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Irrigation of Young and Old Avocado Orchards

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Much has been written about the irrigation of tree fruit crops in general —not so much about irrigation of avocados. It is the purpose of this discussion to bring to the attention of the growers, particularly the newcomer in the avocado industry, some facts concerning the application of irrigation water. It is hoped that by a better understanding of the chief factors involved, the grower will make fewer mistakes and do a more acceptable job of applying water in his orchard.

The main purpose in irrigating is to replace the water, which has been removed from the soil by the trees before they come under stress for lack of water and go into a wilt. Some available soil moisture must be present in at least a portion of the rooting areas of the trees at all seasons of the year. Over irrigation is bad, and under many soil conditions, avocado trees have been seriously injured by excessive irrigation even where drainage is good, it appears that growers have brought this about by attempting to maintain soil moisture at a relatively high uniform level.

Soil moisture in the main rooting zones of avocado trees should fluctuate between wet and relatively dry. When soil moisture is withdrawn, fresh air moves in to take its place. The oxygen in the air is very necessary in maintaining healthy roots. Considerable evidence indicates that avocado roots are most active when the soil moisture content is considerably below the wet point, or the field capacity of the soils in which they are growing.

The irrigation water requirements of avocado trees will vary greatly in the different growing areas of the state and there will be considerable variation within districts. These requirements will be governed by size of tree, soil type, irrigation efficiency, climatic zone (coastal or interior), and the amount and distribution of rainfall. Reliable data on the amount of irrigation water applied indicates that some growers have adequately supplied the needs of mature trees with a total yearly application of eight acre inches of water per acre (29,040 cubic feet), while other growers were required to apply 23 acre inches of water per acre (83,490 cubic feet).

The two principal methods of applying water in avocado groves today are the sprinkler and furrow methods. Some basin and modified basin irrigating is done in mature groves; however, most basin irrigation is confined to one and two year old plantings.

Sprinkler Irrigation

In the California avocado industry today more groves are irrigated by the use of sprinklers than any other method. Sprinkler irrigation can be divided into two general

classifications: the low type or under tree sprinklers, and the high over tree sprinklers. Portable and fixed type systems are used in both classifications.

Many types of sprinklers are in use, which apply water at various rates per hour. In order to intelligently operate a sprinkler system the grower should know how much water it applies per hour. Several locations in the orchard should be checked, particularly locations near the main lines, and those near the ends of lateral lines. The most practical way to measure the rate at which sprinklers apply water over the area wetted by them is to place ordinary tin cans in a vertical position at approximately two foot intervals across the diameter of the area wetted by the sprinkler. The cans should be about six inches tall with the opening at the top the same diameter as at the bottom. Place the cans so that water from the sprinkler falls directly into them and does not strike tree foliage and then drip into the cans. After the cans, or miniature rain gauges, are in place the sprinklers are operated for a definite number of hours under normal irrigating conditions. These conditions are proper water pressure for the type of sprinkler used and a minimum of air movement. At the end of the test period the depth of water in the cans is measured in inches and an average depth computed. The average depth divided by the operating time in hours gives the rate at which water is applied in inches per hour. For some sprinklers this rate will be approximately one inch per hour; for others, only two tenths (0.2) of an inch per hour.

After learning the facts about his irrigation system the grower should consider the soil in the main rooting area of his trees for information regarding when to irrigate and how much water to apply. Better tree health and a longer fruitful life will result if avocados are not irrigated until the soil in the upper two thirds of the active rooting zones of the trees has dried out to a point approaching the wilting coefficient of the soils. Regular soil inspection with a soil tube or auger plus considerable experience and a knowledge of soils will be needed to determine about when to irrigate. Some types of soil feel dry when actual measurements of their available moisture indicate a content of 3% to 5%. On cool damp days soils will feel drier than they actually are, and on hot dry days they will seem wetter. If a grower does not want to rely on guesses he can obtain accurate soil moisture determinations from organizations specializing in this work.

Assuming that the avocado grower knows when to irrigate, the next consideration is how much water will be needed to wet the dry soil in the upper two thirds of the rooting zone. In areas of shallow hillside soils the rooting zone is limited and may only extend to a depth of two feet; whereas, on deep bottom land soils active avocado roots have been found at depths of 6 to 10 feet. In shallow soils a water penetration of 18 to 20 inches would be ample, while in the deep soils a penetration of 3 to 4 feet is needed. The grower should know what the water holding capacity of his soil is, or how much water in surface or rainfall inches will be needed to wet relatively dry soil one foot deep. The amount of water required will be different for the various types of soil on which avocados are grown.

The following classifications of soils, starting with the very light-textured soils, and continuing through to heavy-textured soils, are given with the rainfall or surface inches of water needed to wet the dry soil to a depth of one foot; Hanford and Tujunga sandy loams 0.3 to 0.5 of an inch; Vista sandy loam and Fallbrook fine sandy loam 0.6 of an inch to 1.0 inch; Ramona sandy loam and Ramona clay loam 1.2 to 1.6 inches; Sorrento

and Yolo clay loams 1.6 to 2.2 inches; Altamont loam and Altamont clay 1.7 to 2.0 inches; Diablo clay adobe 2.2 to 3.0 inches.

