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Progress Report on Avocado Breeding

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The development of an avocado breeding program in the Division of Subtropical Horticulture in 1939 has resulted in the production, planting and observation of several progenies from self-cross and open pollinations. Actual research work was begun by Dr. W. E. Lammerts in 1941 and the first progress report of the project appeared in the Yearbook for 1942[2]. It was pointed out early in these investigations that Fuerte is an exceedingly poor female parent, but quite satisfactory as a pollen parent. Observation of the vegetative aspects of several progenies resulting from self-pollinations indicated that these tended to resemble their parents in most respects. The use of bees and caged trees for controlled pollinations was also shown to be a practical approach to the problem of producing progenies in satisfactory number. A second report in 1946[3] indicated that the self-pollinated Mexicola progeny was the only one which had fruited at that time among several planted in 1941. From the data of that year it was possible to show that green as a fruit color behaves as a simple Mendelian recessive factor in avocado inheritance. Black is the dominant character.

Fig. 1. Parent Avocados (Fuerte and Mexicola) and hybrid.

This progress report is presented to indicate the status of the program and to record some of the information accumulated during the past three years. During this period

several more of the progenies have fruited providing further indications as to potentialities of the project. Among the objectives are the development of varieties with commercially desirable characteristics. Information as to the breeding behavior and inheritance of the several varieties used as parents also is being obtained. It should be stated at the outset however, that no fruits of commercial value have been obtained thus far. Data are now accumulating which may be useful in making future crosses, which might result in the development of commercial varieties.

There is a rather clear indication that certain varieties used as either seed or pollen parent will induce precosity and the possibly associated character of good bearing in their offspring. An example is afforded by some of the seedlings of self-pollinated Mexicola. Some of these seedlings were the first to produce fruits from among the several progenies planted in 1941. Not only did they fruit early, but to date a greater percentage of the total progeny population has fruited as compared with other progenies. Many of the individual trees also have borne heavier crops than trees of other progenies. Seedlings from Topa Topa and Lyon self-pollinations also have fruited early, but to a lesser extent than Mexicola seedlings. On the other hand a large progeny of self-pollinated Fuerte seedlings has produced to date only a few fruits on four of its trees while growing during the same period and under the same environmental conditions. Seedlings of Ryan, Henry's Select, and Duke also appear to be slow to come into bearing and in addition are not producing many fruits.

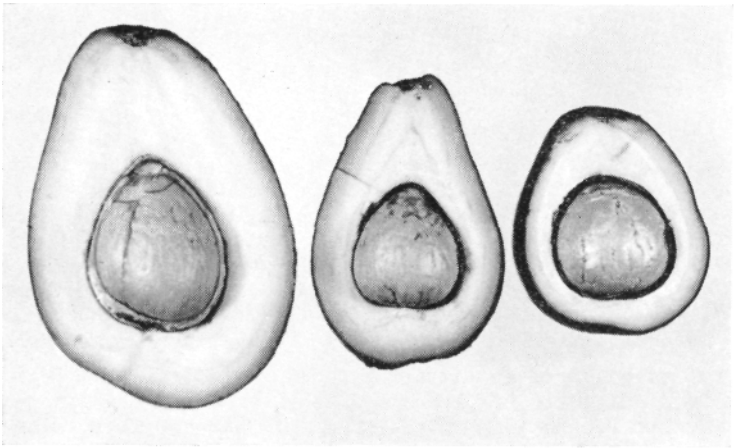

Fig. 2. Section through fruits of Fuerte, hybrid (Mexicola - Fuerte) and Mexicola.

Among the most interesting developments has been the first fruiting of ten control-pollinated hybrids, the first fruits of this type to be observed in California. All of these hybrids represent crosses between the Mexicola as seed parent and Fuerte as the pollen parent. Although Mexicola itself is black fruited it contains in its germ plasm the recessive factor for green skin color. Thus when crossed with a green skinned fruit such as Fuerte the I chances for obtaining a green fruit in the first generation seedling are one out of four. Seven hybrids of the Mexicola-Fuerte cross have fruited thus far, four of the seedlings having green fruit and three having black fruit. All of the fruits have been too small for commercial use, but they have shown some indication of earlier maturity

compared to Fuerte growing along side the hybrid plants. The green skinned hybrid fruits are definitely Fuerte-like in surface character although one is distinctly darker green. The fruit forms are variable, ranging from long necked to oval as in the parent Mexicola. Four of the hybrids tend to be short pyriform similar to the Fuerte parent. Although these seven hybrids are themselves lacking in many desirable qualities they illustrate the fact that controlled hybridization can be accomplished in the avocado. The next procedure in the program will be to back-cross these hybrids to the Fuerte pollen parent or self-pollinate the hybrid seedlings with the hope that in the second generation new combinations of the many desirable qualities of the Fuerte will appear and that the inferior qualities of both parents will be lost. It is hoped too that the hardiness, precocity and good bearing behavior of the Mexicola parent will be retained in some of the new seedlings.

Aside from their scientific and commercial interest these several avocado hybrids are of historical value for they are the first to be produced in California under controlled conditions. In fact there are recorded in the literature only five other avocado hybrids of known origin, all from Florida. (7) None of these have proved to be of commercial value. The few hybrids which have been produced to date do not mean that little effort has been expended in such work. On the contrary many thousands of hand pollinations have been made, but because of the very low percentage of fruit set following pollination the results of this large amount of effort have been exceedingly meager.

The avocado breeding program now has under observation over 875 trees, the result of controlled pollinations or the parentage of which are definitely known. This number is being extended as new materials become available or new crosses are made. Only a few of the trees have fruited thus far, however, and these have been primarily of the 1941 and 1942 plantings. Because of the many desirable characteristics of the Fuerte variety, strong reliance has been placed on it as a parent in this breeding program. Thus among the several progenies Fuerte is one parent in at least 253 of the trees. It has been crossed with such varieties as Edranol, Leucadia, Anaheim, Ryan, Blake, Duke and Mexicola. The desirable qualities of the Hass variety has prompted its use as a parent for 232 trees. Among the progeny trees are 188 which represent hybrids between Fuerte and Hass. The hybrids involving either Hass or Fuerte are being watched with great interest for the chances of getting high quality fruit with good bearing behavior are probably greater in these combinations than in any other crosses made thus far.

The inherent hardiness, early and regular bearing of Mexicola have caused this variety to be used as a parent in several crosses. There are now 29 control-pollinated progeny plants with Mexicola as one parent, not to mention the rather large population resulting from self-pollination. The cross, Mexicola x Fuerte has already been mentioned as being of promise in respect to successfully combining certain fruit characters. Other varieties involved as one of the parents in the 29 Mexicola progeny seedlings are Anaheim, Ryan, Edranol, Blake, Duke and Lyon.

Aside from the well established varieties which have been employed in i the breeding program there has been assembled on the Los Angeles campus I the nucleus of a collection of wild avocado forms and near-relatives in the genus **Persea**. This collection will eventually include many of the hardy and unusual types mentioned by Popenoe and

others (1, 4, 5, 6) which may contain inherent fruit characters, disease resistance, or climatic tolerance now lacking in some of our present varieties. These forms have been brought in as scionwood from Mexico and Central America during the past two years. They have not fruited as yet.

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