

AVOCADO IRRIGATION AND TENSIOMETERS

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INTRODUCTION

Saving water is an important part of any farmer's job in raising a crop. Not only is the price of water high, but it is usually in short supply. Irrigation is the most important and most difficult cultural practice to accomplish in the growing of avocados. General rules on how to irrigate avocado orchards are hazardous, as each orchard has an individual problem which should be handled accordingly. There are basic principles of soil-water-plant relationships which should be considered in developing a sound irrigation program. These relationships depend upon soil factors such as texture, structure, depth, water intake rate, and drainability. Other factors which should be considered in developing an efficient irrigation program and maintaining it are water quality, humidity, temperature, wind, irrigation system operations, and the general tree health.

For a number of years, a group of people have been working on the development of soil moisture measuring devices to be used as an irrigation guide. The instruments so far developed have been for the purpose of measuring available water in the soil. One of the most practical developed so far, and easily purchased, is an instrument called the soil moisture tensiometer. Tensiometers have been in use in San Diego County avocado orchards for a number of years, but it is only lately that growers have become really interested in the use of them. The growers using tensiometers and who have become acquainted with how they work feel they are an excellent guide to a better irrigation program.

THE INSTRUMENT

The tensiometer is an instrument which measures a property of soil water, namely soil suction. It measures the soil moisture condition and not the quantity of water. The instrument consists of a ceramic cup, a body (tube), a vacuum gauge, and a reservoir. Movement of moisture in and out of the ceramic cup causes tension on the column of water in the tube which is shown on the dial of the gauge. Most gauges are calibrated in centibars from zero to one hundred (0-100), the lower reading indicating the wet condition. Readings from above eighty (80) are not reliable. A colored liquid is placed within the body of the instrument through the opening at the top of the reservoir. The whole system, except for the cup, should be air-tight.

PLACEMENT OF INSTRUMENT

Placement of the tensiometer is very important. The stations located in an avocado

orchard should be representative of the soil types present. In other words, if the soil within an orchard varies from a sandy type to a clay type, one set of instruments should be in the sandy soil, one set in the clay soil, and another set in the soil which combines these two types. The most desirable position for the instrument is on the south side of the tree, just under the dripline. The reason for this is that the most active roots are near the dripline and that the south side of the tree usually dries out first.

Each station should include two instruments, approximately eight inches apart, and placed at the twelve and twenty-four inch depths. In a spot where water accumulation is a problem, a thirty-six inch instrument could be placed as a check on the amount of water present at this depth. In San Diego County soils this especially important, because when clay underlays a permeable top soil, there is always the possibility of avocado root rot getting a start. In placing the tensiometers, each instrument should "see" the sprinkler head (Figure 1). The instruments should never be placed on a direct line from the sprinkler.

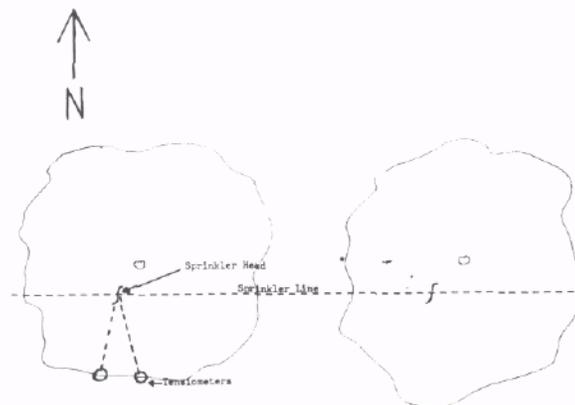


Figure 1. Placement of Tensiometers

INSTALLATION

Installation of tensiometers is also very important. The ceramic cup must be in good contact with the soil. If holes are dug with a small soil tube whose diameter is larger than the tensiometer body, then back-filling with loose soil and packing it around the instrument is necessary.

SERVICE

Tensiometers must be serviced periodically to assure proper operation. This consists of:

- 1—Keeping the instrument full of water
- 2—Removing air from the instrument
- 3—Reading the gauge often to be sure changes in soil moisture are being reported.

After placing the instrument in the soil, the colored distilled water should be added to the instrument. Once the tube is full, the air must be removed. With some instruments, a

vacuum pump can be used to remove the air. This procedure should be followed every two or three weeks to be sure the instrument is giving the proper reading.

READINGS

Readings of the instruments should be made often. After the initial installation, a reading should be made daily to determine whether or not the instruments are operating properly. Once it is known that the instruments are functioning, readings need be made only two or three times a week. It is preferable to read the gauge at the same time each day, early morning being the best. The instruments should be checked periodically during irrigations to see that all obstacles are removed between the sprinkler and the instruments so a proper reading is obtained. A low hanging branch is enough to intercept the water and give an inaccurate reading. Uniform distribution of water is very important to avocado trees, and especially if tensiometers are being used as a guide to an irrigation program.

