California Avocado Society 1945 Yearbook 30: 43-47

The BPS of Avocado Orchard Management for Growers New to the Industry

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The Editor of the Yearbook has asked me to write some "Basic Plain Stuff" on Avocado Orchard Management. I have accepted the assignment with some hesitation. Not because I fear criticism or argument from experienced growers who might disagree, but because I know how easily my statements may be misunderstood or misinterpreted by those who may wish to follow them. To take a complex subject and with *a* few paragraphs make it seem simple and at the same time cover the essential facts is not too easily done by the author, and may mislead the reader into thinking that there is nothing much to it after all. If the arguments pro and con, the "ifs" and "ands", statistics to back them up are put in, then the article is no longer simple and its purpose defeated.

It is impossible to lay down a program that will fit all orchards in exact detail. Such factors as climatic conditions, depth and character of soil, age and condition of trees, and others, vary so greatly that considerable judgment must be used in applying information or advice, regardless of the source or authority. With these words of caution I submit the following outline for your guidance to Good Orchard Management:

The Goal—Good annual production, consistent with the maintenance of tree health and vigor, efficiently, and at a reasonable cost of production.

The Essentials—

Proper irrigation,

Economical but adequate fertilization,

Cultivation or the elimination of competition,

Reasonable access to all parts of the orchard,

Provision for drainage, particularly the removal of excessive winter rainfall,

Proper pest control as needed.

The balance of this article will be confined to a discussion of Irrigation because it is the most critical and important of your orchard management practices. The health and even the very life of your trees depends upon your doing this job reasonably well.

Good Irrigation Most Important

Good irrigation consists in applying a good quality of irrigation water in the proper amount, at correct intervals, as nearly as the practical factors in your particular case permit. You will need to determine certain facts in regard to your own orchard in order to exercise the proper judgment in good irrigation practice. You need to know how much

water it takes to fill your soil to what is known as its "field capacity", and then how long this amount of water will adequately supply the needs of the plants growing on it. By plants, I mean your trees, and such weeds and grass as also are drawing their water supply from the same soil area. When the water or moisture in the soil becomes so low that it will no longer supply the needs of the plants the soil is described as being at the "wilting point". Keep these two terms in mind: "field capacity" and "wilting point", for the water represented by the difference between them is the **usable** amount of water for plant growth and the amount which it should be your aim to supply in your irrigation practice.

The soil is frequently compared to a reservoir which you fill from time to time by irrigation and then the plants pump it out. A better simile for illustrating soil moisture capacity is to compare it to a sponge. For example if you place a dry sponge in a pan and gradually add water, eventually the sponge will become fully saturated or filled with water. This is what happens to the soil during and immediately following a complete irrigation. Now if you lift the sponge out of the water it will continue to drip for some time. When it no longer drips it is in the condition comparable to what we have called the "field capacity" of a soil. Now you squeeze the sponge and you get a lot more water out of it. In the case of the soil the amount of water you have squeezed out of the sponge is to be compared to the amount of water used by the plants plus what may have been lost by surface evaporation. When you have squeezed all of the water out of the sponge that you can, it is still moist and you can't squeeze it hard enough to make it completely dry. This condition in the soil is the "wilting point". There is still some moisture present but the plants can't squeeze it out. The comparison falls down a bit here for while you can readily see that the sponge is still moist, soil in this comparable condition will appear to be completely dry. In fact soils will appear dry to you long before they reach the "wilting point" but plants apparently have more perception, at least they continue to draw water from it. Now we need to add another term to our irrigation practice vocabulary which is "usable water holding capacity", meaning the water represented by the difference in amount in a soil between its "field capacity" and its "wilting point". This usable water holding capacity of soils varies greatly and an understanding ol this factor with respect to your soils is fundamental to successful irrigation practice. To go back to the sponge comparison again. If you were to take two sponges of equal size, a very coarse sponge and a very fine one, you would find that the fine sponge would absorb and hold considerably more water than the coarse one; also that after you had squeezed them there would be more moisture left in the fine sponge. However the difference in the amount of moisture left in the squeezed sponges would be very much less than the difference in the amount of water that you had been able to squeeze out of the two saturated sponges. (Dear me I hope that is not too complicated) Anyway the coarse sponge represents the coarser sandy soils called light soils and the fine sponge the finer textured soils, called heavy soils. These are the extremes and there are all grades in between. The situation is further complicated by the fact that top soil may be "light" and the subsoil under it "heavy". Very few soils are really uniform. Now to go back to sponges again. It is obvious that a large sponge either coarse or fine will hold a lot more water than a small sponge of the same texture. The size of the sponge is comparable to the amount of soil you may have available for your trees; or in other words the soil depth.

