

## COMPARATIVE SEASONAL DEVELOPMENT OF AVOCADO FRUITS AND SEEDS

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### Introduction

Studies of the growth of fruits and their integral parts, aside from being of morphological interest, are of horticultural importance because of the influence which various cultural practices such as fertilizer application and irrigation may have on fruit growth and development. The avocado presents an interesting group of fruits for such studies due to the wide range between varieties in time of maturity, size and shape of fruit, and also in relative size of seed. The relative size of seed in some varieties, Lula, for example, seems to vary from year to year and from location to location, and in many instances the seed is so large as to constitute an undesirably high proportion of the fruit volume. If relative size of seed of such varieties could in some measure be controlled through modification of the cultural practices an important step ahead, marketwise, would be achieved. With the above considerations in mind growth studies were undertaken in 1942 of two avocado varieties, Lula and Taylor, both important commercially in Florida. The trees were located on the grounds of the U. S. D. A. Subtropical Fruit Field Station at Orlando.

### Methods

In early May, shortly after the young fruits had set, 100 fruits of each variety were labeled with numbered tags. The length and width of each fruit were carefully measured at intervals of 2 weeks at first, and later at 3 and 4-week intervals as fruit growth became less rapid. In the first few intervals some loss of tagged fruit was experienced due to normal fruit shedding. The dropped fruits were replaced by tagging others on the tree selected for size to conform with the average measurement of the group remaining on the tree at the time of measurement.

At each time of measurement a sample of approximately 10 untagged fruits of average size were picked from the tree and were measured and weighed. Estimates of the weights of the tagged fruits on the tree were calculated from their measurements by reference to the relation of weights of the picked sample to its fruit measurements. The picked fruits were then cut in half so that the embryos, integuments, and endosperm could be removed and their size and weights recorded.

## Results

**Embryo Development.** The relation of the embryo, integument, and endosperm in a young avocado fruit is shown in Fig. 1. Together they constitute the seed. When the young fruit is approximately 1 inch long the embryo comprises only about 20 percent of the weight of the seed. When the fruit is fully matured, however, the embryo, consisting almost entirely of cotyledons, constitutes practically the total weight of the seed except for the remnant of the integument which then appears as a thin brown, parchment-like covering.

**Integument.** The integument in the very young fruit constitutes the principal volume of the seed. It grows rapidly at about the same rate as the embryo until approximately August 1 in the case of the Lula variety, and until September 1 in the Taylor. From then on the integument, although increasing in size to cover the rapidly growing embryo, becomes thinner and thinner and gradually loses weight until it finally shrivels to the brown, paper-thin covering which forms the seed coat of the mature seed.

**Endosperm.** The endosperm in the seed of a very young fruit appears as a yellowish, jelly-like layer between the embryo and the integument. Presumably it is used up in nourishing the developing embryo, and it finally disappears entirely by June 1 in the Lula variety, and about July 1 in the case of Taylor.

**Growth Curves of Fruit and Seed.** The curves of growth as expressed by fruit length and width are shown in Figs. 2 and 3 for the Lula and Taylor varieties, respectively. The rate of fruit elongation in both varieties proceeds somewhat more rapidly than the rate of growth in fruit width. The size increase in Lula, as might be expected because of its earlier maturity, is more abrupt and is crowded into a shorter growing period than in the case of Taylor. The increase in weight of the fruits as a whole and of the flesh and seeds separately is shown for the two varieties in Figs 4 and 5. It can be noted that the increase in seed weight of the Taylor variety ceases about September 21 but in Lula the seed growth continues until about October 19. This difference of about a month in the time of cessation of seed growth between Lula and the later maturing Taylor variety is the reverse of the situation already noted in the time of cessation of integument growth and in the time of disappearance of the endosperm.

After cessation of seed growth further increase in weight of fruit in both varieties is obviously entirely due to flesh development. Oddly enough, Lula continues its increase in weight well past its normal maturity date, whereas Taylor is seen in Fig. 5 to start to lose some weight after its steady increase up to December 14. It is not known whether this seemingly odd loss of weight of Taylor is always characteristic of the variety or whether it was due to some unknown seasonal factor. The tree did not suffer from lack of moisture during this period, and the fruit measurement curves (Fig. 5) show that size of fruit was increasing despite the loss in weight.

**Loss of Fruit Weight After Picking.** Without relation to the growth studies reported here, some data were obtained incidentally on loss of fruit weight after picking, which seem worth mentioning as of general interest in the problem of avocado fruit storage. At the termination of the experiment on February 8 all the tagged fruits were picked from

the tree. The weight of each fruit was recorded and the fruits stored at room temperature to soften in order to facilitate removal of seeds on which weights were also desired. The Taylor fruits were reweighed 7 days later and were found to have lost 5.8 percent of their harvest weight. The Lula fruits were reweighed 10 days after picking and had lost 6.9 percent in weight.

