

## SOME INTERESTING EARLY- MATURING AVOCADOS

**W. B. Storey and B. O. Bergh**

*Horticulturist and Assistant Geneticist*

*Citrus Research Center and Agricultural Experiment Station,  
Riverside, California.*

### INTRODUCTION

The term "early-maturing" in our title is used to designate avocados which mature their fruits in the fall seven to nine months after blooming. Thus the avocados to be discussed are distinct from others such as the Hass and MacArthur, which may mature their fruits at the same time of year but which require 15 to 20 months from fruit set to do so.

The avocados discussed in this paper are therefore of greater interest to regions with early fruit maturity (such as the Pauma or San Joaquin valleys), rather than later-maturing regions (such as coastal Ventura or Santa Barbara counties) which depend upon late-maturing varieties of Guatemalan type to reach the attractive fall avocado market. Early-maturing avocados are also of interest to regions in which winter wind or frost hazards make later-maturing fruits too risky.

The Fuerte avocado has dominated the market continuously since 1927, when it superseded Taft as the leading California variety. For over 30 years it has accounted for 60 to 85% of all avocado deliveries to California packing houses. It has become the standard by which all other avocados are judged, especially with regard to quality, size, shape, color, and market appeal.

Fuerte, however, is primarily a winter and early spring variety, with a season of maturity extending from November of one year into April of the next. The earliest and latest dates on which Fuerte can be harvested depend upon the climate of the areas in which it is grown; hence for any one region the harvest season will vary from year to year.

When avocado breeding was initiated by R. W. Hodgson at the University of California at Los Angeles in 1939 (2), there was an acute need for good varieties to fill the gap between the end of one Fuerte season and the beginning of the next. The early spring market, i.e. from about April through June, was supplied by a number of well-known varieties, principally Dickinson, Nabal, Spinks, Anaheim, Mayapan, and Benik. These are largely of the Guatemalan type, and while generally acceptable in quality, lacked market appeal because of their large size, and, in some cases, their dark or hard, unyielding, and rough skins. Thus, the need for better spring and early summer varieties was well recognized, and much of the breeding effort was directed toward meeting this need.

The need for late summer and fall varieties was even more acute, however. The late summer and fall season was supplied principally by Puebla, and to a much lesser extent

by Topa Topa, Duke, Ganter, and a multitude of Mexican race seedlings lumped together as "thinskins." In order to produce hybrids, which, hopefully, would combine the early characteristics of the Mexican thinskins with the highly desirable attributes of Fuerte as a market fruit, Lammerts used Blake, Duke, Leucadia, and Mexicola in crosses with Fuerte in his early breeding work (3). Later, Schroeder (5) at U.C.L.A. used Mexicola in many cross combinations, and Lesley at Riverside used Jalna and Duke mainly in crosses with Fuerte.

In 1945, the variety Hass, which has been registered with the California Avocado Society in 1932 and patented in 1935 by Mr. R. G. Hass, was brought into prominence through an article by H. B. Griswold in the 1945 California Avocado Society Yearbook (1). Because of its excellent quality, it climbed steadily from obscurity in 1944 to the place of second only to Fuerte in importance by 1953, a position which it has maintained ever since. In recent years it has represented about 14% of total marketings, compared with Fuerte's 60% or so.

Hass is a medium-sized, dark, rough, thick-skinned variety of the Guatemalan type. Despite these seemingly unsurmountable handicaps, it has risen to its present level of importance largely for three reasons: (1) Its high degree of palatability and over-all good quality, which many persons consider superior to Fuerte; (2) Its season of maturity, which commences about the time the last of the Fuertes are being harvested and which, depending upon locality, may extend into August or beyond; and, (3) Its high yielding ability. These characteristics have enabled it to dominate the spring and early summer markets. Its success, however, was not entirely spontaneous. It might not have come about at all without well-planned and vigorous promotion.

Hass has, to a great extent, obviated the pressing need for a good spring and summer variety that existed in earlier years. The need for a good fall variety still exists, however, for Hass production tapers off toward the end of summer, and, at best, carries up to the onset of the Fuerte season only in cool years and in the cooler coastal regions.

The search has continued, therefore, for early-maturing avocados of high quality, good appearance, and ready marketability to supplement if not supplant the small Mexican varieties and the nondescript thinskins which continue to account for a high percentage of fall marketings. Some interesting, and a few promising, types have been discovered among purposely bred hybrid progenies, chance seedlings, and introductions of foreign origin. Twelve of these are described below.



Fig. 1. (A) Arturo

**ARTURO** (Fig 1, A) —

Origin: Originated with A. R. Chenoweth, Fallbrook, California in 1933. Patented with this name as plant patent no. 667, issued January 15, 1946. Tree is classified as being of the Mexican race. Registered by the California Avocado Society, and described in the first check list, which was published in 1950 (4).

Shape: Long oval.

Weight: 6-10 oz.

Seed: 1½ -2½ oz.; tight in cavity; coats adhere to seed at full ripeness; 20-25% of fruit.

Skin: Color, dull green; texture ,soft-leathery; surface, slightly rough from raised lenticels; lenticels, numerous but tend to be well dispersed and separate; end-spot, slight; corkiness, none in early part of season but becoming progressively worse as season progresses; peeling quality, excellent.

