

SELF-POLLINATED HASS SEEDLINGS

B. O. Bergh and R. H. Whitsell

Plant Sciences Dept., University of California, Riverside

The 'Hass' is gradually replacing 'Fuerte' as California's leading avocado cultivar (variety).

After overcoming strong initial objections to its dark skin color, it has gained steadily in popularity. Most United States markets still somewhat prefer a green-skinned fruit, but 'Hass' is showing more and more consumers that a dark skin can surround superbly-flavored avocado flesh.

By 1971, over 60% of all avocado trees for sale in California were 'Hass', and only 6% 'Fuerte' (Rock, 1972). His projections indicate that by 1977, 'Hass' should account for nearly half of the total California bearing acreage, compared with just over one-quarter for 'Fuerte'. Since 'Fuerte' bearing acreage was over twice that of 'Hass' as recently as 1969, this indicates an exceptionally rapid cultivar changeover for a long-lived tree fruit like the avocado.

Yet 'Hass' is inferior to 'Fuerte' in several respects. In addition to the declining factor of skin color, it is considerably more susceptible to frost injury; also to other adverse environmental conditions; also, its summer harvesting season is probably somewhat less desirable than the winter season — although we naturally want to have abundant supplies for the market the year around.

Why then is 'Hass' being planted to the near-exclusion of 'Fuerte'?

The main reason of course is its much more consistent fruit yields. (See, for example, Gustafson, 1973.) 'Fuerte' is notoriously erratic (Coit, 1972) in bearing habits, but a 'Hass' tree will usually have a heavy crop every other year. A 'Hass' grove will therefore usually average a good crop each year, with about half of the trees "on" when the other half are "off". Adverse conditions during the blooming period, especially cold weather, may result in a near crop-failure on 'Fuerte'. 'Hass' trees in the same location will probably have a reduced but still substantial crop. This relatively uniform production is of direct advantage to the grower, who needs a reasonably uniform annual income. Indirectly, it benefits him further by making possible steady market development. A fruit industry needs the foundation of reasonably consistent annual production.

Another 'Hass' advantage over 'Fuerte' is its thicker skin. This means that the fruit will better withstand handling, and can be shipped longer distances without surface deterioration.

'Hass' possesses a number of desirable breeding traits in addition. It performs well over an unusually wide range of locations. Its seed averages small, and it passes this trait on to a gratifyingly large proportion of its offspring. Its flavor is very good, and again most

of its progeny inherit this desirable trait. It has a remarkably long harvesting season, inherited by the 'Alboyce' for example. Whereas most 'Fuerte' seedlings never set fruit, and most setters have fruits of deplorable size, shape and seed ratio, 'Hass' seedlings average exceptionally high setting ability and quality.

A previous publication (Bergs, 1966) described fruits from seedlings produced by open-pollinated 'Hass' trees. That is, the male parent was not known. Outcrossing is favored in the avocado by its peculiar flower behavior whereby all of the flowers of a given cultivar in a grove are functionally male one part of the day and female a different part. Therefore, while some of the seeds from open-pollination would doubtless be selfed, many others would be the product of cross-pollination.

Selfing — for example, when both the egg and the pollen are 'Hass' — is the only way to find out just what traits are genetically carried by any cultivar (variety). Otherwise, the male parent, whether known or unknown, may have been the source of the observed trait, whether good or bad.

Even, with selfing, variability among offspring will be immense. This permits efficient selection for improved commercial cultivars. For the peculiar avocado flower behavior has ensured countless generations of cross-pollination and so mixing up of the genes. We have looked at thousands of avocado trees produced by selfing and have never found two from a given parent that were identical or even close to it. Some parents are, however, considerably more genetically uniform than others.

Selfed seeds can be obtained by either caging a tree with a hive of bees, or harvesting seeds from a tree so far removed from any other cultivar that bee transportation of pollen is vanishingly unlikely. We have obtained 'Hass' selfs by both methods.

The northeast third of Field 5, South Coast Field Station, was planted to just over 300 seedlings resulting from 'Hass' self-pollination. This article reports on some of them.

