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Fruit Growth Pattern in Kalipatti Sapota

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Abstract

The fruit Kalipatti sapota exhibited a characteristic double sigmoid pattern of growth with two distinct periods of active growth. Stage 1 and stage III, separated by period of suspended growth, stage II. As measured in terms of fresh weight increase, stage 1 confined to 5 months and stage III between month 6 and 8 after fruit set. The period of active growth was separated by a period of lag phase (stage II) between month 5 and 6 after fruit set which was marked by retarted growth rates. Fruit set during July flush required 8 months to reach harvestable maturity under Bangalore conditions. The long period of lag phase (1 month) and slow growth rate in initial stages of fruit development cause the long period of fruit development.

Key words : Kalipatti sapota, Fruit growth.

Sapota (*Manilkara achras* (Mill.) Fosberg is one of the delicious tropical fruits and has been found most adoptable under a vast diversity of soil and climatic condition. It is a native of tropical America and has now spread to almost all the tropical countries of the world. It has attained the status of a commercial fruit in all these countries. Sapota fruit growth mainly depends on climatic conditions. The period required for maturity varied from 4 months to 10 ½ months in different regions. In this regard, fruit growth pattern in sapota is meager. The available reports on the fruit growth pattern and period required for maturity are conflicting. Lakshminarayana and Subramanyam (1966) observed a sigmoid pattern of growth in respect of increase in fresh weight of fruit. However, it was found that double sigmoid nature of growth separated by a period of suspended growth (Sunderarajan and Madhava Rao 1967 and Sulladmath et al. 1979). Therefore the present study was undertaken on the fruit growth pattern and maturity period in sapota under Bangalore conditions.

Methods

The investigations were carried out in sapota orchard of Horticultural Research Station, Gandhi Krishi Vignana Kendra, University of Agricultural Sciences, Bangalore during July 2000. Four uniform 20 year old sapota trees grown under similar soil and cultural conditions of light and temperature were taken for the study. About 500 just set fruits were tagged on each of the four replicated trees. Samples of fruits (10 numbers/replication) were collected at fortnightly intervals to record the fresh weight of fruits. Analysis and interpretation of the experimental data were done as suggested by Sunderaraj et al. (1972).

Results and Discussion

The data on change in the fresh weight of developing fruit are presented in Table 1 and the pattern of growth curve is illustrated in Figure 1. The data on fresh weight of fruit follows a characteristic double sigmoid pattern of growth comprised of the following district growth stages.

Stage-1 : 1 to 10 Fortnight (Period of Slow Growth). This period was confirmed to first 10 fortnights of fruit growth after fruit set. This period was further marked by slow growth rate in initial stages and a steady growth rate in later stages dividing the period into two sub-periods namely, The period of slow increase to fresh weight lasting for first 5 fortnights (stage-la), and the period of steady weight increase during the later half of the period (stage-lb).

The fruit attained significantly a weight of 2.32 g during the first sub-stage of stage 1 and by the end of the second sub-stage the fruit recorded a weight of

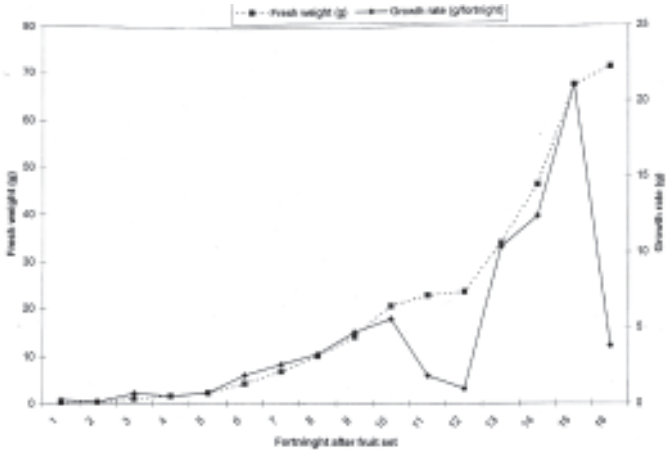

Figure 1. Growth pattern of developing Kalipatti sapota fruit.

20.45 g, and it attained 28.76% of the total weight of mature fruits during this stage -1

Stage-II : 10 to 12 Fortnights (Lag Phase or Phase of Suspended Growth). The stage was marked by relatively slow fruit growth rates. The growth rate was lowest during later half of fortnight 10 of fruit growth. There was little increase in fruit weight (2.85 g) during this period, constituting 4.00% of the total weight of the mature fruit.

