

## **Horticultural Investigations on the Avocado**

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Mr. Chairman, Ladies and Gentlemen: With your kind indulgence, before proceeding to the discussion of the subject assigned me, I should like to briefly review some recent developments in the College of Agriculture in which I feel certain the members of the California Avocado Association will be interested and which have a bearing on my subject proper.

### **THE BRANCH OF THE COLLEGE OF AGRICULTURE IN SOUTHERN CALIFORNIA**

As many of you know, the Regents of the University of California announced their intention several years ago to transfer the Division of Subtropical Horticulture of the College of Agriculture from Berkeley to Southern California as soon as the necessary facilities for its work could be provided. Pursuant to this announcement, in February 1929 a tract of ten acres was allocated to the Division and plans were formulated for supplying other necessary facilities. In order to provide an administrative organization for the work of the College of Agriculture in Southern California equivalent to that which exists in the northern part of the state, in February 1931 the Regents announced the creation of a new administrative unit in the College of Agriculture—the Branch of the College of Agriculture in Southern California. This new unit consists of the Citrus Experiment Station at Riverside, an institution with which you are all well acquainted, and the Department of Agriculture on the campus of the University of California at Los Angeles. The latter organization in turn consists of the Division of Subtropical Horticulture, transferred from Berkeley to Los Angeles, and teaching representatives from certain of the Divisions at Riverside—Entomology, Irrigation, and Plant Pathology. The new Branch of the College of Agriculture is a geographical unit charged with the general responsibility for conducting the research and teaching activities of the institution in the field of subtropical crop production. Dr. L. D. Batchelor, Director of the Citrus Experiment Station, was appointed to the directorship of the newly created Branch of the College of Agriculture and the administrative responsibilities for the Department of Agriculture at Los Angeles were delegated to the Head of the Division of Subtropical Horticulture.

A general division of functions was established as between these two component parts of the new Branch of the College of Agriculture—one at Riverside, the other in Los Angeles. The Citrus Experiment Station will remain, as in the past, a research institution with its instructional activities limited to accommodating a few graduate students. The

Department of Agriculture at Los Angeles will have full responsibility for all undergraduate instruction but may also conduct such research work as time and the facilities available permit.

Pursuant to the creation of the new Branch of the College of Agriculture in Southern California, in September 1931 freshmen students in the Plant Science curriculum of the College of Agriculture were admitted at the University of California at Los Angeles. In the meantime plans were developed for housing the newly created Department of Agriculture and in the spring of 1932 construction was begun on the north wing of the Physics-Biology Building on the Los Angeles campus, provision for which had been made at the legislative sessions of 1929 and 1931.

It is a pleasure indeed to report that in large measure the facilities planned for on the campus at Los Angeles have been provided and that the Division of Subtropical Horticulture is now comfortably situated in its new quarters with equipment and facilities available far superior to any it has enjoyed in the past—equal in fact to those available anywhere else.

With the creation of the Branch of the College of Agriculture in Southern California the University of California now offers undergraduate instruction in Agriculture on three campuses—Berkeley, Davis, and Los Angeles. While the work at Los Angeles is confined to the Plant Science curriculum and the only major available is Subtropical Horticulture, it is now possible for students to enter the College of Agriculture on the Los Angeles campus and to spend the first two years there, regardless of curriculum or major, with virtually no loss of time. The only exception appears to be presented by the curriculum in Landscape Design in which it is desirable, though not absolutely necessary, for students to spend the second or sophomore year in Berkeley.

In all the other curricula—Animal Science, Agricultural Economics, Agricultural Engineering, Entomology, and Forestry—students may spend the first two years at Los Angeles and then transfer to the campus where their major work is offered. Students majoring in Subtropical Horticulture may, of course, spend the full four years at Los Angeles though many of them will wish to spend the junior year at Davis, where courses in Pomology and Viticulture are available.

## **FACILITIES AVAILABLE FOR AVOCADO RESEARCH WORK ON THE LOS ANGELES CAMPUS**

While the members of the California Avocado Association are undoubtedly interested in the newly instituted instruction in Agriculture at the University of California at Los Angeles I suspect that most of you are even more interested in the facilities available for avocado research work and our plans for carrying such work forward. As we view the situation, the principal problems now confronting the avocado industry have to do with insect and disease control, inducing the trees to bear regular crops, and providing proper conditions of storage for the fruit—at both shipping point and destination and during transit. It is my understanding that the excellent entomological and pathological investigations now under way at the Citrus Experiment Station are to be continued insofar as the reduced appropriations, inevitable for the coming biennium, permit.

Primarily because of locational reasons, we have been given the responsibility for conducting the horticultural investigations on the avocado and we propose to do such work as our facilities and available time will permit.

Our new laboratory facilities are adequate for such histological, cytological, physiological, and chemical investigations as may be required in the study of horticultural problems. Moreover we now have a modern air-conditioned cold storage and refrigeration plant of sufficient capacity to permit of conducting experimental work on the commercial storage of fruits. Within the near future we expect to have it ready for operation. If our appropriations are sufficient to operate it during the coming biennium we shall lack only operating experience and fruit.

