

Avocado Research at the University of California, Los Angeles— Progress and Plans

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Introductory Remarks

The present report does not include the important work on insect enemies and diseases of the avocado conducted by the Citrus Experiment Station at Riverside, nor is it to be considered as a comprehensive summary of all the avocado research work conducted by the College of Agriculture at the University of California, Los Angeles. It is, rather, a brief report of progress on certain of the studies now underway on the campus at Los Angeles, in which it is believed significant findings have occurred during the past year, together with an outline of some of the more important new investigations started during the year or about to get underway.

Correlations Between Size of Nursery and Orchard Trees

In 1938 there was reported the results of a study of correlations between size of seed, seedling and nursery tree in which, from a start with 832 seeds in 1934, there resulted 772 budable seedlings in 1935 and 629 nursery trees in 1937. A strong tendency was shown to exist for large seeds to produce large seedlings and large nursery trees, and for small seeds to give rise to small seedlings and small nursery trees. The nursery trees in question were planted in five localities from El Cajon to West Los Angeles in 1937. Annual measurements of the trees have been made each fall and yield records were started with the 1939-40 crop. While detailed correlation studies of the data have not been made and will await the accumulation of data for several more years, it is already evident that in general the large nursery trees are now the large orchard trees, and vice versa.

Relation Between Favorableness of Climate and Bearing: in the Fuerte Variety

It has long been felt that, exclusive of frost hazard, certain localities are climatically much better adapted to the Fuerte variety than are others. Striking evidence which supports this belief is now available from two sources.

The Fuerte trees in propagation referred to above are from two parents—one a tree of high yield record in a profitable orchard in the La Habra Heights district, the other a splendid tree in the Oxnard district which has never produced a crop of more than 50 fruits and averages less. The behavior of the young orchard at Fallbrook which contains

43 Fuerte trees from each parent has been most interesting thus far. In its first crop, that of 1939-40, a few of the trees from both parents produced 40 to 50 fruits. A recent detailed survey of the 1940-41 crop, in which the trees were graded according to crop, gave the following results:

Medium crops, or better		71 trees
High yield parentage	32	
Low yield parentage	39	
Light crops or nothing		15 trees

It seems clear from these results that the low-yielding parent tree in the Oxnard district is environmentally limited. And, since later blooming varieties in the same orchard there regularly bear well, the limitation in question is considered to be mean temperature during the blossoming and fruit-setting period. Corroboration of this conclusion is afforded by the fact that temperature records for the past ten years show that the locality in question, while enjoying a very low frost hazard and being especially well adapted for lemon culture, has nevertheless the lowest mean winter and spring temperature of any avocado district studied.

Further evidence which supports this conclusion is provided by the set of fruit on Fuerte trees in this orchard this spring, following the mildest winter on record. Without exception the crops are likewise the best on record, and for many of the trees comprise the first good crops ever set.

Evidence Concerning Fuerte "Strains" Resistant to Low Mean Temperature During the Blossoming and Fruit-Setting Period

For some years past the idea has been prevalent that there are "strains" of the Fuerte variety of more regular bearing habit than that most widely propagated. In order to test this belief, in 1934 low-yielding 13-year old Fuerte trees in the Oxnard district were topworked to eleven selections— 10 from outstanding high-yielding trees scattered from La Mesa to Ojai, the other from the remaining original tree in Altadena. Because of limitations as to the number of trees available only one tree was topworked to each selection and only two left as controls. Among the so-called "strains" included were Popenoe, Cole, Carr and Newman. For three years past two of these "strains" have consistently produced significantly larger crops than the others, which have not differed from the controls. As indicated above, following the exceptionally mild winter of 1939-40, all have good crops for 1940-41. The yields for the 1939-40 crop are of interest and were as follows: Newman 245 fruits; Carr 206; Weill 130; Hansen 78; Cole 67; Popenoe 22; Control 14; Lewis 8; Culbertson 7; Hoffman 4; Donlon 1; and Zemke 0. There is reason to believe that Weill and Newman represent the same strain and I strongly suspect that Carr also traces back to it.

In appraising the possible significance of these results it should be remembered that they come from single trees of each "strain" and that they were obtained in a locality where the Fuerte variety is subject to serious climatic limitation. While they appear to be suggestive, many more and extensive trials will be necessary to establish the facts.

Moreover, should it prove to be true that there is a Fuerte "strain" more resistant to low mean temperatures during the blossoming and fruit-setting period and hence better yielding in the coastal districts, this by no means assures that this "strain" will be **more regular** in bearing behavior in localities climatically more favorable for the Fuerte variety.

Topworking "Drone" Fuerte Trees

Industry experience in the topworking of low-producing Fuerte trees is now sufficiently extensive and the results have been so generally satisfactory as to suggest the advisability of more widespread employment of this practice. There are now numerous cases of "drone" trees having been successfully converted to profitable trees by topworking with scion-wood from other Fuerte trees in the same orchard or locality, obviously taken from trees of known high yield capacity. The reasons for these results are not understood. They can hardly be attributed to the existence of a large number of strains of varying yield capacity for, as above indicated, a trial of 10 so-called high-yielding "strains" in a locality of unfavorable climatic conditions suggests the probability of only two "strains" in that collection. It seems much more likely that something associated with the topworking itself, very possibly the girdling effect of the second bud-union, is responsible. An experiment on double-working has been undertaken in an effort to unravel this mystery.

In the meantime for those growers who wish to continue to grow Fuerte in coastal areas it is suggested that low yielding trees be topworked to one of the "strains" resistant to low mean temperatures during the blossoming and fruit-setting period. In districts climatically more favored it is suggested that drone trees be topworked to scions taken from healthy, high-yielding trees in the same locality.

Control of the Alternate Bearing Behavior of the Fuerte Variety

As our experimental work proceeds, it becomes increasingly evident that practicable measures for controlling the alternating bearing behavior of the Fuerte variety are not likely to be found and that the solution to the problem will lie in the finding or creation of a variety with the fruit characteristics of Fuerte and the bearing behavior of Lyon, Anaheim, Dickinson or Hass. The past year has contributed further evidence on this point.

It has previously been shown that the stride of alternation of bearing in the Fuerte variety can be changed by (1) early harvesting of girdled branches or (2) complete crop removal during July and August, but not by fruit-thinning or late crop removal. The effect of the severe heat wave of September, 1939 further confirmed these findings. Many trees which at that time were carrying heavy crops dropped a large part of their crops, in some cases all of it. In none of the trees under observation was the stride of alternation changed so as to permit their setting good crops for the season 1940-41 in spite of the extremely mild winter of 1939-40.

New Investigations

Among the more important studies started during the past year or just now getting underway are the following:

Selection and Breeding Investigations. Trees of Fuerte and other varieties with desirable characters are under propagation in large galvanized iron cans and a pollination chamber has been constructed in which controlled cross-pollination can be effected by means of bees. Seventy-five Fuerte seedlings of known parentage have been set out as a windbreak planting. And of much greater importance, an experienced and successful plant breeder, Dr. Walter E. Lammerts, has recently been added to our staff and will devote part of his time to avocado breeding.

Fruit Studies. A detailed study of the embryology, morphology and anatomy of the avocado has recently been undertaken by Mr. C. Arthur Schroeder, graduate student and Research Assistant in Subtropical Horticulture, under the supervision of Professor P. Murray Scott of the Department of Botany.

A biochemical study of the avocado has also been undertaken by Dr. D. Appleman, Assistant Professor of Plant Nutrition.

It is hoped and expected that these studies may contribute much of value to our understanding of avocado maturity and handling and storage problems.