GROWTH AND DEVELOPMENT OF LITCHI FRUIT CV. BREWSTER ([1])

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ABSTRACT

Fruit growth and development of litchi (*Litchi chinensis* Sonn.) cv. Brewster, were observed during growing season in Viçosa, State of Minas Gerais, Brazil. From panicle flowering to about 45 days after flowering (DAF), 95% of fruit fresh weight was due to the seed and skin. Fruit weight increased exponentially from 45 to approximately 80 DAF, but lower increases were observed until 104 DAF. At a later stage of drupe development, the aril accounted for 60% of fruit fresh weight, while 14% consisted of seed and 26% skin. Soluble solids reached maximum value at about 77 DAF, becoming somewhat stable afterwards. Acidity, on the other hand, dropped from 6.0% at 45 DAF to 0.6% at 89 DAF onwards. Mature red fruits were present 89 DAF from panicle flowering, but after 104 DAF fruit skin became brown.

Index terms: fruit growth, *Litchi chinensis* Sonn., soluble solids, acidity.

RESUMO

CRESCIMENTO E DESENVOLVIMENTO DE FRUTOS DE LICHIA CV. BREWSTER

Acompanhou-se o crescimento e desenvolvimento de frutos de lichia (*Litchi chinensis* Sonn.) cv. Brewster, em Viçosa (MG). Da abertura das panículas até cerca de 45 dias após o florescimento (DAF), 95% da matéria fresca total dos frutos correspondeu à soma das massas da semente e da casca. A matéria fresca dos frutos aumentou exponencialmente entre 45 e 80 DAF; observaram-se, porém, incrementos menores de matéria até o final do desenvolvimento, aos 104 DAF. Próximo ao final do ciclo de desenvolvimento do fruto, atribuiu-se 60% da matéria fresca total ao arilo, enquanto 14 e 26% corresponderam à semente e à casca respectivamente. Os frutos apresentaram maior conteúdo de sólidos solúveis totais aos 77 DAF. A acidez total foi reduzida de 6,0%, aos 45 DAF, para 0,6%, aos 89 DAF. Obtiveram-se frutos vermelhos maduros aos 89 DAF. Frutos colhidos aos 104 DAF apresentaram casca marrom-escura.

Termos de indexação: crescimento do fruto, *Litchi chinensis* Sonn., sólidos solúveis, acidez.

([1]) Received for publication in December 18th 1995 and approved in May 6th 1996.

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1. INTRODUCTION

Litchi (*Litchi chinensis* Sonn.) has diffused from Southern China throughout the tropical regions of India, USA, Brazil, South Africa and Australia (Costes, 1987; Lee & Wicker, 1991). The fruit is classified as a drupe and its delicious and pleasant flavor makes it well appreciated by consumers. Regardless of its quality for *in natura* consumption, it can also be canned, dried or used in the juice industry (Paull & Chen, 1987). Litchi growing areas in Brazil are restricted to the Southern States, but more recently, new areas have been established in the Northern States of Brazil (Martinez, 1992). In spite of this recent expansion, growing areas are small compared to the large number of potentially favorable ecological regions existing in Brazil. Also, no information is available about fruit growth and compositional changes throughout fruit development in Brazil.

The objective of the present study is to determine some physical and compositional changes during various stages of litchi development. Information on the relationship of growth and quality parameters is vital for the establishment of fruit maturity standards for Brazilian growers.

2. MATERIAL AND METHODS

A group of thirty adult trees of litchi cv. Brewster were randomly selected for the experiment at the Federal University of Viçosa Research Station, State of Minas Gerais, Brazil. Panicles were tagged when approximately 75% of flowers were opened, and a minimum of 20 fruits in four replicates were used for the analyses conducted. Fruits were harvested every 12 to 17 days, beginning at 30 or 45 days after flowering (DAF), depending on which parameter was being analyzed. The experiment was conducted during the growing season, from October, 1991 to mid January, 1992.

Fruits were harvested and immediately weighed in the laboratory. Each fruit was then separated into seed, aril (pulp) and skin for further analyses. The length and diameter of fruit and seed were measured with a vernier caliper. Composed aliquots of pulp juice in 10 replicates were used to determine total soluble solids and tritratable acidity. A small juice sample was used for total soluble solids determination by using a hand refractometer maintained at 25°C and standardized with water. Pulp homogenate was titrated with 0.01 N NaOH until pH 8.3 and the results were expressed in percentage of malic acid.

3. RESULTS AND DISCUSSION

Total fruit and aril fresh weight increase was initially slow and then became faster until approximately 45 days after flowering (DAF) (Figure 1). From 80 DAF onwards, the rate of growth started to fall, but trends of weight increase occurred until later stages of fruit and aril development. At later stages of development, there was no increase in fruit length and diameter; thus the observed fruit fresh weight increase was mainly due to aril growth (Figure 1). Huang & Xu (1983) studying fruit growth of different litchi cultivars observed similar trends of fruit and aril fresh weight increase at later stages of fruit development.