One of the more surprising discoveries from the selfed-'Hass' seedlings as a whole was the presence of Mexican-race genes in this cultivar. Usually it has been considered a straight Guatemalan. Actually, it is made up about 1/6 (1/4 to 1/8) Mexican. This was shown by the segregation of such Mexican traits as thin skin, large seed and early maturity. The segregants with more Mexican inheritance were generally of inferior quality.

The presence of Mexican genes presumably explains such 'Hass' traits as greater cold hardiness and earlier maturity than typical Guatemalans.

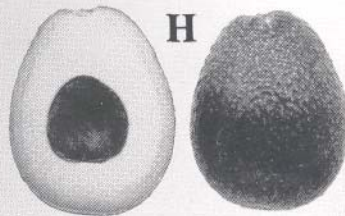
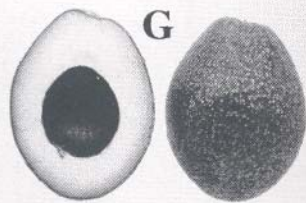
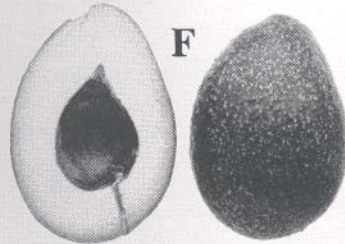
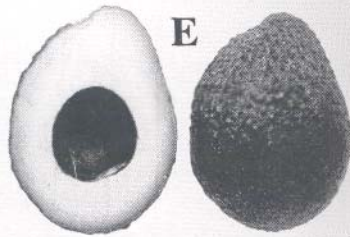
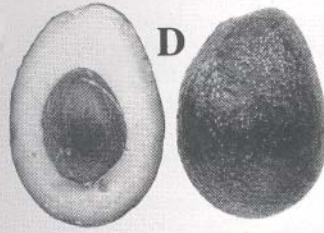
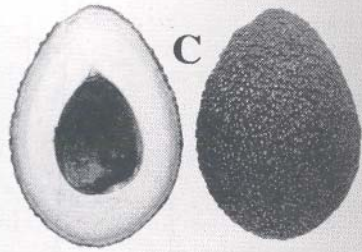
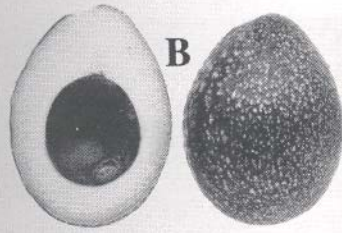
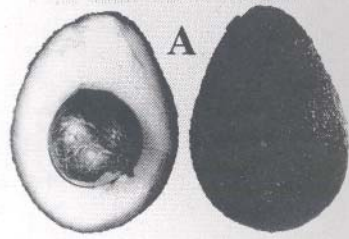
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H530

0 1 2 3 4 5 6 7 8 9 10 cm

H439

0 1 2 3 4 5 6 7 8 9 10 cm

FIGURE 1

Figure 1. 'Hass' (A), and superior selfed seedlings with green skins. Usually there is some skin darkening eventually, when the fruit hangs past maturity.

B: H513. While the 'Hass' fruit is ovate, this seedling has a more elliptic shape. It has the advantage of a slightly larger average size. Seed size is larger than the ideal. The skin is about as thick as 'Hass' but less rough. Matures about June, hangs into October.

C: H398. One of the best; "a green Hass". Ovate. Slightly larger than 'Hass*'. Slightly smaller seed. Skin very thick, rough. Season May through October, still attractive in October.

D: H455. More elliptic than 'Hass'. If anything, a bit smaller than 'Hass'. Seed no smaller. Skin thinner. May through October.

E: H670. Outstanding. Thicker ovate. A bit larger than 'Hass'. Seed at least as large — that in the photo is smaller than average. Thick skin, coarse roughness, peels very well. May through October, rated very attractive in October. One of the heaviest setters.

F: H625. Ovate. One of the largest — average larger than shown. Seed medium, sometimes slight upward cavity extension (shown). Skin thick, quite smooth. June into October. Heavy setter.