Flesh: Clear light yellow; fiber-free; soft and melting in texture; quality very good, flavor mild.

Remarks: The season for Arturo in Riverside extends from September into December, rather than into April as indicated by the check list. Possibly fruit might carry on the tree into April in cool coastal areas. In Riverside and San Bernardino, apical end deterioration begins to set in November, and although the fruit can be held on the tree until the middle of December, deterioration is very extensive by that time.

Arturo is one of the highest quality early varieties tested in Riverside, with oil at 11.5% as early as September 20.

Mr. Harlan Griswold once had Arturo under trial at San Luis Rey Heights in San Diego

County but gave it up because of low yields.. In a trial orchard at East Highlands in San Bernardino County, the fruit has been excellent, but bearing of the tree has been erratic. In Riverside, the tree has been a consistently good producer for the past five years.

Grafted trees of Arturo tend to develop a strong central leader and long, slender, drooping lateral branches which form a fairly open head, somewhat like Zutano.

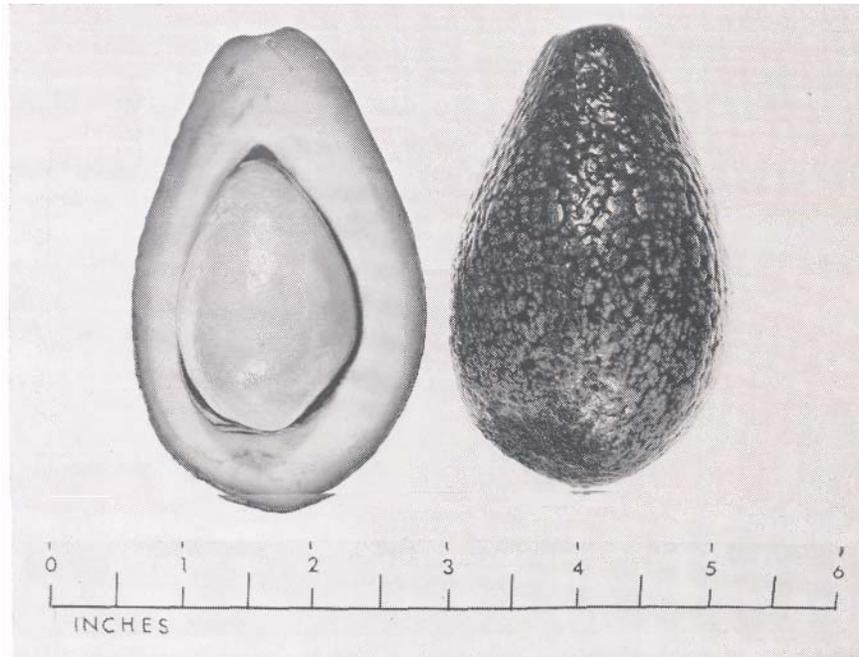


Figure 1. (B) Ettinger

**ETTINGER** (Fig. 1,B) —

Origin: Originated as a seedling of Fuerte in Israel where it is second in importance only to Fuerte. Introduced into the United States by the U.S. Department of Plant Introduction, as P.I. 218196. Propagated at the Citrus Research Center from buds received from the U.S.D.A. in 1959. Fruited for the first time in the fall of 1962.

Shape: Pyriform.

Weight: 6-12 oz.

Seed: 1½ -2½ oz., loose in cavity; seed coats adhere to flesh; 20-30% of fruit.

Skin: Color, bright green; texture, soft leathery; surface slightly rough from raised lenticels; lenticels, scattered toward basal end, numerous and coalescing toward apical end; corkiness, slight, mostly toward apical end; end-spot, severe, appearing early; peeling quality, excellent.

Flesh: Clear light yellow; fiber-free; soft and melting in texture; quality excellent, comparable to that of Fuerte; no oil determination has been made.

Remarks: As noted earlier, this is a leading commercial variety in Israel. In that country its period of ripening well precedes the onset of the Fuerte season.

The trees at Riverside grow well, and give the impression that they will be good producers. They tend to grow with a strong central leader and drooping lateral

branches. It does not appear, however, that they will mature their fruits much in advance of Fuerte under our conditions.

It seems unlikely that Ettinger will ever become important in California. The following characteristics militate against it: (1) Seed too large; (2) Seed loose in cavity; (3) Seed coats adherent to flesh; (4) Some tendency to surface corking; (5) Pronounced tendency toward end-spotting; and, (6) Season which coincides, at least in part, with Fuerte.

