



## STUDIES ON FRUIT DEVELOPMENT IN DIFFERENT CULTIVARS OF SAPOTA

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### ABSTRACT

The different cultivars of sapota namely Cricket Ball, Singapore, CO-1, CO-2, PKM-1, PKM-2, PKM-3, DHS-1, DHS-2, Kalipatti and Pala took about 6-9 months from fruit set to harvestable maturity and followed double sigmoid curve in terms of fruit weight. The number of days required from fruit set to harvest differed significantly with the varieties. The cv. DHS-2 recorded the highest number of days (263.46) to attain harvestable maturity followed by cv. DHS-1 (258.00) and Cricket Ball (257.93) while the lowest was observed in cv. PKM-1 (189.33). The fruit weight was maximum in cv. Cricket Ball (123.20 g) followed by cv. DHS-1 (122.40 g) while it was minimum in cv. Pala (32.09 g) and PKM-1 (46.18 g). The pattern of fruit development in terms of fresh weight of the fruit followed double sigmoid growth curve and maximum increase in fruit weight was observed between 150- 210 days after set.

### KEY WORDS:

### INTRODUCTION

Sapota (*Manilkara achras* (Mill). Fosberg) is one of the most important fruits of India. It belongs to family sapotaceae and is a native of Tropical America. It is a sweet smelling, delicious fruit of commercial importance. The development of fruit taste palatability as well as ripening are markedly influenced by proper growth, development and fruit maturity. Fruits on attainment of harvestable stage fail to show a green tissue or latex when scratched with finger nail. The fruit shed off brown scaly external material and become smooth on attainment of physiological maturity. The varietal differences with regard to fruit growth and development of sapota were earlier reported (Sulladmath, 1975, Ingle *et al.*, 1982 and Paralkar *et al.*, 1987 and Dhua *et al.*, 2006).

### MATERIAL AND METHODS

The canopy of the trees was divided into lower, middle and upper strata for recording observations on branching and flowering. The lower part of the canopy up to 1/3<sup>rd</sup> height was considered as lower strata, from 1/3<sup>rd</sup> to 2/3<sup>rd</sup> height as middle strata and the top 1/3<sup>rd</sup>. Height of the canopy as upper strata. Five randomly selected branches in all directions of the canopy were considered in lower, middle, and upper strata in each tree for recording the observations. Thus data were recorded

on a total of 15 branches in each tree and 45 branches in each replication in a given variety.

For this purpose, all the branches in the three strata were recokened as one. The data were recorded at monthly intervals from fruit set to harvest to observe the fruit development pattern. Fruit weight in grams was recorded on fifteen randomly selected fruits from all the strata in each tree and the mean values were presented. Dry weight of the fruits was also recorded on all the sampled fruits at monthly intervals till harvest. The seed weight was also recorded along with fruit weight at monthly intervals till harvest. During the period of fruit growth and development the maximum and minimum temperature ranges from 29.5°C to 37.2°C and 16.7°C to 26.8°C, respectively and relative humidity ranged from 66.10 to 86.23 per cent.

### RESULT AND DISCUSSION

#### Days to harvest

Significant differences among the varieties were observed with regard to days to harvest (Table 1). The mean number of days from fruit set to harvest ranged from 189.3 to 263.4 days in with different cultivars. The fruits of cv. DHS-2 recorded the highest number of days to harvest (263.46) followed by the fruits of cv. DHS-1 (258.00), Cricket Ball (257.93) and CO-1 (257.930) which were at par with CO-2 (257.46) and PKM-3 (257.44).

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## Studies on Fruit Development in Sapota

The cv. PKM-1 recorded the shortest period of fruit development (189.33 days) closely preceded by cv. Singapore (192.26) and Pala (194.66) and no significant difference were observed among these three.

### Fresh and dry weight of the fruit (g)

A perusal of data on fruit growth indicated significant variation among varieties (Table 2 and 3). The average fresh fruit weight of different varieties at harvest ranged from 32.09 to 123.20 g. The fruits of Cricket Ball (123.20 g) were significantly superior over DHS-1 (122.40 g) and DHS-2 (120.70 g). The minimum fruit weight was recorded in cv. Pala (32.09 g) which was significantly inferior to others and was preceded by PKM-1 (46.18 g) and Singapore (71.23 g).