G: H530. Elliptic — "ovate toward both ends". Presumably too small. Skin rather thick, quite smooth. May into October (was rated still very attractive in November one year). Heavy setter.

H: H439. Thick blunt ovate. Medium size. Small seed. Skin thick, fairly smooth. June into October. This tree has had light set. Exceptionally rich flesh color.

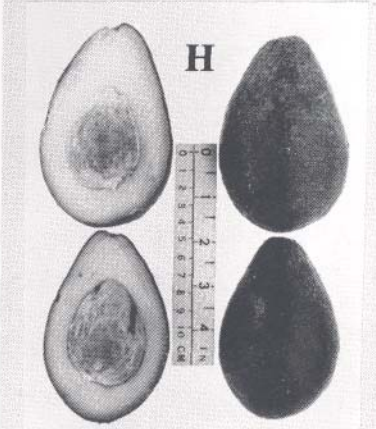
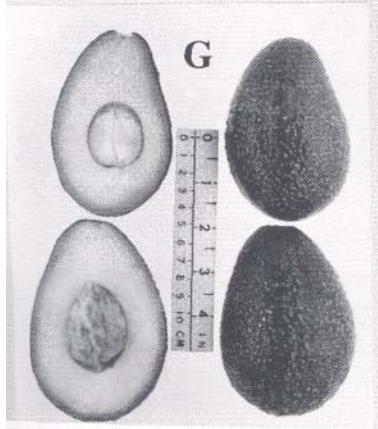
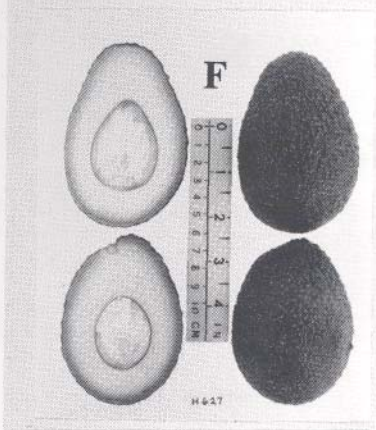
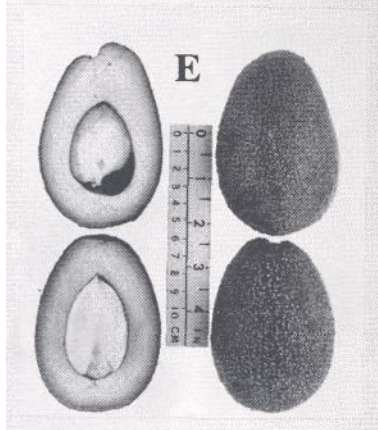
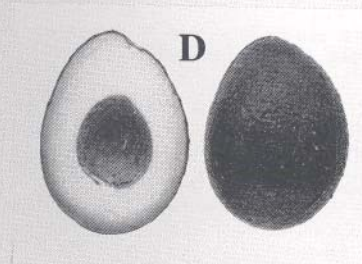
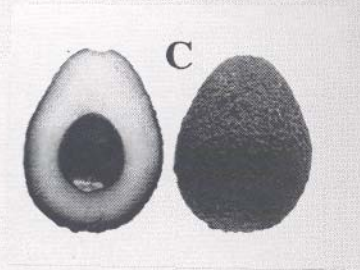
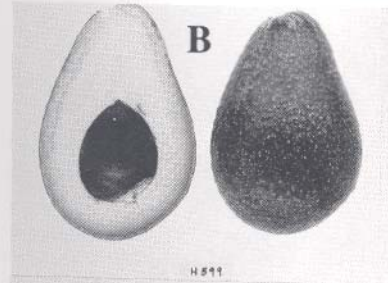
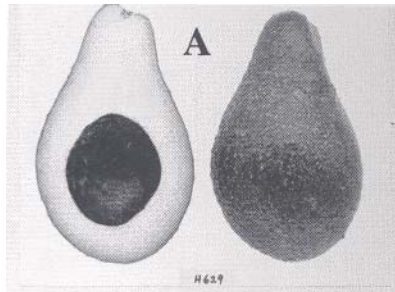


FIGURE 2

Figure 2. Other seedlings of merit. A, B, E and F are green at maturity. H is deep purple, G nearly all purple, and C and D are a green-purple mixture.