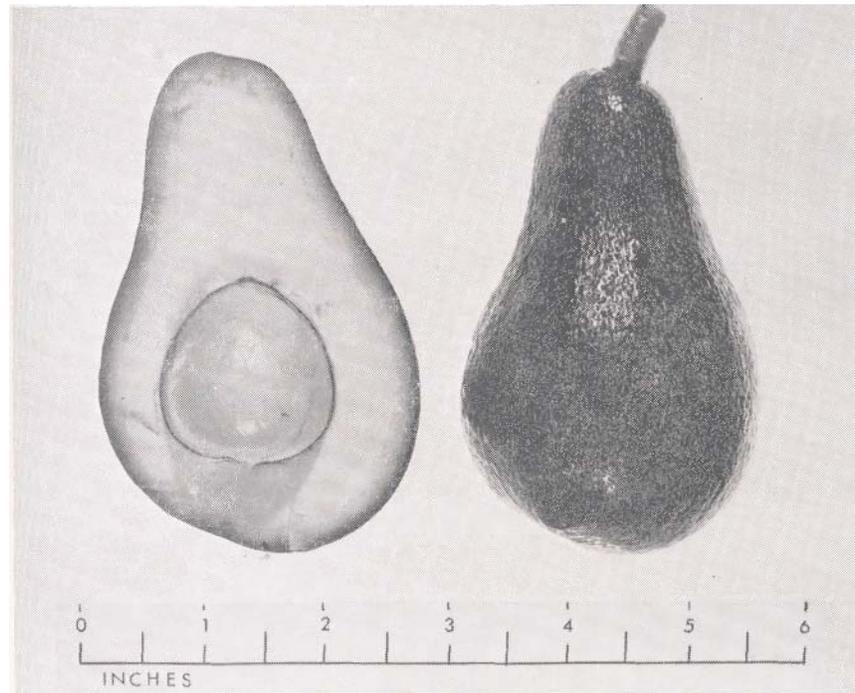


Figure 1. (C) Stewart

**STEWART** (Fig. 1, C) —

Origin: Originated as a seedling of a Mexican race avocado (possibly Mexicola) on the Stewart Ranch at Mentone, San Bernardino County, California. First propagated for trial in the C.R.C. avocado variety orchard in 1952. The variety has been propagated and distributed to some extent as Stewart, a name which has never been registered with the California Avocado Society and does not appear in any check list.

Shape: Pyriform.

Weight: 6-10 oz.

Seed:  $\frac{1}{2}$  -2 oz.; tight in cavity; coats adhere to seed; 10-20% of fruit.

Skin: Color, green but with a slight hint of purple at the basal end at early maturity, the purple becoming darker and suffusing over the entire surface. When the fruits reach fullest maturity and began to drop, the color is a rich dark purple; slightly rough from raised lenticels which are sparse and scattered near the base but very numerous with much coalescence at the apex; corkiness, none to very slight; end-spot, none, texture, soft-leathery, with excellent peeling characteristics.

Flesh: Clear, bright, light yellow shading into green toward the rind; firm, but melting in

texture; of excellent quality and high palatability.

Remarks: The Stewart tree is a strong, spreading, vigorous grower. In early years it was thought to have a marked tendency toward alternate bearing. At Riverside, however, it has borne good crops for the past four or five years in succession.

Its season of bearing at Mentone and Riverside extends from early October to the middle of December. Oil determinations on Riverside fruits show the oil content to be above 8.0% by the first of October, about 12.0% by October 15, and about 16.0% by the middle of November. The last fruits of the season drop about the middle of December. They do so without the serious blossom-end deterioration which characterizes many varieties as they pass beyond the period of optimum maturity. Also, they do not become strong and "cheesy" in flavor to the point of unpalatability as do many varieties.

Stewart has many qualities to recommend it. Probably its worst drawback from the standpoint of marketability would be its dark skin.

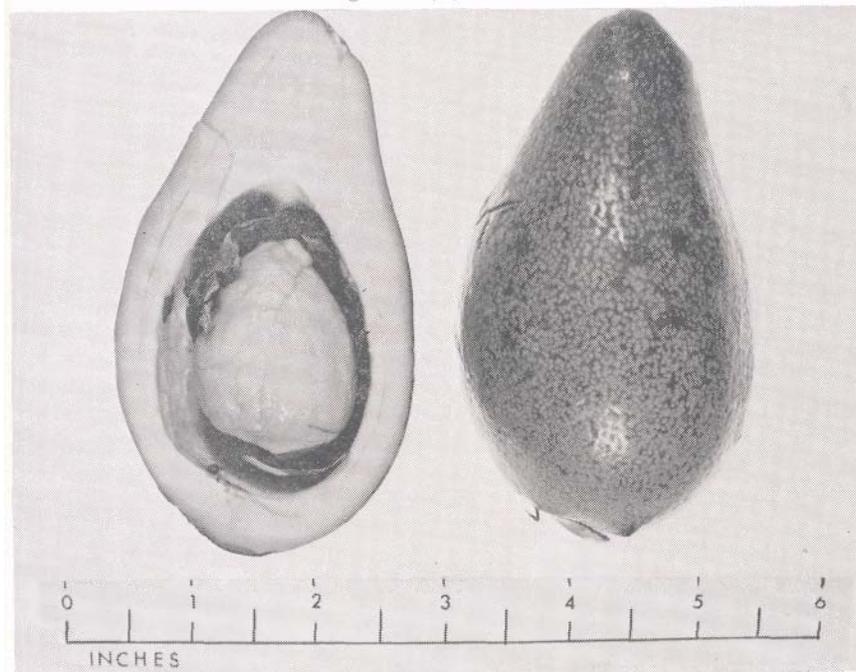


Figure 1. (D) Yama

**YAMA** (Fig. 1, D) —

Origin: This variety originated with C. Yamaguchi at Cucamonga, San Bernardino County, California. Its name and description appear in the check list in the 1950 Yearbook of the California Avocado Society. It was classified as being of the Mexican race, and, indeed, the over-all aspects of tree and fruit suggest Duke.

