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SOME PROBLEMS IN THE IRRIGATION OF AVOCADOS

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President Dutton: The next talk will be another subject that Science has to deal with. I used to think that irrigation meant turning on the water and then getting out with a shovel, but I learned differently. So did many others when they found they lost trees through over-irrigation in certain soils, etc. So we have found out there is something to be learned about irrigation. The University through its State Experiment Station has been doing a lot of work for the avocado grower on many of our problems. They have been working on this problem of irrigation. Prof. S. H. Beckett will tell us something about his researches, which are of vital interest to all engaged in the raising of avocados.

Prof. Beckett:

Irrigation is one of our oldest agricultural industries. Modern irrigation dates from the time of the Mormon settlers in Utah, and in Western United States has been in practice about eighty years, rapidly extending from the valley of the Great Salt Lake into Arizona, and over into California. It is interesting to note in these older irrigated areas that much of the initial land placed under irrigation has now passed into disuse, probably due to abuse, rather than a proper use of irrigation facilities.

Going back to the earliest agricultural enterprises, there may be found remains of old irrigation systems and abandoned agricultural lands. Generally speaking, the failure of agriculture on these lands has been attributed to alkali accumulation, and is a direct result of over-irrigation. Although it has not been definitely proven that permanent agriculture can be established under irrigation, we do not look on the problem with alarm. Scientific methods in the application of irrigation water, along with that which is being learned concerning reclamation, will ultimately result in a permanent and lasting agriculture.

Irrigation practice may be defined as the artificial application of water to the land. It is for one purpose only, and that is to create in the soil a favorable moisture condition for plant growth. Apparently in the past some of us have not fully realized why we are placing water on the land. During the past ten years we have entered a new era in irrigation practice and we are learning much concerning that which constitutes proper irrigation practice.

Remembering our definition of irrigation and what it is supposed to accomplish, it is logical to ask the question: "In the production of avocados, what constitutes a favorable soil moisture condition for growth and crop yields?" This knowledge is a basic requirement to sound irrigation practice.

Second, knowing this favorable moisture condition: "What seasonal depth of irrigation water and what frequency of irrigation is required to maintain it?"

Our third problem deals with methods. Under the wide variation in soil type, topography of land, and methods of delivery of water: "What method of irrigation should be used in order to obtain the most satisfactory distribution of soil moisture with the least waste?"

The fourth, and most perplexing problem is: "What is the effect of a soil moisture deficiency at different periods of growth throughout the year on such factors as the rate of growth of the tree, time of blossoming, the set, quality and quantity of the fruit?"

Coming back to a consideration of our first problem regarding favorable soil moisture conditions for crop production, soil physicists and irrigationists, in discussing soil moisture, refer to certain so-called critical soil moisture points, such as the "moisture equivalent," "field capacity," "wilting coefficient," "hygroscopic coefficient," etc. In irrigation practice we are interested only in two of these points. These are the so-called "field capacity" of the soil, which is the soil moisture condition you obtain after applying an irrigation, and the "wilting point," which is the moisture percentage in the soil at the time plants permanently wilt. In the irrigation of deciduous and citrus fruits, as well as many other crops, indications are that as long as the soil moisture content is maintained within the range between the "field capacity" and the "wilting point," conditions are favorable for plant growth. At the present time there is no reason to believe that this conclusion does not also apply to avocados.

In the various avocado areas of Southern California, at the present time, we do not know the least amount of water necessary to maintain normal growth and profitable production. This is a problem that the individual grower is going to have difficulty in solving for himself, and definite results can only be obtained by an intensive study in which variable accurately measured quantities of water are applied to experimental plots. Such treatments must be continued without variation for a sufficient number of seasons to produce conclusive evidence as to the effect on growth and yields.

In the case of limited water supplies, the problem becomes complicated; your soil does not dry out uniformly. The rate of water extraction is dependent mainly on the root distribution and activity. The top foot of soil may be expected to dry out first, followed by the second and third foot. In the meantime the tree may suffer from drought, or even reach a wilting state, with plenty of available water in the lower soil depths.

Under these conditions the grower is confronted with the problem of just how and when this limited water supply should be applied in order to obtain the highest efficiency from it. As an example, you may be obtaining your irrigation water from a water company which entitles you, through the number of shares you hold, to a quantity equivalent to three acre inches per acre per month. In mature groves in the interior areas of Southern California this quantity of water is not sufficient to keep continuously moist a full 100 per cent of the soil mass occupied by the root system. Very seldom is it found that irrigation water is so applied that the whole of the soil mass is moistened at each irrigation. However, you do have the privilege of irrigating fifty per cent of the soil mass, by furrowing out fifty per cent of the land area and applying your three acre inches to that fifty per cent of your soil surface. This would be equivalent to six inches over the area to which the water is actually applied. On. the other hand, you have the privilege of

irrigating in alternate furrows or alternate middles. There are any number of different ways in which it may be applied. Under our widely varying soil conditions and topography we are unable to tell you which of these different methods will give you the highest efficiency and maximum results. This the grower can best learn for himself by trial and close observation.

Regarding methods of application. In the application of your irrigation water you may use either flooding, sprinkling or sub-irrigation in any one of their many forms. Although a few general rules may be given concerning irrigation methods on certain soil types, the method which gives the most uniform distribution, with the least waste, is one that has to be worked out by the individual irrigator for his particular piece of land. Most certainly the man who lives on the land, and who, year after year, applies water to it, should, in the course of time, know more than anyone else concerning his soil, and just how it should be irrigated. In the irrigation of avocados or any other crop, it is very often not possible or convenient to apply irrigation water in such a way that there will be available moisture in all the soil at all times. At some time during the year, a soil moisture deficiency is created in certain parts of the soil mass. We hear many guesses as to the effects of these deficiencies, but until definite information is obtained, both by observation and experimentation, in which these deficiencies and drought conditions may be reproduced year after year, with close observations made of resulting effects, we must admit we can not supply a satisfactory answer,

With our limited knowledge concerning proper irrigation practice, the grower with a reasonably adequate water supply is still indeed fortunate. Within reasonable limits, he may choose the time of irrigation and depth of water which he wishes to apply. The method of irrigation is wholly under his control, and with care and good judgment he should be able to produce that soil moisture condition which is most favorable to normal development of the trees and profitable yields.

I believe that is all I have to say to you. I thank you!

President Dutton: We are certainly much obliged to you and the Experiment Station for working on our problems, and we think if they can keep up their experiments along these lines that eventually they will solve most of our problems. Anyhow, they are doing the best they can, and their work is of great value to us.