A: H629. Necked pyriform. A little larger than 'Hass' (fruit shown is larger than average). Medium seed. Much thinner, rather rough skin that is unusually attractive and never shows purple. June through October. Heavy bearer.

B: H599. Pyriform, sometimes slightly hooked. 'Hass' size (photo is larger than average) and seed ratio. Thick, fairly smooth skin. Never shows purple. Late May into November.

C: H663. Thick ovate. Smaller than 'Hass' (fruit shown is larger than average) — so is probably too small. Small seed: Thick, rough skin. June into October.

D: H696. Very thick ovate. Larger than 'Hass'. Medium seed. Fairly thick, rather smooth skin. Less attractive than some. May into October. Good setter. Unusually rich flesh color.

E: H618. Oblong to slightly ovate. At least as large as Hass. Larger seed. Skin thick, rather rough. Exceptionally attractive. May through September.

F: H627. Ovate. Fruit barely 'Hass' size, seed averages smaller (photo not very typical). Skin thick, quite rough. Remains solid green long past maturity, otherwise much like 'Hass'. June through September.

G: H425. Pyriform-ovate. Barely 'Hass' size. Very small seed. Skin fairly thick, fairly rough. Unusually attractive. May through September.

H: Hill. (Photographed fruits were over-ripe.) Pyriform to slim ovate. Barely 'Hass' size. Slightly larger seed. Skin thin and nearly smooth. April through August. Very good bearer.