Shape: Pyriform.

Weight: 6-8 oz.

Seed:  $\frac{1}{2}$  - 1 oz.; loose in cavity, seed coats papery, but tend to adhere to flesh; 10-15% of fruit weight.

Skin: Light green; dull as the fruit hangs on the tree from a fairly heavy surface bloom; glossy when bloom is wiped off; surface of skin, smooth; lenticels, flat, sparse toward apex, numerous and coalescing toward apex; skin very thin, easily rubbed off; peeling quality, poor; corkiness, none to very slight; end-spot, none.

Flesh: Clear pale yellow; fiber-free; soft and melting in texture; mild in flavor; over-all quality, good.

Remarks: At Cucamonga, East Highlands, and Riverside, Yama has been a consistently fairly good to good bearer, with fruits which can be harvested early in September. No September oil determinations are available, but October determinations are; those show oil content around the middle of October to be 15-16%.

As a fruit, Yama has little in its favor, for it has a very easily injured skin, seed coats which adhere to the flesh, and a large cavity in which the seed rattles about, as may be seen in Figure 1, D. As a tree, however, it has attracted a great deal of interest because of its observed high degree of tolerance to cold. This was particularly striking in the fall of 1958, when virtually every other variety in a test planting on the Newhall Ranch at Piru was either killed outright or severely damaged. Yama showed little injury, from temperatures which were below 22° F for six hours. This suggests that it might have a place for persons with the desire to grow an avocado in a location which is too cold for the better varieties. Its potentialities in breeding for cold tolerance are indicated, also.

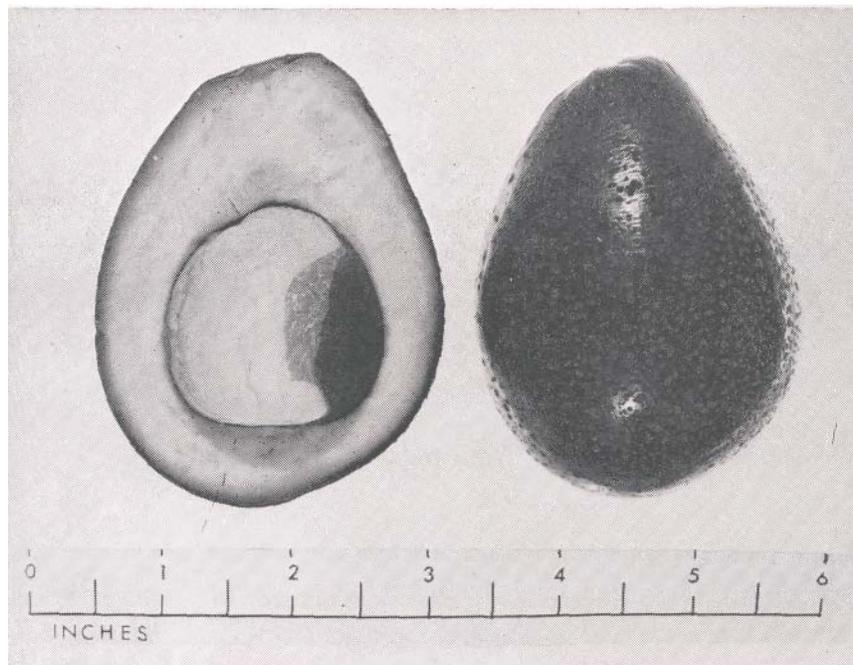


Figure 1. (E) CRC-11-4

**CRC-11-4** (Fig. 1, E)—

Origin: Seedling of a cross between Emerald and Fuerte made by J. W. Lesley in 1951.  
Shape: Oval. Weight: 4-6 oz.

Seed:  $\frac{3}{4}$  -1.0 oz., tight in cavity, seed coats adherent to seed; 15-20% of fruit weight.

Skin: Dark, dull green; slightly rough from barely elevated lenticels; lenticels scattered more or less uniformly on surface; medium in thickness; tough; peeling quality, excellent; corkiness slight, confined to lenticels; end-spot, none.

Flesh: Clear yellowish green; fiber-free; firm but melting in texture; flavor rich, over-all quality, very good; oil content in mid-October, 13%.

Remarks: This is a small October fruit of very good quality. A grafted tree at the South Coast Field Station near Santa Ana holds its fruit well into December, and the fruit develops less corkiness than at Riverside. The seedling parent tree has borne good crops several years in a row.