In illustrating a practical application of the above data we will consider two mature avocado groves irrigated with sprinklers: one growing on Vista sandy loam soil, the other on Yolo clay loam. In the first grove an application of approximately two surface inches of water will be needed for a normal irrigation while in the second grove an application of 5 surface inches is required. In groves with a heavy leaf or straw mulch under the trees an allowance of possibly one half inch of water should be made to wet this mulch. In a number of orchards, especially those located on the heavier-textured soils, it has been found advisable to wet only 50% of the soil at each irrigation. This is done by operating alternate sprinklers in the tree rows, or by wetting alternate middles between rows. This method of applying water cannot be used with a high overhead type system, where each sprinkler irrigates an area involving several trees.

Growers using sprinklers should be aware of the fact that sprinkler nozzles can become partially or completely clogged by pipe scale or other debris in the water. A screen or suitable filtering device placed in the main line will eliminate some of the trouble. Standard practice is to check all sprinklers as soon as they have been turned on, in order to be certain that all are functioning properly. An occasional check should also be made during the irrigation period.

Furrow Irrigation

Furrow irrigation involves some of the factors which apply to sprinkler irrigation. It is different in that water must be run in small ditches along a uniform grade. The grade or slope should not exceed 1½% on light-textured soils and 3% on heavy-textured soils. The length of run or distance between distribution lines should be governed by the permeability of the soil (the rate at which water moves into it). For soils which take water readily a 150 foot run would be maximum and for the less permeable soils approximately 300 foot runs are satisfactory.

The amount of water which will move into any soil from the bottom of a furrow is directly related to the amount of contact between soil and water. Thus, more water can be put into a soil by using broad flat furrows than by using the same number of narrow "V" type furrows.

The number of furrows used per tree row in mature avocado groves varies from 3 to 6 per middle in square and contour planted orchards, and from 2 to 4 per row in terraced plantings. One broad based furrow is usually considered to be the equivalent of 2 narrow "V" type furrows. The practice of irrigating alternate middles is used with the furrow system to good advantage especially on the heavier textured soils.

Applying water in furrows requires constant attention by the irrigator. When the irrigation starts a sufficiently large volume of water should be turned into each furrow to carry it to the end of the run in a relatively short time. On permeable soils 15 to 20 minutes should be ample, and on less permeable soils possibly 1 to 2 hours maximum flow will be needed before the water can be set. Just prior to the time that water reaches the lower ends of the furrows, the flow at the upper end is reduced sufficiently to allow a continuous flow of water throughout the length of the furrows without wastage at the

lower ends. Further adjustments of flow will be needed from time to time. After the flow of water has been properly adjusted it is allowed to run until the desired penetration is obtained. Experienced irrigators can determine water penetration with fair accuracy by timing the run after the water is set; however, most good irrigators use some type of soil probe. A good instrument of this type can be made by welding a 12 inch handle on one end of a 3/8 inch steel rod, 36 to 40 inches long. A 2 inch long tapered point is ground on the other end and a slight enlargement made at the point where the taper starts. Suitable depth marks can be made by filing notches on the rod at 12 inch intervals.

To determine depth of water penetration push the probe into the soil in the bottom of the furrow while the water is running. When dry soil is encountered greater resistance to the downward movement of the probe will be noted. In some soils this increased resistance will be much greater than in others and experience is needed to make fairly accurate water penetration tests. If the grower does not wish to rely entirely on probe tests he can check his results by making borings with a soil auger or soil tube about a week after an irrigation is completed. Most penetration tests should be made near the lower ends of the furrows.

Basin Irrigation

As previously stated, basin irrigation is confined principally to young plantings one and two years old. Within a day after young trees are planted they should be irrigated. Rather deep narrow basins are made around the trees so that 7 to 10 gallons of water which they should hold will be concentrated above the original tree ball. Recently planted trees depend entirely upon soil moisture from the tree ball to supply their needs. They cannot use moisture from adjacent soil until they have made one good root growth cycle. The first strong root growth usually occurs between the first and second top growth cycle.

Rather frequent light irrigations are needed for young trees. Under some conditions of soil and climate, irrigations at weekly intervals may be necessary; under others, a two week interval is sufficient. If the soil in the tree ball is of the same or a lighter texture than the soil in which the young tree is planted, no difficulty should be experienced in getting water into the ball; however, if the tree ball soil is considerably heavier in texture than the soil in which the tree is planted it may be difficult to wet the ball properly. A practical method of determining whether or not a tree ball has been wetted is to push a quarter inch diameter steel probe through the outer one third of the ball after the water in the basin has soaked in. Water will have penetrated to the depth where increased resistance to the downward movement of the probe is noted.

Starting with the second year after planting the basin walls are pulled out to about 24 inches from the tree trunks, and the trees irrigated in flat bottomed basins.

Weed growth in and bordering tree basins will remove soil moisture. If allowed to grow much beyond the seedling stage, additional irrigation to offset this competition will be needed.

Summary

The application of irrigation water is one of the most important cultural practices performed by the avocado grower. In order to maintain healthy trees, with a long fruitful life, irrigation water should only be applied when the soil in the upper two-thirds of the rooting areas of the trees has become relatively dry.

Irrigation water is applied by the use of sprinklers, furrows, and basins. The most common practice at the present time is the sprinkler method.

Irrigation water requirements of mature avocado trees will vary considerably. The requirements of some mature groves have been met by a yearly application of 8 acre inches of water per acre (29,040 cubic feet). Other groves have required 23 acre inches per acre (83,490 cubic feet) of applied water.

Young trees, one and two years old, need frequent and rather light applications of water due to the limited extent of their root systems.

A satisfactory job of irrigating cannot be done without regular and frequent inspections of the soil in which the roots live. This can be done by making borings with a soil auger or soil tube or by employing a competent organization to do this work.