Manilkar achras* (Mill) Fosb.) is one of the important fruit crops grown in tropical and subtropical parts of India, Mexico, Venezuela and Guatemala (Kulkarni et al., 2007). It is commonly known as sapodilla, chikoo and bully belongs to the family Sapotaceae. It is a family comprising roughly 35–75 undefined genera and about 800 species, the majority of which are tropical trees (Kaur et al., 2020 and Fayek et al., 2012). Sapota is an evergreen long-lived tree native to Central America, southern Mexico and the Caribbean although it has extended to Asian countries like Sri Lanka, India, Philippines, and Malaysia where it has been accepted extremely well (Kaur et al., 2020 and Madani et al., 2018). The fruit was first introduced in India in Gholwad village of Maharashtra (Jadhav, 2018a, b). In India, it is widely cultivated in Gujarat, West Bengal, Maharashtra, Andhra Pradesh and Tamil Nadu. It can be grown from sea level upto 1200 m. It thrives in moist conditions and shows robust growth in both arid and humid regions, as well as coastal climates. Sapota flowering almost throughout the year under tropical conditions. The tree survived up to 10 days during flood without long-term damage which makes it favourable for flood prone area (Nickum et al., 2010). There are two or three main seasons of peak flowering from February to March and September to October. The time takes for sapota fruit to reach maturity after flowering ranges from 160-180 days (Kishore et al., 2015). This duration varies based on cultivar, the agricultural climate where it's grown, and the prevailing temperature conditions. Fruits are of two shapes viz., round (rarely) and oval (maximum). Fruit is one of the rich sources of carbohydrate (50.49g 100 g^{-1}), protein (0.7 g 100 g^{-1}), fat (1.1g 100 g^{-1}), fiber (2.6 g 100 g^{-1}), and minerals nutrients such as calcium (28 mg 100 g^{-1}), iron (2.0 mg 100 g^{-1}), phosphorus (27 mg 100 g^{-1}), ascorbic acid (6.0 mg 100 g^{-1}) (Dola et al., 2019; Panda et al., 2014 and Shanmugavelu and Srinivasan, 1973). Fruit pulp contains fair amount of sugar between 12 and 14 percent (Dey et al., 2014). The sapota fruits have a very high antioxidant activity (404.75 µm Trolox equivalent/100 g) (Moo-Huchin et al., 2017). Sapota pulp use for making some dehydrated slices, jams, jellies, squash, preserve, candy and wine and chewing gum manufactured from the latex of sapota tree. There are several cultivars of sapota are available which vary in foliage colour, branching type, fruit texture, fruit shape and pulp quality (Hiwale, 2015). The main characteristics of an acceptable fruit is sweet pulp with a small number of seeds. In India, more than 35 cultivars of sapota are under commercial cultivation (Durairajan and Malarkodi, 2022 and Madani et al., 2018). Due to their wide adaptability, the growing area of sapota is increasing day by day. In the present day most of sapota cultivars are developed from seedling selection and a narrow genetic base is a limiting factor of its cultivation. Due to absence of a number of good choice varieties, failed to meet up the expected level of production in this country. Characterization is an important part for documenting the performance of the studied cultivars, which will then aid in the introduction, selection, and improvement of existing sapota varieties. Therefore, this experiment was undertaken to evaluate different sapota cultivars to find out suitable cultivars with the best fruit quality and higher yield under the Gangetic plain of West Bengal.

2. MATERIALS AND METHODS

The experiment was carried out in the field of ICAR-AICRP on Fruits, Mohanpur centre and the laboratory of the Department of Fruit Science, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal during the pick harvesting time of sapota from April to June of 2022. The ten years old cultivars are Cricket Ball, PKM-1, PKM-2, PKM-3, CO-1, CO-2 and CO-3 are planted in the square system in a spacing of 5×5 m^2. A standard package of practices was followed to raise the crop. The experiment was done on the pick cropping time i.e., April-May. Five fruits from each replication were randomly selected for the estimation of different physicochemical parameters. The average fruit weight was calculated by the total weight of fruits divided by the total number of fruits taken. Fruit volume was measured by the water dispersal method. The average fruit length and breadth were measured by digital vernier callipers. Total soluble solid (TSS) was measured by a digital hand refractometer. The ascorbic acid (percent) was determined by 2,6-dichlorophenol indophenol dye solution. The titrable acidity (percent) was measured by titrating against N/10 sodium hydroxide (NaOH) with a known volume of fruit juice and using an indicator i.e. phenolphthalein. Total sugar and reducing sugar are estimated by titration in felings solution (AOAC, 1965). The experiment was laid out in Randomized Block Design (RBD) with seven treatments each replicated thrice. The statistical analysis was done in online OPSTAT software.