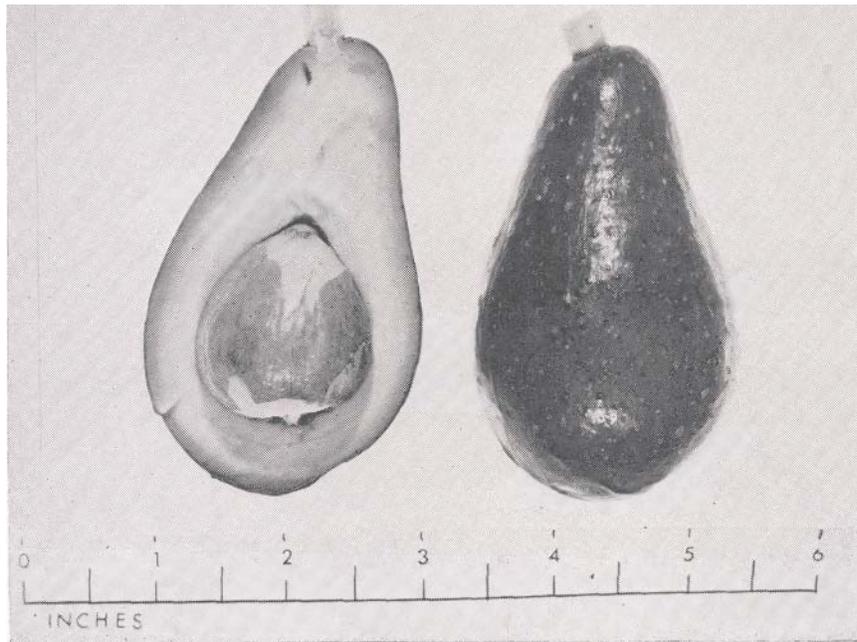


Figure 1. (F) CRC-11-6

**CRC-11-6** (Fig. 1, F)—

Origin: Same as CRC-11-4 above.

Shape: Pyriform.

Weight: 4½-6 oz.

Seed: 1-1½ oz., tight in cavity, coats adherent to seed; about 20% of fruit weight.

Skin: Dark, dull green; slightly rough from elevated, sparsely distributed lenticels, which are scattered more or less uniformly over the whole surface; medium in thickness; tough, peeling quality excellent; corkiness slight, confined to lenticels; end-spot none.

Flesh: Clear yellowish green throughout; fiber-free; firm but melting in texture; flavor rich; over-all quality very good; oil content in mid-October 13.0-14 %

Remarks: This is a sibling tree of CRC-11-4, previously described. It behaves similarly. At both Riverside and the South Coast Field Station it has been a consistently good bearer

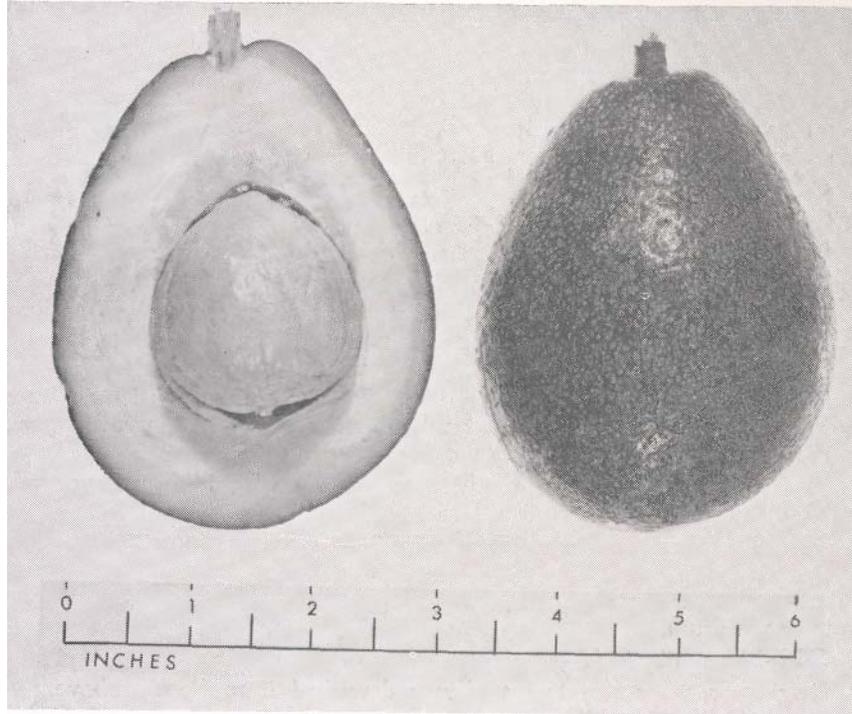


Figure 2. (A) CRC-14-II

**CRC-14-11** (Fig. 2, A) —

Origin: Seedling of a cross between Duke and Fuerte made by J W. Lesley in 1952.

Shape: Oval.

Weight: 12-16 oz.

Seed: 1.5-2.2 oz.; averaging about 13% of weight of fruit; tight in cavity; coats adherent to seed.

Skin: Dark, dull green; quite smooth, since lenticels, although numerous, are not raised; thin, but fairly tough; peels readily; corkiness and end-spotting absent.

Flesh: Light greenish yellow in color; smooth and buttery; fiber lacking; eating quality very good to excellent; oil content in mid-October 10-12%.

Remarks: The tree is a vigorous grower. The original seedling at Riverside under crowded conditions is tall and columnar with a strong central leader. A grafted duplicate at the South Coast Field Station is of medium height and spreading tendency. Under the adverse conditions in which it grows at Riverside, crops have been small to medium, although annual bearing has been fairly consistent. At the South Coast Field Station, crops have been better, averaging a "moderate" rating.

