

Developmental pattern and maturity standards for litchi (*Litchi chinensis* Sonn.) cv. Calcuttia

B.V.C. Mahajan and B.S. Dhillon

Punjab Agricultural University Regional Research Station, Gurdaspur-143521, Punjab, India.

Abstract

Investigation was carried out to study the developmental pattern and maturity standards of litchi fruits cv. Calcuttia for ascertaining its optimum harvesting period under Gurdaspur, Punjab conditions. It was observed that litchi fruits attained maximum size, weight and total soluble solids at 55 to 60 days after fruit set, which may be taken as harvest period for Calcuttia litchi. At this stage the fruits had attained attractive pinkish red colour.

Key words: Litchi, *Litchi chinensis* Sonn., Calcuttia, maturity standards, weight, TSS, fruit colour

Introduction

Litchi is an important fruit of the sub-mountainous region of Punjab. It grows successfully in Gurdaspur, Hoshiarpur and Ropar districts of Punjab. Calcuttia is a heavy bearing cultivar of litchi, possesses large and attractive fruits with excellent quality. The physico-chemical constituents and their interrelations, biochemical events and role played by growth substances and mineral nutrition during the critical stages in the fruit development provide us an insight into the aspects of ontogeny of fruit described as maturation and ripening. Litchi is a perishable fruit and do not improve in quality after harvest. So the harvesting of litchi fruits at proper stage of maturity is desirable for maintaining the quality and consumer acceptability (Sharma *et al.*, 1987). Therefore, the present investigation was conducted to study the developmental pattern of litchi fruits cv. Calcuttia in order to ascertain its optimum harvesting period under Punjab conditions.

Materials and methods

The studies were conducted at experimental orchard of Punjab Agricultural University Regional Research station, Gurdaspur. Three, 25-years old Calcuttia litchi plants of uniform size and health were selected. These plants received the identical

treatments such as recommended doses of fertilizers and pesticides during the course of investigations. The branches having uniform fruit set on all four sides of the plants were tagged immediately after fruit set. The data recording on physico-chemical changes of the fruits was started 20 days after fruit set and continued until last harvest. The fruit sampling was done at 5 days interval. On each sampling date, 25 fruits were harvested at random from all sides of the plants and analysed for fruit size, weight, pulp weight, seed weight, pericarp colour, total soluble solids and titratable acidity. The length and diameter of the fruit was measured with Vernier's calipers. The weight of the fruit was recorded on top pan balance. The total soluble solids of the fruit was recorded with hand refractometer and correction at 20°C was applied. The titratable acidity of the fruit was determined with standard A.O.A.C. procedure (1980). The experiment was laid out in randomized block design.

Results and discussion

The data on the developmental pattern of litchi fruit has been presented in Table 1. The size (length and diameter) of litchi fruit increased with the advance in the age of the fruit. The maximum fruit size was noticed at 55 days after fruit set and thereafter the size of the fruit almost stabilized after attaining.

Table 1. Developmental pattern of litchi fruits cv. Calcuttia

Sampling date	Days after fruit set	Fruit size		Fruit weight (g)	Pulp weight (g)	Seed weight (g)	TSS (%)	Acidity (%)	Pericarp colour
		Length (cm)	Diameter (cm)						
15-May	20	1.3	1.0	2.7	-	1.0	9.0	0.92	Green
20-May	25	1.9	1.3	3.8	-	1.6	11.5	0.85	Green
25-May	30	2.5	1.7	5.0	2.0	2.1	13.5	0.80	Green
30-May	35	2.9	2.0	6.5	4.5	2.6	15.5	0.71	Green
4-June	40	3.1	2.2	11.0	6.5	2.8	10.5	0.60	Green
9-June	45	3.4	2.5	14.0	8.2	3.0	17.0	0.52	10% Red
14-June	50	3.6	2.6	16.0	9.0	3.1	17.2	0.45	25% Red
19-June	55	3.9	2.9	19.0	9.5	3.2	18.0	0.42	75% Red
24-June	60	3.9	3.0	19.5	10.0	3.2	18.3	0.40	100% Red
CD ($p=0.05$)		0.2	0.1	0.5	0.2	0.1	0.5	0.02	

3.9 cm length and 3.0 cm diameter. A rapid increase in fruit weight was noticed up to 40 days after fruit set, thereafter a gradual increase in fruit weight was seen until last harvesting date *i.e.*, 60 days after fruit set when fruit had attained the maximum weight of 19.5 g. The increase in size and weight of the litchi fruit appears to be due to occurrence of cell division in early stages (Bailer, 1950) and later stages of fruit growth (Bain and Robertson, 1951) and accumulation of carbohydrates (Coombe, 1960). Badiyala (1991) studied the maturity standards of litchi fruit under Paonta valley conditions of Himachal Pradesh and reported that harvest maturity of litchi can be predicted on the basis of size of the fruit.

The pulp and seed weight of fruit increased significantly up to 55 days after fruit set. The pulp weight increased rather slowly up to 30 days after fruit set but at a faster pace as growth period with very slow growth at the end of sampling duration. Contrary to this, the seed weight showed dramatic increase during first phase *i.e.* 35 days after fruit set and thereafter gradual increase was noticed. Zhoug and Wu (1983) reported that in fruit growth of litchi, rind develops initially at high rate followed by membranous mesocarp and aril which grow very fast towards the later stage of fruit development. A sigmoidal pattern was noticed during growth and development of the fruit.

The total soluble solids content of the fruit increased with the increase of the growth of fruit. The increase was much faster up to 40 days after fruit set and after that TSS increased at a slower and gradual rate and maximum level of TSS was recorded on last sampling date. The TSS ranged between 9.0-18.3 °Brix during growth process of the fruit. Syamal (1986) and Sharma *et al.* (1987) also observed similar trend in China and Shahi varieties of litchi under Bihar condition. The regular increase in sugars in the pulp of the fruit may be associated with increased translocation of photosynthates from leaves to the fruits (Leopold and Kriedman, 1975). The increase in TSS during fruit development could possibly be attributed to the difference in the *in vivo* activities of invertase (Chan *et al.*, 1975). There was a gradual linear decline in titratable acid content with the advance in growth period of the fruit (0.92- 0.40 %). The decrease in acidity during fruit growth might be due to use of organic acid as a respiratory substrate during ripening (Ulrich, 1974; Echeveria and Valich, 1989).

The fruit of *Calcuttia litchi* remained green up to first week of June and colour break started in second week of June (45 days after fruit set) when just 10% area of the fruit surface turned red. The process continued and on the last two consecutive dates the whole surface of the fruit turned pinkish red. The development

of colour on fruit is more dependable maturity index. The litchi fruit is said to be ready for harvesting when the pericarp is uniform red. Jaiswal *et al.* (1987) reported that in litchi, total chlorophyll content declined rapidly along with synthesis of anthocyanin during ripening and senescence. Prasad and Jha (1978) reported that fruit of litchi turn deep red when fully ripe. From the ongoing discussion, it may be concluded that the litchi fruit followed a sigmoid curve. The optimum time of harvest for *Calcuttia litchi* varied from 19th June to 24th June under Punjab conditions. In other words, this cultivar should be harvested in between 55-60 days after fruit set for fetching better market price. At the time of the harvest the fruit must have attained the weight of 19-20g and TSS of 18 g and pinkish red colour with smooth tubercles.

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