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CROSS-POLLINATION

Robert W. Hodgson
University of California, Los Angeles

Two years ago we started some work on the general problem of how to make avocado trees bear regular crops. It is a subject, I take it, of general interest, and from what I have seen of field conditions this season, of very great importance. Obviously the only approach to the problem available to us has been laboratory studies on the histology, cytology and embryology of the avocado. This problem was assigned to one of our graduate students, Mr. H. Van Elden, whom some of you may have met or heard of, and who has just finished up his work and returned to his home in South Africa.

During the past eighteen months or two years he has done some very interesting laboratory work on the avocado. It doesn't answer the question of why the avocado does not bear regular crops every year but it throws a little light on some of the possible causes. Incidentally, as a matter of scientific interest only, which is the way a lot of laboratory research goes, Mr. Van Elden made an accurate count of the number of chromosomes in the avocado. Some of you may be a little hazy as to what chromosomes are, but they are thought to be, and I think have been pretty well demonstrated to be, the bodies in the nucleus of plant and animal cells which are the actual carriers of the hereditary factors. Consequently they are of very great interest to students of genetics. That is a small contribution, but it doesn't help the avocado industry much.

The principal facts that Mr. Van Elden's work has brought out may be summarized very briefly. He has checked both in the laboratory and in the field, and I have also checked with him in the field, certain of the facts that were announced by Dr. Stout. The rhythmic opening and closing of the flowers under certain environmental conditions has been thoroughly checked and verified. We do find, however, plenty of offstride, so to speak, in this rhythmic process to provide, we believe, ample opportunities for either cross or self pollination under practically all conditions so that we conclude that in a practical commercial way this clock-like opening and closing, which would apparently minimize the possibilities for cross-pollination, is probably not of very great importance.

Mr. Van Elden has made thousands of slides, which is laborious and tedious work, and from these he has shown conclusively that at the first opening of the flowers of the Mexican and Guatemalan varieties, the embryo sac is in proper condition for fertilization. He has also found much evidence that by the second opening of the flower, at which time the pollen is being shed, fertilization has already occurred. Of this, I think, there can be very little question. This means, of course, that fertilization occurs either from overlapping of blooming or from pollen from other trees.

This represents a lot of work. It doesn't establish any facts of commercial importance,

but at least we have a better understanding of the situation. We have outlined a further continuance of this work and expect to prosecute it as vigorously as we can as soon as we move down. The projected studies will consist of field trials of various kinds—the use of nitrogenous fertilizers, thinning of flower clusters, ringing and girdling experiments at certain seasons of the year and chemical analyses of the nitrogen and carbohydrate contents of the flower and fruit-bearing parts.

We have much reason for believing that the avocado, being an evergreen, lives from hand to mouth, so to speak. Dr. Cameron has demonstrated conclusively from several years of study that the citrus tree does not lay by large carbohydrate reserves as do the deciduous trees, but that it manufactures what it needs as it goes. That is what would be expected of an evergreen plant adapted to conditions favoring constant growth throughout the year. There is much reason for believing, therefore, that the avocado simply wears itself out, and depletes its reserves to the point where it cannot set a crop regularly every year. If this is the case, and the evidence points in that direction, then we will have to work out ways and means of balancing up the situation or of supplementing the needs of the trees at certain periods of the year. This is by no means a hopeless problem and promises interesting and rather quick results from the combination method of attack mentioned.

I am speaking of matters in the future largely, but we hope to be able to make some of these futures come true. For the large general field trials needed by the avocado growers—such trials as relate to fertilization and irrigation, it seems clear that the method of attack will of necessity have to be cooperative field trials. The station at Riverside has plenty of land, but climatic conditions there are of questionable adaptation to the avocado. It would certainly be better to have these conducted under more favorable climatic conditions. We had hoped to have twenty-five acres of land and proposed to devote ten acres to field trials with avocados. As things have worked out, we have ten acres of land to serve all of our needs and about the only experimental planting of avocados that we will be able to set out will be the row that I have mentioned. Consequently it is clearly evident, I think, that you in the industry who are interested in further experimental work, especially as that relates to field trials, will have to face the problem of working these out on a cooperative basis, much like the station at

Riverside has done a good deal of its walnut work—cooperative field plots located under favorable conditions of soil and climate and under the supervision of men at Riverside or in the Division of Subtropical Horticulture. I am sorry to have to report that this is the way the matter has finally worked out. We had hoped to work it out otherwise. But we have to face the facts and adapt our procedure to conditions as they actually exist.

In closing, may I emphasize again the fact that we are very greatly honored by your presence here. The California Avocado Association was the first fruit growers' organization to ask us when we would be at home and when its members might call on us. We are deeply appreciative of this courtesy. It is a pleasure to have you here as the first group of fruit growers to meet on this tract, and we hope you will follow our developments here with interest and that you will visit us as often as you can. We hope, moreover, that as a result of the expenditure of money, time, and human effort in the development of this tract, there may be returns to the avocado industry itself which will be worth while. You are invited to come back and see us as often as you wish.

If you haven't already tramped around so much you are tired and it doesn't look too dusty to you, you are invited to look at our trees. They look just like any other citrus trees planted last May, but we think they have made a fairly good growth for one season.

Question: I would like to ask if you have a Pomelo from China?

Answer: We have, I suppose, five or six of them. We have one called the "Giant Pomelo."

Question: What about the "Honey Orange"?

Answer: I don't know that we have that.

Questioner: It is a loose-skinned orange and sweeter than the navel orange. **Question:** Professor, how will we go about it to get two rows of avocado trees out here?

Answer: Well, I'll tell you. I don't know how exactly, but that does bring up a question that I rather hesitate to mention. This is a new campus and every time one turns around it costs money. There is nothing here in the way of facilities. Money is the hardest thing there is to get when it comes to making developments, to which I can testify from personal experience, as I have been endeavoring in every possible way to get more of it here. The institution, however, rarely if ever turns down donations and some of the most useful donations that might be made to an enterprise of this kind would be trees— trees for orchard planting. If they were available, probably something else might be crowded out.

Questioner: I think we can get you some.

Prof. Hodgson: When the purchasing agent is told that a good avocado tree costs from $2.50 to $3.00, it nearly causes heart failure. Only an avocado grower knows that it is worth it. We have many difficulties which arise from a lack of understanding concerning the value and importance of trees and plantings. Agricultural education and research are expensive, more so than in most other fields. This is not generally understood or

appreciated. But while this is true, these plantings are laboratories just as necessary and important as those which consist of buildings equipped with desks, racks and stands, glassware, chemicals, and other equipment.

Mr. Rounds: The Agricultural Extension Service appreciates your cooperation in making this a successful tour and I believe the Avocado Association will say the same thing in making the semi-annual meeting of the Avocado Association a success. I think we ought to give Prof. Hodgson a vote of thanks. (This was unanimously passed with cheers.)