The fruit weight recorded from second month after set increased gradually towards harvest. The mean fruit weight increased from 0.810 g at second month after set to 65.35 g at seventh month after fruit set by which time four varieties attained the stage of harvest. Significant differences in fruit weight were observed among different months after set. However, the fruit growth continued till 9 months after set in 6 cultivars *viz.*, CO-1, PKM-3, Cricket Ball, DHS-1 and DHS-2.

The interaction between the varieties and the month of fruit development significantly influenced the fruit growth. The PKM-2 (0.740) and Pala (0.750) at second month after fruit set recorded the lowest weight while, the highest was observed in fruits of Cricket Ball (123.2 g), DHS-1 (122.4 g) at harvest.

Similar trends were also observed with the dry weight of fruits at different stages of development (Table 2 and 3). The mean dry weight of fruits ranged from 9.05 g in Pala to 39.567 g in Cricket Ball at harvest.

### Seed weight (g)

The data on seed weight recorded from the third month after fruit set were presented in the Table 4. Which revealed significant differences among varieties.

The mean seed weight of different varieties at harvest ranged from 2.11 g to 5.81 g. Significantly higher seed weight was observed in Cricket Ball (5.81 g) followed by the DHS-2 (5.61 g). Significantly lowest seed weight was recorded in Pala (2.11 g) preceded by PKM-1 (2.42 g) and Kalipatti (3.73 g).

The seed weight recorded from third month after fruit set increased gradually towards harvest. The seed weight increased from 0.083g at third month after set to 4.135g at seventh month after set by which time four varieties attained harvest maturity. The seed growth continued till ninth month after fruit set in remaining six varieties.

## DISCUSSION

These results correlated with those reported by earlier workers (Sundararajan and Rao, 1967) who observed a fruit development period of 8-9 months in different varieties under different agro-climatic conditions. Variability with regard to fruit set and fruit weight was reported by Shirol *et al.* (2009). Considerable variation in fruit development period of sapota due to cultivars, agro climatic location and temperature of environment was earlier reported (Sulladmath, 1975) which supported the varietal differences observed in this study. Interestingly, the fruits which recorded higher fruit weight at harvest recoded higher number of days to attain maturity thus DHS-2 and Cricket Ball took maximum number of days to attain harvestable maturity while the small fruited Pala and PKM-1 were the earliest recording less number of days from fruit set to harvest. The influence of three main factors *viz.* fruit size, canopy spread and environmental temperature on earliness of cultivar was indicated earlier (Sulladmath, 1975) which support the findings of this investigation.

A perusal of the data revealed an initial increase in fruit size (in terms of fruit weight) up to 90 days after fruit set followed by decreased rate of growth up to 150 days from fruit set. There was a rapid increase from 150 to 210 days after which the rate of increase was low thus the fruit development in terms of weight followed a "Double sigmoid growth curve". This kind of growth pattern was typical in sapota fruits as reported by Rao (1978) and Dhua *et al.* (2006) and was observed in almost all the varieties studied in the present investigation.

The incremental improvement in dry weight of the fruit also followed the same trend as that of fresh fruit weight. As observed from the data, the seed was traceable from third month after set and growth of seed was at its peak between 180-210 days after which it was low till harvest. The cultivar which produced bigger fruits also recorded more seed weight. These findings are in consonance with those reported by Dhua *et al.* (2006)

**Table 1. Number of days required from fruit set to harvest in different varieties of sapota**

Varieties	R-1	R-2	R-3	Mean
Cricket Ball	255.40	258.80	259.60	257.93
Singapore	194.00	189.80	193.00	192.26
CO-1	256.60	255.40	257.80	257.93
CO-2	257.60	255.40	259.40	257.46
PKM-1	187.80	189.60	190.60	189.33
PKM-2	216.60	228.00	225.80	232.66
PKM-3	257.20	255.20	259.80	257.44
DHS-1	255.40	260.00	258.60	258.00
DHS-2	261.40	259.20	269.80	263.46
Kalipatti	232.40	234.60	231.00	232.66
Pala	203.00	196.40	184.60	194.66
S.E(m)±				2.477
C.D (P=0.05%)				7.359
F-Test				*