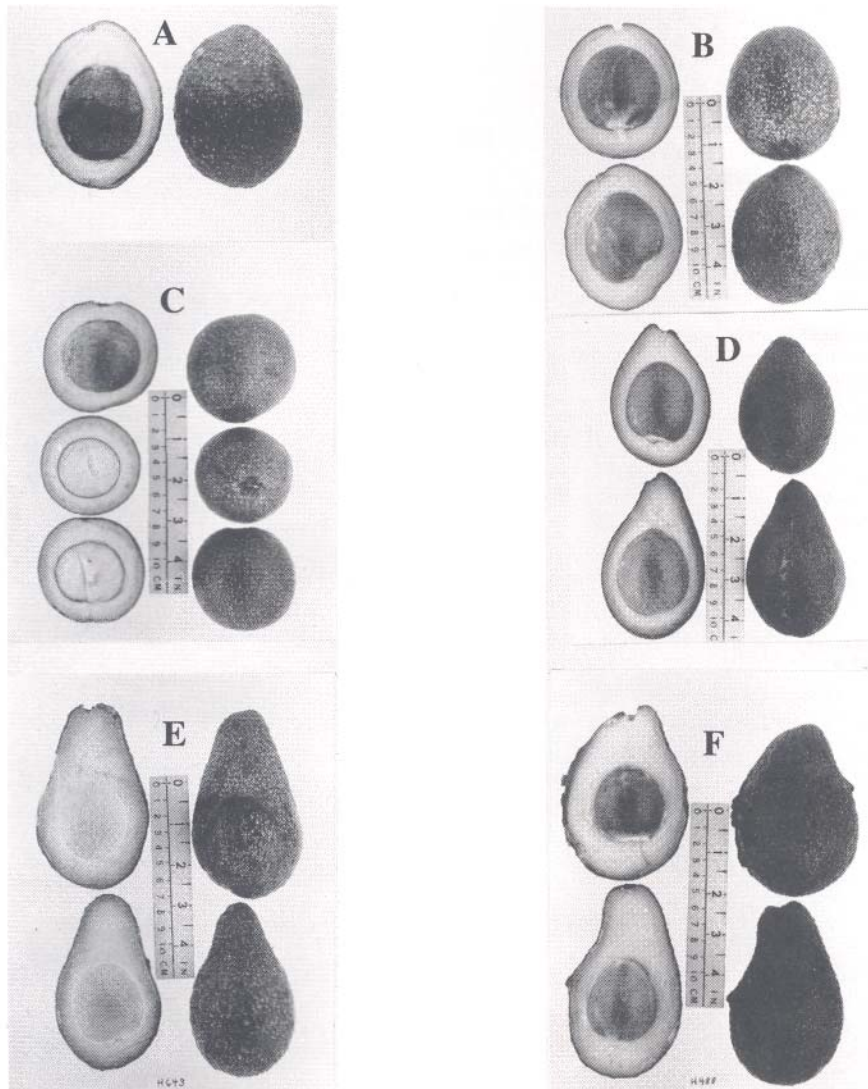


FIGURE 3

Figure 3. A to D: large seed ratios. These fruits are exceptions to the tendency noted earlier of 'Hass' offspring to inherit their parent's small seed, it is interesting that these fruits are all smaller than the average (A has larger magnification than the other three). Both the fruits and the seeds of C are round with occasional asymmetry.

Figure 3. E, F: surface irregularities. E has curved ridges, as seen in each right half. (These seeds had a thin adhering flesh layer.) F has warts that sometimes coalesce into ridges.