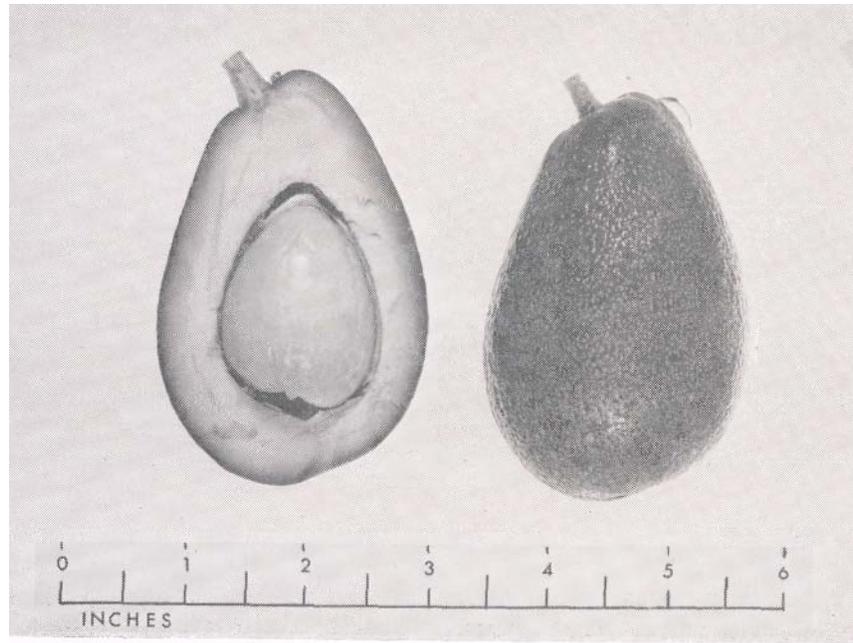


Figure 2. (B) CRC-14-43

**CRC-14-43** (Fig. 2, B)—

Origin: Same as CRC-14-11 above.

Shape: Oval.

Weight: 5-8 oz.

Seed: 1-1¼ oz., averaging 17% of weight of fruit; coats rather loose both on seed and flesh, and are readily removed from the flesh; fits fairly snugly but is not tight in cavity.

Skin: Dark green; smooth; thin to medium thickness; lenticels numerous, but not raised and fairly evenly distributed; peeling quality good; corkiness and end-spotting absent.

Flesh: Greenish yellow; smooth in texture; free from fiber; flavor very good; oil content—mid-October, 13.5-14.5%.

Remarks: This tree is a sibling of CRC-14-11, described above. The tree both a Riverside and the South Coast Field Station tends to grow upright with a strong central leader. It has been a good bearer, with crops rated at medium.

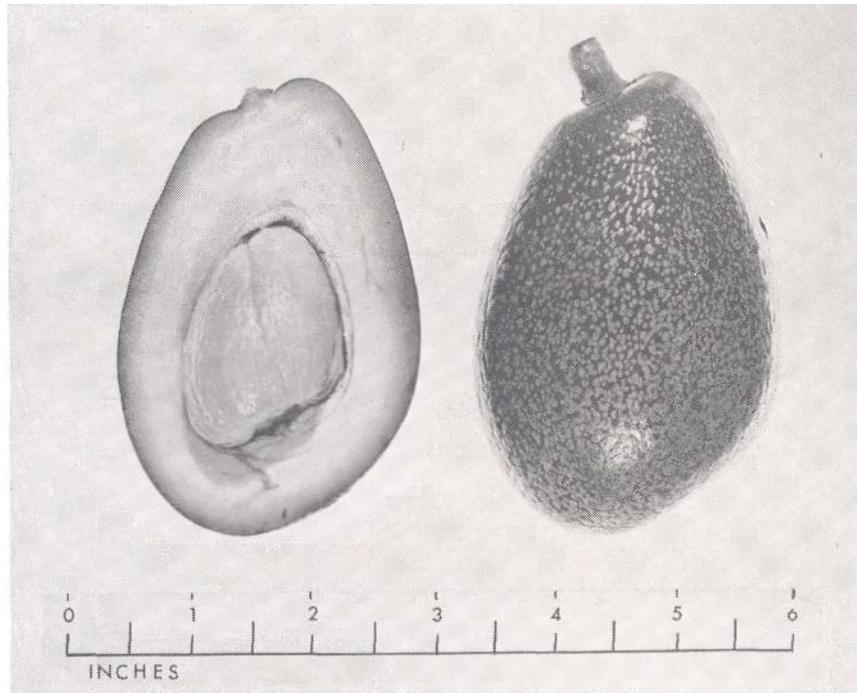


Figure 2. (C) CRC-14-72

**CRC-14-72** (Fig. 2, C)—

Origin: Same as the two seedlings described immediately above. Shape: Oval, with obliquely flattened apex and base. Weight: 4-8 oz.

Seed: 1-1½ oz., averaging about 17% of weight of fruit; tight in cavity; coats adherent to seed.

Skin: Medium to light green, slightly rough from numerous slightly raised lenticels; medium in thickness; peeling quality good. Corkiness is absent; but there is a slight tendency toward end-spotting.

Flesh: Greenish yellow; smooth in texture; fiber-free; flavor good; oil content in mid-October about 10%.

Remarks: As noted above, this tree is a sibling of the two in the 14-series previously described. The tree is a vigorous grower, and the crops have been fairly good.