Total skin and seed fresh weight was increasingly higher until 77 DAF, followed by a phase with little changes. These results are similar to those found during fruit growth of an apparent earlier cultivar Haui Zhi (Huang & Qiu, 1987). Cultivar Brewster fruit developmental cycle was similar to those found for cultivars like Gui Wei and Mei selection, in which a prolonged initial lag phase is present before growing (Paull et al., 1984).

From panicle flowering until 45 DAF, 95% of fruit fresh weight was due to the combined individual weights of fruit seed and skin (Figure 2). This proportion dropped to about 40% at 104 DAF, with 14% and 26% due to seed and skin weight, respectively. At the end of drupe development, aril alone accounted for the remaining 60% of total fruit weight. This ratio was lower to the 72% average found in cultivars like Early Large Red, Calcuttia, Muzaffarpur and Bedana (Singh et al., 1987); the lower proportion of edible portion present in the cv. Brewster seems to be due to its greater skin weight at the end of development.

Fruit length and diameter became increasingly greater from 30 to 77 DAF, followed by no apparent changes in both dimensions (Figure 1). Unlike fruit length and diameter, seed length presented a slight decrease from 77 DAF, but seed diameter showed 26% reduction at the same stage (Figure 2). Thus, the reduction of seed dimensions could be due to possible water movement from the seed to the aril and skin; this fact might explain the slight decrease observed in seed fresh weight (Figures 1 and 2). In a previous report, Huang & Qiu (1987) found negative influx of water at later stages of embryo and seedcoat development, while the aril showed positive influx of water.

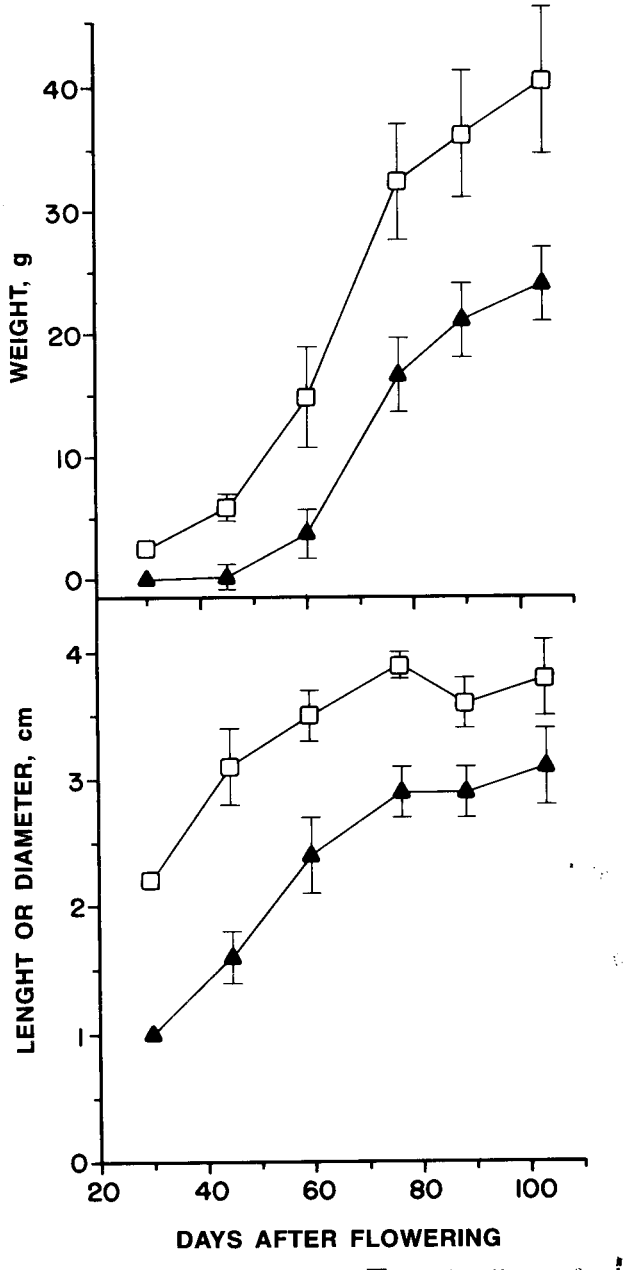

Figure 1. Changes in fruit (□) and aril (σ) fresh weights (upper figure), and in length (□) and diameter (σ) (lower figure) throughout development of litchi cv. Brewster.