Table 1. Change in the fresh weight and growth rate of developing Kalipatti sapota fruit.

Fortnight after fruit set	Fresh weight (g)	Growth rate (g/fortnight)	Percentage of final weight attained at maturity
1	0.26	0.26	
2	0.38	0.12	
3	1.09	0.71	
4	1.59	0.50	
5	2.32	0.72	
6	4.21	1.88	28.76 (Stage-I)
7	6.80	2.59	
8	10.07	3.27	
9	14.09	4.68	
10	20.45	5.54	
11	22.77	1.85	
12	23.52	1.00	4.00 (Stage-II)
13	33.87	10.35	
14	46.25	12.37	66.89 (Stage-III)
15	67.29	21.04	
16	71.10	3.80	
F test	*	*	
CD at 5%	0.80	0.63	

Stage-III : 12 to 16 Fortnight (Phase of Accelerated Growth). This phase was characterized by accelerated fruit growth rate and weights significantly increased by multiple folds. The maximum fruit weight (47.56 g) was attained during this period constituting 66.89% of the total weight of the mature fruit. The fruit attained a maximum weight (71.10 g) at the end of the fortnight 16 after fruit set when it was fully mature.

The graphical representation of data on changes in fresh weight revealed that sapota fruit fallows a characteristic double sigmoid pattern of growth comprised of period of two active growth separated by a period of suspended growth (Fig.1). Sulladmath (1975) worked on Kalipatti sapota also reported double sigmoid pattern of growth with two months of lag phase. Mahadevaiah (1981) also reported double sigmoid pattern of growth with one month of lag phase. But in the present investigation, the lag phase lasted for only one month. This difference may be ascribed to the difference in the season of the study. The degree and the duration of lag phase, however, vary with variety and also with climatic conditions (Kobayashi and Nii 1965).

Several reasons have been put forth to explain the cause of the lag phase (Bertrand and Weaver 1972). However, there has been no universally acceptable theory on this aspect. Sulladmath (1983) observed that maximum rate of seed growth and color of the seed turns from yellowish white to brown as sign of lignification and reduction in absolute amount

of some of the minerals indicating that possibility of utilization of minerals in developing seeds and thus possible competition between fruit pulp and seed for nutrients during the lag phase of fruit growth.

Maturity Period and Harvesting Stage of Fruits. The observations revealed that the fruits of Kalipatti variety of sapota required about 8 months after the fruit set to maturity as judged by several visual changes such as drop down of brown scurf, changes in the skin color from brownish to light potato brown and disappearance of latex and orange brown color when streaked.

References

Bertrand D. E. and R. J. Weaver. 1972. Effect of exogenous gibberellin application on the endogenous hormone content and development of Black Corianth grape. *Vitis.* 10 : 292—297.

Kobayashi A. and N. Nii. 1965. Studies of thermal conditions of grapes. IV. Effect of day and night temperature on growth of Delaware grapes. *J. Jap. Soc. Hort. Sci.* 34 : 25—32.

Lakshminarayana S. and H. Subramanyam. 1966. Physical, chemical and physiological changes in sapota Fruit (*Achrassapota* L.) during development and ripening. *J. Fd. Sci. and Technol.* 3 : 1—4.

Mahadevaiah G. M. 1981. *Studies on flowering fruit set and fruit development in Kalipatti sapota.* M. Sc. (Ag.) thesis. Univ. Agric. Sci., Bangalore, India.

Sulladmath V. V. 1975. Studies on growth and development in sapota cv Kalipatti. M. Sc. (Ag.) thesis. Univ. Agric. Sci., Dharwad, India.

Sulladmath V. V. 1983. Accumulation of mineral elements at different stages of developing sapodilla fruit. *Scientia Hort.* 19 : 79—83.

Sulladmath V. V., S. S. Rao and M. R. Advani. 1979. Studies on pattern of growth of developing Kalipatti sapota (*Manikara achras* (mill) Foresberg) fruit. *J. Maharashtra Agric. Univ.* 4 : 55—66.

Sunderarajan S. and V. N. Madhava Rao. 1967. Studies on fruit development and fruit quality in some varieties of sapota (*Achras zapota* L.). *South Indian Hort.* 15 : 52—57.

Sunderaraj N., S. Nagaraju, M. N. Venkataramu and N. K. Jagannath. 1972. *Design and analysis of field experients.* Univ. Agric. Sci., Bangalore, India.