Remarks: The parent tree at Riverside is a vigorous upright grower. Crops have been good since first bearing, with an exceptionally heavy crop in 1962.

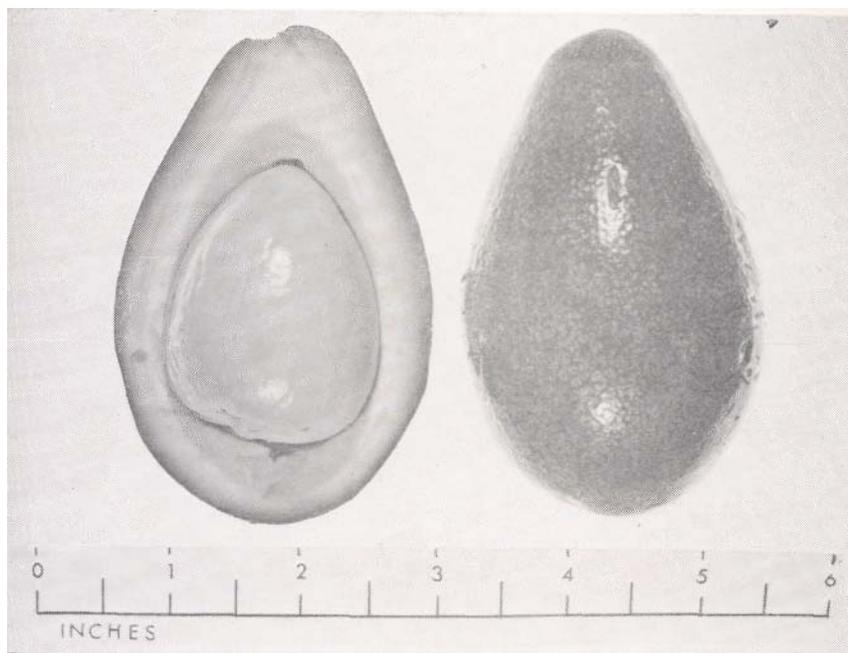


Figure 2. (E) CRC-CH-5

**CRC-CH-5** (Fig. 2, E)—

**Origin:** Seedling of the cross between Clifton and an unnamed West Indian type seedling. In 1955, scions of Clifton were sent to Hawaii where they were topworked into branches of a good type of West Indian tree by Mr. E. T. Fukunaga, Superintendent of the Kona Branch Station of the Hawaii Agricultural Experiment Station. When the Clifton scions fruited in 1956, the seeds were extracted from the fruits and mailed to the Citrus Research Center for growing. This seedling is the first of four to produce fruit.

**Shape:** Oval.

**Weight:** 6-10 oz.

**Seed:** Ranges from 20-25% of weight of fruit; tight in cavity; coats loose on seed, but separating easily from flesh.

**Skin:** Light glossy green; smooth, since lenticels are not raised; lenticels numerous, with greater concentration toward apex of fruit; thin, and soft in texture, but peels fairly readily; no corkiness or end-spotting.

**Flesh:** Light yellow shading to green toward rind; fiber-free; flavor bland; oil quantity at maturity not determined.

**Remarks:** This tree is of interest because it definitely displays West Indian characteristics. Hybrids between varieties of the West Indian and Mexican races have not been reported previously. Much of the interest in this type of cross focuses on the possibility of combining a purported higher tolerance of West Indian types to saline conditions with the demonstrated cold hardiness of Mexican types.



Figure 2. (F) CRC-JH-11

**CRC-JH-11** (Fig. 2, F)—

Origin: Seedling of the cross between Jalna and an unnamed West Indian type seedling, produced under the circumstances mentioned above for CRC-CH5.

Shape: Oval; slightly flattened at basal end.

Weight: 6-10 oz.

Seed:  $\frac{1}{2}$  - 1 oz.; averaging about 10% of weight of fruit; coats adherent to seed.

Skin: Smooth, with flat lenticels; lenticels small and numerous, especially toward apical end; dull green due to cover of light bloom; shiny when rubbed; at late maturity it has faint purple coloration showing through; thin, and more or less characteristic of Mexican race; palability only fair; corkiness none; end-spotting, a trace.

Flesh: Bright yellow, shading to green toward rind; flavor very good.

Remarks: The tree is of moderate vigorous growth. Crops have been light to medium.

The remarks pertaining to Mexican-West Indian hybrids above pertain here. Additionally, however, this tree has considerable promise as an early season producer. In most years, the fruits reach maturity early in September and show signs of deterioration by mid-October.

**CONCLUDING REMARKS**

The varieties and seedlings described herein are reviewed because either they continue to attract the interest of prospective growers or else they seem to have some special

promise which deserves their being given a trial by growers in various localities.

It must be pointed out that the observations reported herein were made mostly at Riverside on the grounds of the Citrus Research Center. Periods of ripening which obtain in this locality may differ quite widely when these avocados are grown in others of the numerous climatic zones in southern California. Also, the period for a given fruit may vary considerably from year to year, depending upon how climatic factors have advanced or delayed the season of flowering and what the climate has been like during the period of development from pollination to fruit maturity.