## Summary

Growth curves of the fruits and seeds are presented for two important Florida avocado varieties, Lula and Taylor. Lula, the earlier maturing of the two, makes a more rapid fruit growth during June, July, August, and September, than does Taylor. In the season of 1942 Taylor stopped its gain in fruit weight by December 14 and thereafter lost weight although continuing to increase slightly in size. Lula continued to gain appreciably in weight after November 16 and up to February 8 without appreciable gain in size

The seeds of Taylor ceased to increase in weight after about September 21, while Lula seeds continued to gain until about October 19. The notably large seed size in the Lula variety is a reflection of more rapid seed growth, during a longer growth period than occurs in the case of Taylor.

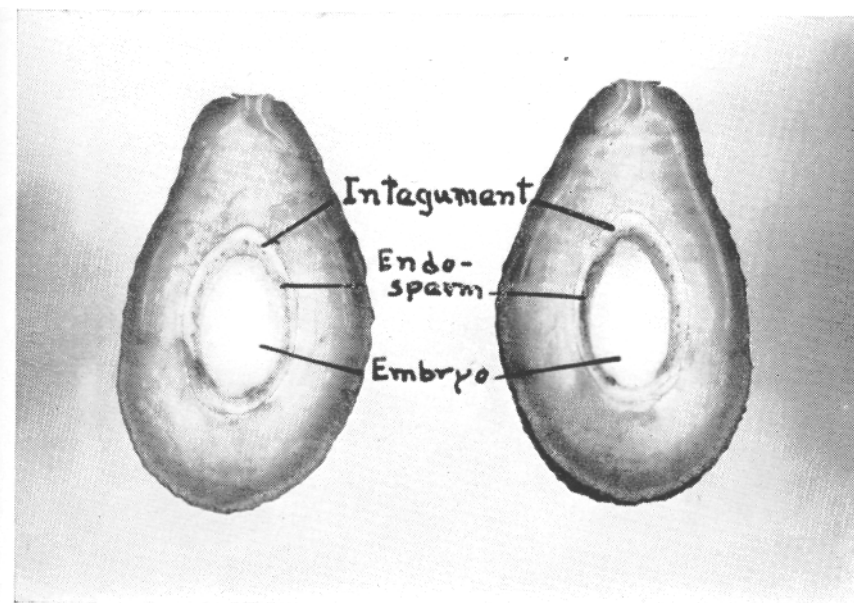


Fig. 1. Young avocado fruit sectioned longitudinally to show the relation and development on May 15 of the integument, endosperm and embryo, which together constitute the seed.

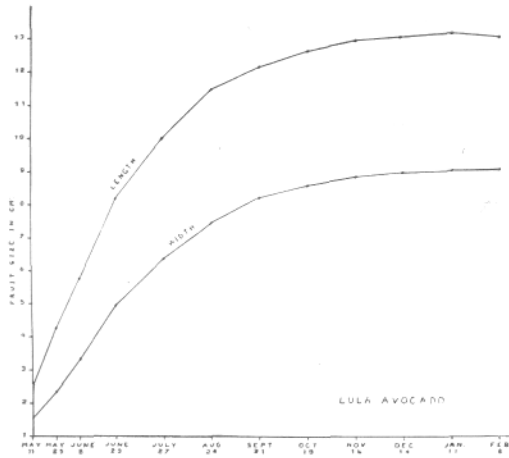


Fig. 2. Length and width growth curves of Lula avocado fruit.

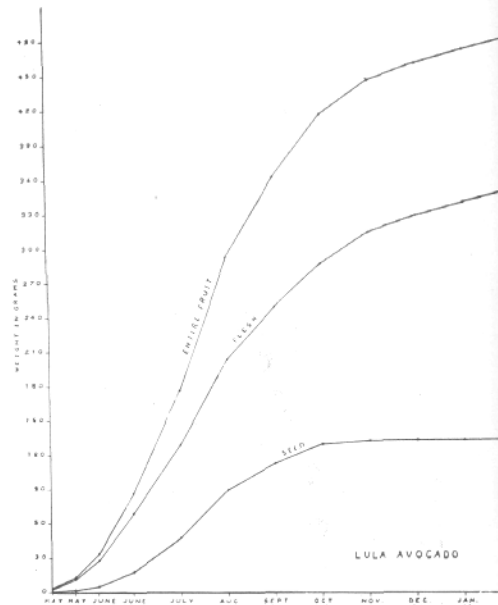


Fig. 4. Growth in weight of Lula fruit and seed.

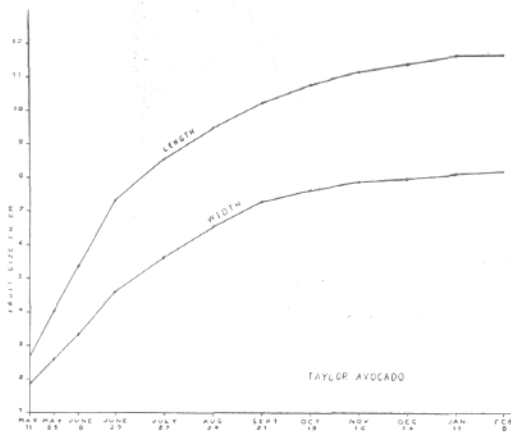


Fig. 3. Length and width growth curves of Taylor avocado fruit.