\* Significant at 5% level

**Table 2. Fresh weights of the fruit (g) at various stages of growth in different varieties of sapota**

Varieties	Days after set							
	60	90	120	150	180	210	240	270
Cricket Ball	1.037	3.450	5.740	21.50	36.89	74.55	104.00	123.20
Singapore	0.757	2.350	4.487	15.63	37.18	71.23	-	-
CO-1	0.807	3.160	5.333	18.93	39.78	78.95	102.7	119.38
CO-2	0.780	2.293	3.367	18.73	39.98	79.25	104.3	118.25
PKM-1	0.907	2.577	3.193	10.49	25.24	46.18	-	-
PKM-2	0.740	3.293	4.547	12.62	32.68	60.95	83.63	108.40
PKM-3	0.777	3.660	5.797	17.28	35.38	68.21	92.42	122.40
DHS-1	0.833	2.657	3.760	15.65	35.31	74.21	101.7	120.70
DHS-2	0.767	3.170	5.313	19.40	39.60	79.24	104.9	-
Kalipatti	0.757	2.673	4.000	13.63	28.83	53.99	74.49	-
Pala	0.750	2.600	3.267	8.90	18.85	32.09	-	-
	0.810	2.898	5.034	15.70	33.61	65.35	-	-
S.E (m)±		C.D (P=0.05%)					F-Test	
Days after set (D)	0.098		0.274					*
Variety (V)	0.836		0.233					*
D × V	0.277		0.774					*

\* Significant at 5% level

# Studies on Fruit Development in Sapota

**Table 3. Dry weights of the fruit (g) at various stages of growth in different varieties of sapota**

Varieties	Days after set							
	60	90	120	150	180	210	240	270
Cricket Ball	0.323	1.437	1.553	5.343	11.56	23.85	32.37	<b>39.567</b>
Singapore	0.273	1.080	1.360	4.277	12.12	21.81	-	-
CO-1	0.175	1.140	2.107	6.053	13.19	23.79	31.43	36.02
CO-2	0.274	0.533	0.993	4.670	12.88	24.57	31.39	34.96
PKM-1	0.260	0.653	1.107	3.543	7.85	15.11	-	-
PKM-2	0.163	1.207	1.753	4.607	10.86	22.53	24.48	-
PKM-3	0.197	1.353	1.893	5.230	10.7	18.85	28.26	31.93
DHS-1	0.317	0.873	1.200	5.940	11.27	23.35	29.53	38.847
DHS-2	0.320	1.107	1.953	5.530	11.71	24.27	31.97	37.173
Kalipatti	0.187	0.787	1.427	3.887	8.78	19.37	24.39	-
Pala	0.223	0.643	1.040	2.327	5.47	9.05	-	-
<b>Mean</b>	<b>0.247</b>	<b>0.983</b>	<b>1.490</b>	<b>4.673</b>	<b>10.59</b>	<b>21.81</b>	-	-
			<b>S.E(m)±</b>	<b>C.D (P=0.05%)</b>			<b>F-Test</b>	
Days after set(D)			0.192	0.538			*	
Variety(V)			0.142	0.397			*	
D × V			0.471	1.318			*	

\* Significant at 5% level

**Table 4. Seed weight at various stages of fruit growth in different varieties of sapota**

Varieties	Days after set						
	90	120	150	180	210	240	270
Cricket Ball	0.099	0.196	0.940	2.700	4.727	4.812	<b>5.818</b>
Singapore	0.099	0.185	0.847	2.393	3.873	-	-
CO-1	0.074	0.250	0.953	2.607	5.087	4.979	5.326
CO-2	0.065	0.177	0.787	2.420	5.193	5.353	5.370
PKM-1	0.095	0.205	0.407	2.033	2.427	-	-
PKM-2	0.060	0.130	0.773	2.347	4.207	4.539	-
PKM-3	0.067	0.194	0.813	2.087	4.393	4.554	5.621
DHS-1	0.099	0.202	0.847	2.447	4.607	4.761	4.890
DHS-2	0.099	0.334	0.860	2.367	4.960	5.385	5.615
Kalipatti	0.065	0.229	0.820	1.993	3.733	3.644	-
Pala	0.095	0.217	0.800	1.380	2.113	-	-
<b>Mean</b>	<b>0.083</b>	<b>0.211</b>	<b>0.804</b>	<b>2.252</b>	<b>4.135</b>	-	-
		<b>S.E(m)±</b>	<b>C.D (P=0.05%)</b>			<b>F-Test</b>	
Days after set (D)		0.185	0.077			*	
Variety (V)		0.027	0.052			*	
D x V		0.061	0.172			*	

\* Significant at 5% level

who observed peak fruit development between 180-195 days after set in Cricket Ball. Similarly, Paralkar *et al.* (1987) also reported fruit development period of eight months in cv. Kalipatti and indicated that the seeds were traceable early during the third month after fruit set (Sulladmath, 1975, Ingle *et al.* 1982).

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