3. RESULTS AND DISCUSSION

3.1. Fruit physical parameters

The data presented in Table 1 revealed that fruit physical characteristics were significantly varied in different varieties. The maximum fruit weight was measured in CO-1 (73.86 g) followed by CO-2 (73.53 g) and PKM-3 (65.50 g), where the minimum fruit weight was found in PKM-2 (52.17 g). The longest fruit length was observed from CO-2 (7.00 cm) followed by CO-1 (6.45 cm). The highest fruit dimension was observed in CO-2 (5.07 cm) followed by CO1 (4.80

Table 1: Fruit physical parameters of different cultivars of sapota

Variety	Fruit weight (g)	Fruit length (cm)	Fruit dimension (cm)	Fruit volume (ml)	Specific gravity	Peel weight (g)	No of Seed	Seed weight (g)	Pulp weight (g)	Pulp: peel ratio
Cricket ball	52.82	4.44	4.41	48.63	1.09	12.16	3	2.15	48.51	3.99
CO-1	73.86	6.45	4.80	65.67	1.12	11.54	3	2.45	68.96	5.98
CO-2	73.53	7.00	5.07	65.45	1.16	13.00	2	1.97	69.58	5.35
CO-3	64.01	5.86	4.65	58.05	1.10	11.51	3	2.35	59.31	5.15
PKM-1	60.58	5.77	3.69	52.00	1.12	14.65	3	2.18	56.22	3.84
PKM-2	52.17	5.00	4.46	50.28	1.04	18.30	4	2.68	46.81	2.56
PKM-3	65.50	5.56	4.80	63.50	1.03	15.60	3	2.4	60.70	3.89
SEm±	0.868	0.077	0.064	0.800	0.015	0.180	0.042	0.032	0.805	0.065
CD (p=0.05)	2.676	0.238	0.196	2.464	0.046	0.554	0.129	0.099	2.481	0.199

cm) and PKM-3 (4.80 cm). The maximum fruit volume was found in CO-1 (65.67 ml) followed by CO-2 (65.45 ml) and PKM-3 (63.50 ml). The difference in fruit volume among the variety is due to variations in fruit length, fruit dimension and fruit weight values. The highest specific gravity was obtained from CO-2 (1.16) whereas the lowest fruit specific gravity was recorded from variety PKM-3 (1.03). Higher peel weight was observed in the cultivar PKM-2 (18.30 g), whereas the lowest peel weight was found in CO-3 (11.51 g) followed by CO-1 (11.54 g). The number of seeds per fruit varied from two to four. The maximum number of seeds per fruit was observed in PKM-2 (4), whereas the minimum number of seeds per fruit was found in CO-2 ((2), which might be due to the varietal character of the cultivars. The average seed weight varied on the number of seed present in the fruit. The highest seed weight was found in PKM-2 (2.68 g), whereas the lowest seed weight was observed in CO-2 (1.97 g). The seed weight was varied due to the different number of seeds among the variety. The maximum pulp contained in the cultivar CO-2 (69.58 g) followed by CO-1 (68.96 g) was attributed to the large size of the fruit. The cultivar PKM-2 had the lowest pulp (46.81 g) content due to the smaller fruit size. The higher pulp-to-peel ratio was calculated in CO-1 (5.98) followed by CO-2 (5.35). The highest pulp weight of CO-2 and CO-1 was due to the maximum fruit weight found in those varieties. Significant variation among cultivars in terms of fruit physical character might be due to varietal characteristics in combination with the agro-climatic condition of this area. Ramadoss and Arivazhagan (2016) found similar result of eight different cultivar of sapota, where pulp weight varied from 49.63 to 149.27 g, peel weight varied from 8.22 to 32.86 g) and pulp to peel ratio from 4.44 to 8.06. This finding was higher compared to the result of Jadav et al. (2018) where fruit length ranges from 44.08 mm to 60.19 mm and fruit width varies from 37.00 mm to 49.34 mm.

