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ORCHARD MANAGEMENT

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Orchard management covers too wide a variety of subjects to discuss in a short period of time. For this reason only certain phases of irrigation and fertilization will be considered. Because the management of each individual orchard is a special problem, no specific recommendations will be made.

Successful production of avocados is more dependent on adequate irrigation than on any other orchard operation. In many cases it is also the most expensive operation. For these reasons it deserves first attention.

Experiments are now under way to determine the water requirements of avocado trees but the answers are not yet available. It is necessary, therefore, to determine by field observation how the information from other sources applies to avocado production.

We have learned that it requires suction to take water out of soil. In other words, plants must do work to obtain water. The drier the soil the more energy the plant must expend to extract water. A point is finally reached when the plant can no longer absorb water fast enough to replace the water lost by transpiration and it wilts. As the energy used to absorb water increases, the rate of growth decreases and as the wilting point is approached growth ceases entirely. Drought has a greater effect on the amount of succulent growth than on the increase in dry weight. Farmers have known this for a long time. They know that drought produces low yields, small raggy fruit and woody textured products.

This suggests that maximum results will be obtained by light frequent irrigations rather than heavy irrigations at longer intervals. It is not uncommon to find symptoms of drought where more than enough water is used, but the interval between irrigation is too long with resulting periods of dryness.

The presence of excessive amounts of soluble salts in the soil increases the amount of work a plant must do to obtain water. In other words, the presence of soluble salts in the soil reduces the availability of soil moisture to the plants. These materials may be native to the soil but usually they come from irrigation water, fertilizer and soil amendments. In many cases, water used in avocado orchards contains a ton or more of salt per acre foot. Regardless of the source of the salts, their presence makes more frequent irrigation necessary. It is also necessary to use more water than would be required on a normal soil. Unless enough water is used to dissolve the salts and carry them below the root zone, they will accumulate causing tip burn and reduced growth and yield.

Since most of the water used on avocado orchards carries some salt, it follows that successful production cannot be expected on soils that do not have good drainage.

Because water is expensive it is necessary to use it effectively. There is no economy in using less water than is needed to produce maximum yields but certain orchard practices should be examined to see if their cost in water use is justified.

The practice of growing a permanent cover between trees has been widely used. It protects the soil from erosion and avoids tillage, both desirable objectives, but it increases the amount of water needed. There is disagreement as to the amount of water such a cover uses but there is evidence that an acre of grass will use as much water as an acre of trees. This same evidence indicates that mowing has little influence on the use of water. This may not appear to be reasonable but you can see for yourself by examining soil some time after an irrigation in an area occupied only by tree roots and comparing it with soil under sod. Some water can be conserved by wetting only the soil occupied by tree roots but more water can be saved by controlling weeds with oil sprays or tillage. In many 5-year-old orchards and even in some at 10 years only 25% of the soil is occupied by trees and 75% by grass. Where water costs \$35 to \$40 per acre foot, I think it would be cheaper to control the weeds by means of oil sprays.

A number of growers have solved this problem by planting 2 to 4 times as many trees as they want in the mature orchard. In this way they minimize the waste space between trees and increase the income during the first 10 to 12 years two to four fold. This plan gives better use of irrigation water and permits the grower to select the highest producing trees to make up the mature orchard.

This requires some added expense for irrigation equipment and \$250 to \$300 for trees, but it is a good investment. An orchard that does not pay dividends during the first 10 years usually has a new owner before it matures.

Information available at this time indicates that light irrigations given often enough to avoid letting the soil become dry are best suited to avocados. Because most irrigation water carries some salt, occasional heavy irrigations are desirable to leach excess salts from the soil. Experience in recent years shows that rainfall cannot be depended on to do the leaching. Water can be used more effectively if weed growth is prevented and trees in close plantings make better use of the available water.

Avocado fertilization is another operation that is based largely on experience with other crops. We know that avocados respond to nitrogen fertilization on many soils but how much to use and on what basis to judge need remains to be learned.

It has often been observed that avocado trees thrive when interplanted with citrus trees that are showing a lack of nitrogen. As a result of similar observations, someone guessed that avocados require half as much nitrogen as citrus. Recent developments suggest that this was really an educated guess. Current work on citrus fertilization indicates that 1½ lbs. of nitrogen per tree per year is adequate for most citrus trees. On this basis, avocados would need ¾ lb. of nitrogen per tree.

The work of Dr. Tom Embleton of the Citrus Experiment Station indicates that a relatively low level of nitrogen gives better yields in avocados than higher levels. Excessive use of nitrogen seems to promote vegetative growth at the expense of

fruitfulness. His progress report will be available in the next yearbook of the California Avocado Society.

The indications are that growers generally have used more nitrogen on avocados than is needed. On the basis of present information it would seem best to use enough nitrogen to keep the trees healthy but not enough to promote maximum growth. If I were required to make an estimate of the need it would be ½ lb. of nitrogen per tree per year for mature trees.

Zinc deficiency is common in avocado orchards. The symptoms are small mottled leaves that tend to form rosettes. Fruit that is normally pear-shaped becomes round. Zinc deficiency is increased by heavy applications of nitrogen and phosphorus. Zinc can be supplied as a spray or as a soil application.

The most common spray formula is 5 lbs. of zinc sulfate and 2½ lbs. of hydrated lime to 100 gallons of water. Thorough coverage is desirable but it is not necessary to drench the trees.

For soil applications use 5 lbs. of zinc sulfate per mature tree. Spread it uniformly over the root area so as to avoid root damage. It would be wise to talk to your farm advisor before using zinc on the soil because it is easy to damage trees with soil applications of zinc sulfate.

Phosphorus deficiency may occur in avocados but we have not been able to demonstrate it. Dr. Embleton is working with trees that are growing on soil where citrus failed because of phosphorus deficiency. These trees have absorbed added phosphorus but have shown no response in yield or growth.

In numerous tests the level of potash in avocados has been adequate without fertilization. Cases of deficiency have not been found.

It is well to keep in mind that it pays to use fertilizer elements that are lacking in the soil but that the use of elements already present in adequate amounts wastes money, and in many instances it reduces yield.

SUMMARY

1. Irrigation is the most important operation over which a grower has control.
2. It does not pay to use less water than is required for maximum growth and production.
3. Water should be applied when the soil approaches dryness; not after it is dry.
4. Frequent light irrigations give best results.
5. Occasional heavy applications of water are necessary to leach accumulated salts from the soil.
6. Good irrigation is not possible without good drainage.
7. A permanent cover crop often uses as much water as the trees.
8. Close plantings make more effective use of soil and irrigation water.

9. Avocados respond to nitrogen fertilization but excessive use appears to favor growth at the expense of fruitfulness.
10. Zinc deficiency is common but can be controlled by either soil or spray applications.
11. We have found no instance where avocados have responded to phosphorus or potash fertilization.
12. Unnecessary use of fertilizer wastes money and may reduce yields.