Productivity, also, is greatly influenced by climatic factors in a given year. In the past few years, all of the avocados mentioned have produced fair to excellent crops in Riverside. The 1963 crop, however, is extremely light on all varieties, and in some cases will fail completely. This, probably, reflects the extreme cold weather in January, just at the time of flower formation and opening. The cold snap, which caused some damage, was followed by the coolest spring and summer on record. A near-failure of fruit set is shown by such usually reliable bearers as Mexicola, Hass, Zutano, Duke, Dewey, and others, so we have some assurance that the failure of many hybrids to produce fruit this year is due not to inherent causes but to external influences. Reports from growers in other parts of the state indicate a normal or near-normal crop. Instead of a few years in a single location, therefore, one should observe performance over a fairly protracted span of years and in a number of representative locations.

The 12 varieties and seedlings described in this paper are summarized below with concluding remarks:

**ARTURO:** In most respects, this is an excellent variety, one deserving wider trial than it has so far been given.

**ETTINGER:** This variety was included because it continues to attract attention as a leading variety in Israel, and many California growers have expressed the opinion that its possibilities as a commercial type should be examined here. Unfortunately, its performance at Riverside gives no indication of usefulness under California conditions.

**STEWART:** A high quality variety which should be given wider trial. Its only serious drawback—dark skin at full maturity—has probably been overrated.

**YAMA:** Its main recommendations are the earliness of the fruiting season, and the high degree of cold hardiness of the tree.

**CRC-11-4:** Good quality October fruit, but probably not good enough in all respects for commercial planting.

**CRC-11-6:** Same as above.

**CRC-14-11:** A medium sized, most attractive fruit. Deserves wider trial.

**CRC-14-43:** One of the earliest. Fairly large seed with loose seed coats detracts from its otherwise high quality.

**CRC-14-72:** An attractive fruit, but with slight tendency to end-spotting. Should be tried more extensively.

**CRC-17-51:** One of the most promising in all respects, deserving extensive trial.

**CRC-CH-5:** Of horticultural interest only.

**CRC-JH-11:** A very early, fairly promising type for more extensive trial.

### LITERATURE CITED

1. Griswold, H. B. 1945. The Hass avocado. California Avocado Soc. Ybk. 1945:27-31.
2. Lammerts, W. E. 1942. Progress report on avocado breeding. California Avocado Soc. Ybk. 1942: 36-41.
3. Lammerts, W. E. 1945. The avocado breeding project. California Avocado Soc. Ybk. 1945: 74-80.
4. Rounds, M. B. 1950. Check list of avocado varieties. California Avocado Soc. Ybk. 1950: 178-205.
5. Schroeder, C. A. 1948. Progress report on avocado breeding. California Avocado Soc. Ybk. 1948: 71-73.

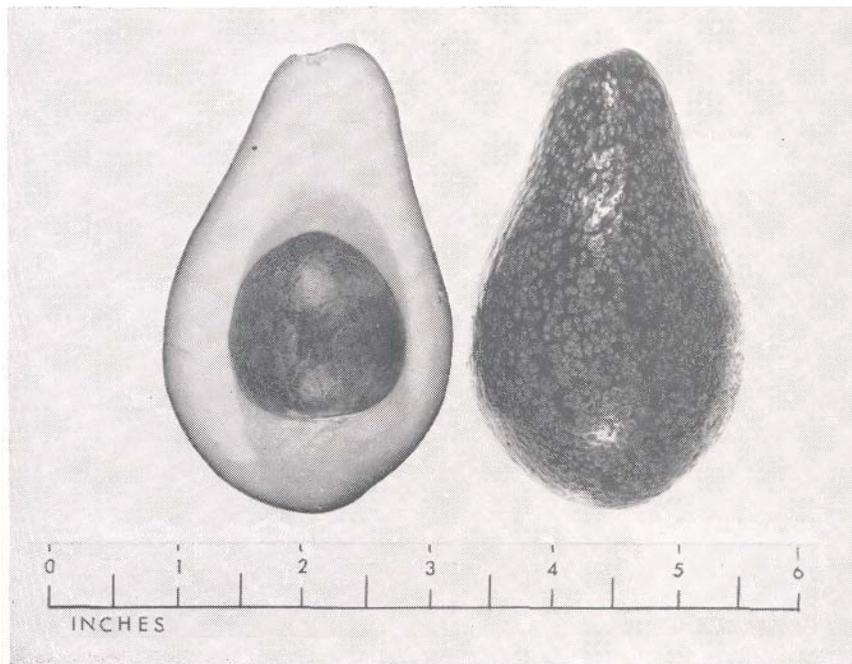


Figure 2. (D) CRC-17-51

### **CRC-17-51 (Fig. 2, D)—**

Origin: Seedling of a cross between Hass and Clifton made by J. W. Lesley in 1952.  
Shape: Pyriform. Weight: 4-10 oz.

Seed:  $\frac{1}{2}$  - 1 oz.; averaging about 12% of weight of fruit; tight in cavity; coats adherent to seed.

Skin: Light shiny green; slight undertone of purple appears toward end of season pebbled with slightly raised lenticels; lenticels numerous and more or less evenly

distributed; medium in thickness; soft-leathery in texture; peeling characteristic excellent; no corkiness or end-spotting.

Flesh: Greenish yellow; smooth in texture; fiber-free; flavor, excellent; oil content at full maturity not determined.