3.2. Chemical composition

The data presented in Table 2 revealed that the cultivars CO-2 excelled over the other cultivars with regard to the chemical composition like TSS, acidity, ascorbic acid, total

Table 2: Chemical Composition of different cultivars of sapota

Variety	TSS (°Brix)	Acidity (%)	Ascorbic acid (mg 100 g^{-1})	Total sugar (%)	Reducing sugar (%)	Non reducing sugar (%)	TSS: acid ratio
Cricket ball	21.22	0.21	20.00	15.00	9.17	5.54	101.05
CO-1	19.30	0.20	39.99	14.76	9.09	5.39	96.5
CO-2	25.17	0.12	62.85	16.78	10.00	6.44	209.72
CO-3	20.28	0.16	45.71	13.43	9.66	3.58	126.77
PKM-1	19.00	0.25	28.57	14.28	12.50	1.69	76
PKM-2	18.84	0.28	39.99	13.66	8.00	5.38	67.28
PKM-3	17.50	0.31	35.61	12.65	8.50	3.94	56.45
SEm±	0.273	0.003	0.638	0.191	0.125	0.064	1.870
CD (p=0.05)	0.842	0.009	1.966	0.588	0.386	0.197	5.76

sugar, reducing sugar, non-reducing sugar, and TSS: acid ratio. The maximum value of TSS was found in CO-2 (25.17°Brix) followed by Cricket Ball (21.22°Brix) and CO-3 (20.28°Brix). The minimum value of TSS was found in PKM-3 (17.5°Brix). The acidity percentage of sapota pulp juice negatively correlated with TSS. The lowest acidity was found in CO-2 (0.12%) followed by CO-3 (0.16%), CO-1 (0.20%) and Cricket Ball (0.21%), whereas the maximum acidity was estimated in PKM-3 (0.31%). The cultivar CO-2 registered the highest values of ascorbic acid (62.85 mg 100 g^{-1}). The lowest value of ascorbic acid was found in Cricket Ball (20 mg 100 g^{-1}). The maximum total sugar was found in CO-2 (16.78%) followed by Cricket ball (15.0%), where the minimum total sugar was recorded in PKM-3 (12.65%). The maximum reducing sugar found in PKM-1 (12.50%) followed by CO-2 (10.0%) and CO-3 (9.66%). The minimum reducing sugar found in PKM-2 (8.0%). The non-reducing sugar content of fruit juice varied from 6.44 (CO-2) to 1.69 (PKM-1). The Chemical Composition of different cultivars of sapota varied might be due to genotypic character. Durairajan and Malarkodi (2022) reported that the TSS value range from 17.0 to 23.4°Brix, these results were in accordance with the present study. Ramadoss and Arivazhagan (2016) found that TSS: acid ratio varied from 57.23 to 97.30 and total sugar range from 7.0 to 12.03%. These results are in close conformity with the results of Kulkarni et al. (2007) (Total soluble solids (20.68%), Acidity (0.16%), Reducing sugar (9.86%), Total sugar (11.06%) and Ascorbic acid (10.52 mg 100 g^{-1})) and Dola et al. (2019) (highest vitamin-C content found 11.42 mg 100 g^{-1}). Saraswathy et al. (2010) found that highest TSS (25.5°Brix), total sugars (10.9%) and ascorbic acid (3.55 mg 100 g^{-1}) in a local genotype. Dorairaj conducted experiment in 1985 to assess ten different sapota cultivars. Their findings indicated that CO2 was the best cultivar followed by Cricket Ball.

Figure.1: Different cultivars of sapota

4. CONCLUSION

Among the seven-variety evaluated, CO-2 was appeared the best variety based on fruit weight, pulp weight, a smaller number of seed and fruit quality attributes.

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