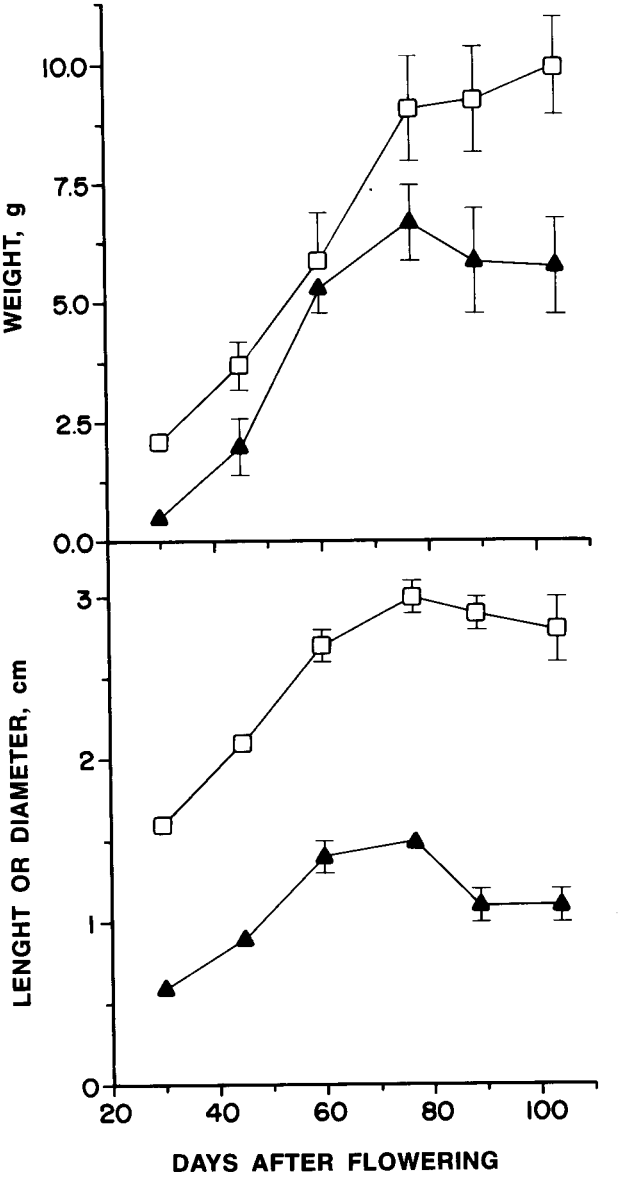

Figure 2. Changes in skin (□) and seed (σ) fresh weights (upper figure), and length (□) and diameter (σ) of seed (lower figure) throughout development of litchi fruit cv. Brewster.

Higher values for aril total soluble solids were found at 77 DAF, remaining stable afterwards (Figure 3). The rapid build up of 10.8 to 19.4% in the aril total soluble solids occurred from 45 to 77 DAF, coinciding with the exponential phase of fruit and aril growth; however, no further accumulation of soluble solids seemed to participate in the increase of fruit and aril weight observed at later stages of their development cycle (Figures 1 and 3). Fruit acidity dropped from 6.2% at 45 DAF to 0.6% at about 89 DAF, with no changes onwards (Figure 3). Full mature fruit level of soluble solids and acidity found for cv. Brewster were similar to those observed in cultivars like Calcuttia, Huai Zhi and Bedana (Gaur & Baipai, 1977; Huang & Xu, 1983; Singh et al., 1987). Base on available data, the horticultural standard for harvesting mature red fruit occurs after 89 DAF. Under the conditions of this experiment, harvest after 104 DAF is not recommended, because skin browning becomes enhanced.

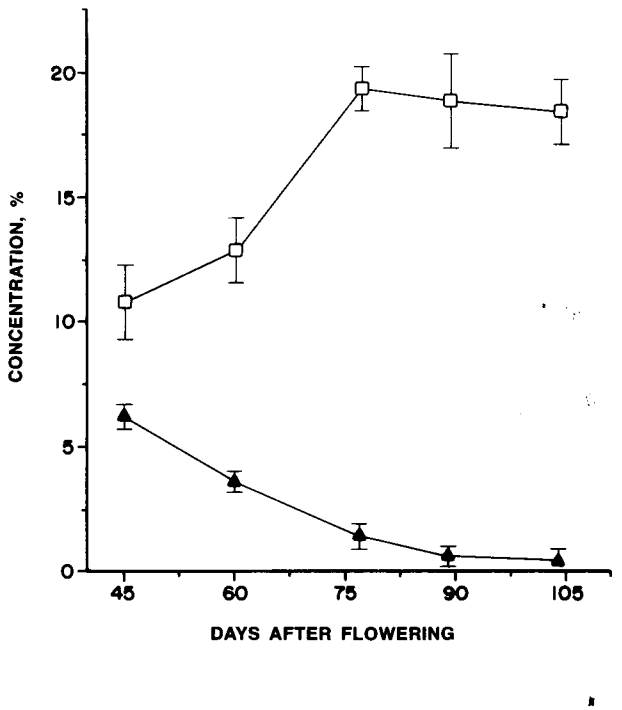

Figure 3. Total soluble solids (□) and acidity (σ) changes in developing fruit of litchi cv. Brewster.

4. CONCLUSIONS

1. Litchi fruit cv. Brewster showed a simple sigmoid curve during development. The exponential phase of growth started at about 45 days after panicle opening (DAF) lasting until 80 DAF. Lower growth rates were observed until the end of developmental cycle at 104 DAF.

2. Soluble solids reached a maximum value at 77 days after panicle flowering (DAF), but acidity stabilized at a lower level from 89 DAF.

3. Mature red fruits were obtained from 89 DAF, but 104 days old fruit were overripe.

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