Our greatest need at present is for trees on which to make observations and to conduct experiments. Since our primary work is teaching, our orchard area has of necessity been planted almost exclusively to collections propagated and arranged for teaching purposes. Our present avocado plantings— and we have no room for additions— consist of a windbreak row along the north fence line of our tract, comprising some 60 four-year-old Mexican seedlings, half of which were recently topworked for a variety collection, and two double planted orchard rows, each of twenty-five trees, to be topworked to three varieties, set aside for differential treatments. The only trees on which observations can now be made are the 30 remaining seedlings in the windbreak row. Several years must elapse before the other trees can be used for either teaching or experimental purposes. In the expectation that within the next two or three years additional land may be made available, last fall we planted several hundred Mexican seeds,, all from one isolated parent tree, and these were recently transplanted to our nursery.

## **INVESTIGATIONS NOW UNDER WAY**

In anticipation of our removal to Southern California, the time of which was then most uncertain, several years ago an experiment station project was prepared and approved on the subject "A study of the factors affecting fruit-bearing in the avocado" and some preliminary cytological work was done by H. van Elden, a graduate student working in our laboratory. For several years past, however, nothing has been done on this project nor could anything be started until our removal was accomplished. I moved down from Berkeley last October and the following month started weekly observations on the blooming behavior of the four year old Mexican seedling trees in the windbreak row, a few of which bore their first crop last fall.

It is with considerable hesitation that I present some of the preliminary observations, for they are at best merely suggestive and far from adequate as a basis for the drawing of conclusions. Not until much more intensive studies have been made extending over a period of several seasons, will it be possible to draw safe conclusions. My observations have been highly interesting, however,, and I am glad to report that at least we have made a start. Among the observations of chief interest are the following:

1. Some of my trees, in fact the majority of them, have been in continuous bloom for a period of four to five months, December to May, approximately.

2. . The amount of bloom has varied considerably, ranging from very heavy to light.
3. The light blooming trees nearly all bloomed much later than the heavy blooming trees.
4. So far as I am able to determine, the light blooming trees are those which bore a crop last season. The three trees which had the heaviest crops bore the lightest and latest bloom of all.
5. Fruit setting has seemed to be directly related to weather conditions. A few of the early and heavy blooming trees set fruit during the mild weather of early December. Practically no setting occurred during the cold weather of December and January and the month or more of cool wet weather that followed. Setting was not resumed until the advent of warm weather in March and April.
6. The late and light blooming trees in general have a fair to good set, but only a few of the early and heavy blooming trees have set well. On most of them the bloom appeared to be weak by the time favorable setting weather occurred.
7. The failure to set during the winter does not appear to be related to lack of insect activity. The trees were heavily frequented with a variety of insects at practically every observation.
8. While a pronounced tendency to dichogamy was evident, more pronounced on some trees than others, flowers in both first and second opening stages were seen on all trees at virtually every observation. Moreover the pistils in many of the flowers at the second opening appeared to be receptive. Collections of materials were made for later study to determine this point.
9. Pollen production in the avocado appears to be scanty, particularly so in comparison with the superabundance of bloom normally produced.

## **INVESTIGATIONS PLANNED**

A pronounced tendency to alternate bearing has long been recognized in the avocado, particularly in certain varieties. It has further been observed that following a season of heavy production the trees may bloom lightly or not at all. It seems reasonable to conclude therefore that the effect of a heavy crop may carry over to the following season and influence the time of bloom, the amount of bloom, and the setting of the fruit. Such effects have long been known to exist with certain alternate-bearing apple varieties and good evidence has recently been reported of their occurrence in the olive, which likewise has a pronounced alternate-bearing habit. The extremely heavy bloom and long blooming period so characteristic of the avocado would certainly suggest the probability of a heavy drain for nitrogen during the blooming and setting period.

It is our plan to study intensively the carbohydrate and nitrogen contents and constituents of avocado trees from this point of view with the hope that information may be developed concerning the causes for the occurrence of the above-mentioned phenomena. We expect also to experiment with various treatments—fertilization, injection, girdling, blossom-cluster removal, fruit-thinning,, and pruning—which may possibly correct the alternate bearing habit. This, however, will take time, and early

results immediately applicable to orchard practice are hardly to be expected. We shall carry on this work as rapidly as time and facilities permit.

It may be that, as in the case of certain apple varieties and the sugar prune, no practicable means will be found to overcome the alternate bearing habit of some of our best varieties. This raises the question of the advisability of work being undertaken the objective of which would be the development of better varieties than those we now have—equal in quality to our best but less erratic in bearing habit. Such a project, it seems to me, would be good insurance for the future of the industry.

I know of only one practicable way by which such varieties may be obtained within a reasonable time—the planting of large numbers of seeds of desirable parentage and bringing the seedlings into fruit as rapidly as possible for study and selection of the promising sorts. Such work done on a moderate scale only for a few years would probably result in better varieties than those we now have.

In conclusion may I again express our very great pleasure at finally and at last being permanently located in the southland, on the beautiful campus of a magnificent young institution where adequate facilities have been provided for the discharge of our responsibilities. For the Division of Subtropical Horticulture it is indeed a new era and one in which we trust our services to the avocado industry may be increased many-fold.