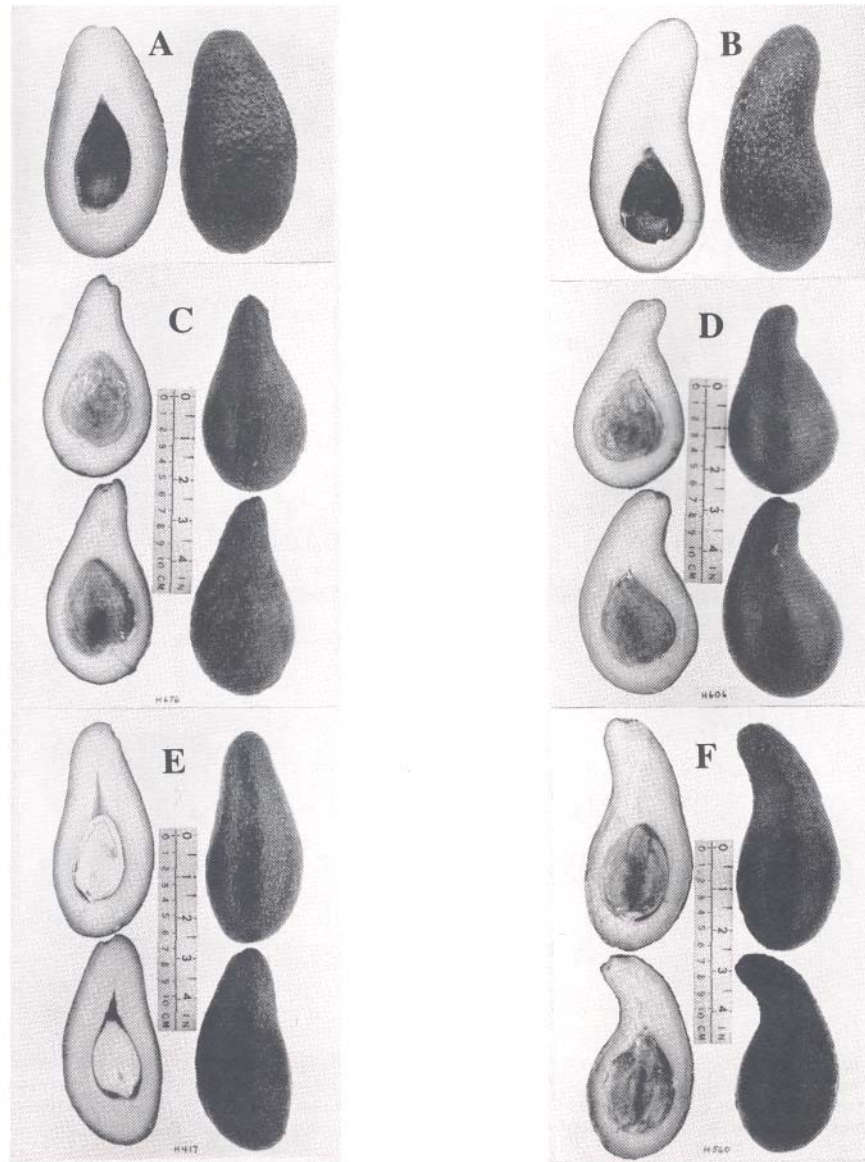


FIGURE 4

Figure 4. Elongate fruits. The most common weakness among these 'Hass' offspring was too small fruits; the next most common weakness was too elongate fruits. In elongate fruits, the seed cavity commonly extends upward — as seen in A, D, F, and especially in E and B (although the very long cavity extension of the latter is almost invisible because of its rounded form).

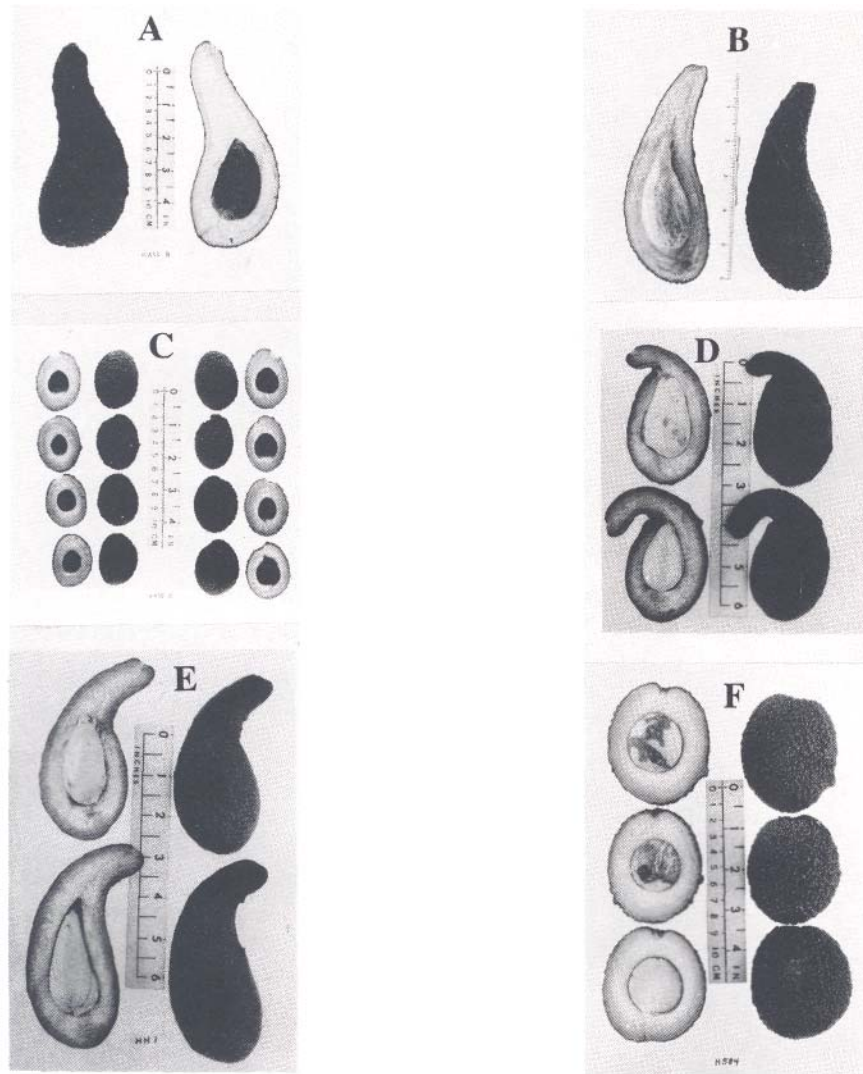


FIGURE 5

Figure 5. Some queer ones. Who would have thought that beautifully-formed 'Hass' was hiding these monstrosities in its genes! Fruits of C averaged just under one ounce each. The skin of the F's was perhaps the thickest and roughest that we have seen — all the more striking because of the small fruit size.