CHARTS

Charts should be kept on all instruments in the orchard. The chart is the key to how often an irrigation is needed and how much moisture is required. In evaluating the soil moisture condition from the readings on the chart, it is important to realize that it is not so much a particular reading at any one time but the rate at which readings are changing that guides the need for irrigation. Studying the charts, a grower can know two or three days in advance when an irrigation is needed. To obtain the maximum value of the use of tensiometers the instruments should be read frequently, consistently, and the results plotted on a continuing chart (Figure 2.) It will be noted that each irrigation was based on the rate of change on a twelve inch instrument. The twelve inch instrument reached twenty centibars (20) in approximately five days and the reading in the next two or three days rapidly climbs toward the forty (40) to fifty (50) centibar range. It is this rate of change during peak water use that is important and gives a good guide to when to irrigate. The twenty-four inch instrument showed sufficient moisture so a deep irrigation was not needed until the third or fourth irrigation. If the thirty-six inch instrument had been placed in this station, the rate of climb would be even less than the twenty-four and in most cases would not reach much over twenty-five (25) centibars. The reason for this pattern is that the largest percentage of active roots are in the first two feet of soil with very little root activity below this level. Also, the Vista sandy loam soil and Fallbrook fine sandy loam soil, which predominate in the avocado growing areas of San Diego County, are relatively coarse textured in the upper eighteen inches and therefore have a tendency to dry out faster because of a low water holding capacity and the activity of the root system of the avocado.

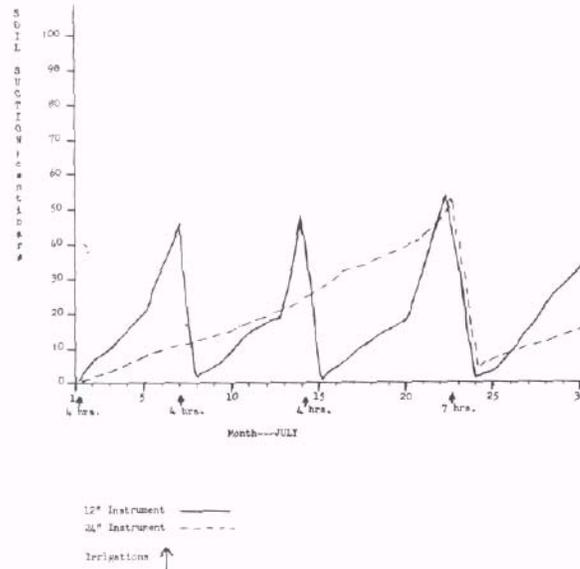


Figure 2. Tensiometer Charts

IRRIGATION PRACTICES

Since avocado trees are surface rooting plants, it is important to maintain a good water supply to these roots at all times. The irrigation studies in conjunction with the tensiometer work have shown that the upper twenty to twenty-four inches should be irrigated frequently (usually seven to ten days). Irrigation practices vary with the type of soil present since all soils do not have the same capacity to store water. Clay soils retain the most water and loam soils hold more than sand soils. The shallow and coarse textured soil types need more frequent applications of water than the deeper and finer textured soils since they have less storage capacity.

Water is removed from the first foot of soil rapidly after an irrigation due to the activity of the plant roots, evaporation of water from the first four to six inches of soil to the air, and the extensive root system of the weed or grass cover. Therefore, if additional water is not put on to take care of the grass or weed cover present and to compensate for evaporation loss, the trees will suffer,

When winter rainfall is short, the first irrigation of the season should be a deep one in order to fill the soil profile with moisture. This helps leach out accumulated salts in the root zone. Subsequent irrigations should be applied in such a manner as to refill only that portion of the soil which has been depleted of water. During summer and fall months it is important to put on periodic (every four or five irrigations) leaching irrigations. The purpose of this leaching program is to remove from the first two feet of soil as much of the accumulated salts as possible.

In a recent survey of nine avocado orchards in San Diego County, it was shown that in all cases the salt accumulation was highest in the soil in the fall months (September through November). Fall is becoming the crucial time for the irrigation of avocados in San Diego County. It is at this time that high temperatures, low humidity, and high winds

hit the area. These three factors increase the rate of transpiration in the plant and put an extra burden on the root system to withdraw moisture from the soil. It is at this time that the frequent and shallow irrigations with the periodic leachings would benefit the plants. Because of the build up of chlorides and additional salts, the incidence of tip burn is prevalent during this time.

The use of tensiometers has been helpful during these crucial fall months when the growers are undecided as to how to irrigate. It is felt that the rains normally should be coming by November and there is a tendency to start cutting down on irrigation water. Experience in the past number of years has shown this to be an erroneous conclusion, and many groves have suffered when the irrigation water was not applied regularly during October and November.

SUMMARY

In summary, it can be stated that for irrigating avocados in San Diego County that a frequent and shallow irrigation is desirable. Tensiometers are good guides to tell when an irrigation is needed. For maximum use of the instruments, they should be installed correctly and carefully; they should be placed on the side of the tree where the soil dries out the fastest and also in the most active root area. Readings should be recorded and plotted on a chart often to determine the drying pattern of the particular station where the instruments are located. Instruments should be placed in pairs, twelve inch and twenty-four inch, and sufficient stations in the orchard to get a good representation of the soil drying characteristics. The instruments should be serviced periodically to assure proper operation.

Fall irrigation has become more important because of the hot and dry weather occurring during this period, and for the lack of early rainfall.