Study Your Soil Conditions

The first and most important thing that you can do if you desire to irrigate intelligently is to become thoroughly familiar with the soil conditions in your orchard. Is it light or heavy (a coarse sponge or a fine sponge), or about where does it fit in between? Is it represented by a large sponge, a medium sized, or a small one—that is, how deep is your soil? What are the differences in various parts of your orchard? What is the character of the subsoil and how much surface soil have you on top of it? How far down will water penetrate? There are other soil characters of importance but the ones just mentioned will keep you busy for quite a spell and give you a good understanding of your soil conditions. How are you going to find out all of this? Well, your best bet is a soil auger, but not too large a one either, or you are likely to become discouraged in using it. Where are you going to get one? You will probably have to get your blacksmith to make it for you. An ordinary wood bit not larger than 3/4 inch in size, with not too steep a pitch and with the screw tip filed off and the cutting edges tipped down a little. This, welded to a 1/2 inch steel rod with a handle welded on is about as simple an auger as you can get that will be reasonably efficient. A so called "ship auger", if you can find one, which I doubt, is a little better than the common wood bit. For most avocado orchards your auger will not need to be more than four or five feet in length.

There is a technique in using the soil auger that you will need to learn. Do not bore too deep before pulling the auger out; the length of the bit each time is enough. In heavy subsoils even that may be more than you can pull out easily. Just boring holes in your soil to see how far down you can go is not enough. Study each auger full to learn the character of the soil, noting the moisture condition, keeping in mind that the working of the auger has probably compacted the sample a bit if the soil is at all wet.

The best time to make this first study of your soils with the auger will be after there have been two or three good winter rains, enough to have completely filled the soils to their full depth and water holding capacity. This does not happen every winter but you can hope that it will this year. If it does, and you are able to complete your tests before the irrigation season starts you will have the information on which to develop good irrigation practice.

Don't Irrigate Too Early in Spring

A normal irrigation season, if there is such a thing in Southern California, usually extends from June through November. Frequently of course early fall rains will shorten it toward the end of the season, and deficient rainfall in March and April will make it necessary to start irrigation earlier. Your irrigation practice will be guided by the seasonal variations.

Many avocado growers have a tendency to start irrigation too early in the spring. The first few warm or hot days in April or May, and on goes the water, regardless of the fact that there may be and probably is, plenty of moisture in the soil, remaining from the winter rains. On the other hand there is a tendency to go too far in withholding water in the fall in the hope of early rains. You should guard against these two faults.

When the soil moisture approaches the "wilting point" in the spring, then is the time for

you to learn how much water you will need to supply to bring the soil moisture up to the "field capacity". You will note that I said "approaches" the wilting point. It is not well to allow avocado trees to get too dry, even though someone has advanced a pet theory that you should not water during the blooming season.

With the first irrigation you need to learn a few more things. How many hours will you need to run your sprinklers or furrows to restore the needed water? Are you sure it is really time to irrigate anyway or are you just being a "copycat" and think you should, because you have seen some of your neighbors at it. If you wish the right answers to these questions you will need to do a bit of probing with your soil auger. If you carried out the soil exploration suggested in an earlier paragraph, you should have a pretty good idea of what your soil is like when it is filled with moisture to its "field capacity". Now is your chance to find out what it is like as it approaches the "wilting point". If your trees are looking all right, and weeds show no sign of wilting, and if you have no trouble getting your soil auger down, after you get through the first few inches of dry soil, and there is perceptible moisture in the borings you bring up, then it is desirable for you to wait a few more days and then try again. But if you are really convinced by test that the soil is approaching dryness it is time to start the water and make your next test. In making your tests preceding irrigation try to determine how far down the soil is really dry. If it is dry down eighteen inches or two feet and then moist below that depth, then your problem is to apply just enough water to bring the dry soil up to its field capacity again without adding greatly to the soil already moist. This is particularly true of the first irrigation. How are you going to determine how much water it will take to do this? There is only one sure way that I know and that is by trial and test.

Many of you are equipped with sprinklers. Most sprinklers of the whirling type put on water at a rate compared with rainfall of 1/4 to 1/2 inch per hour. The spray type nozzles usually at a much faster rate. It would be well for you to find out for yourself just what the rate of application of your sprinklers is. Place a few straight sided tin cans (one pound coffee cans are about the best, if you still have some of the old relics) around your sprinkler starting about a foot from the sprinkler and then setting others at about three foot intervals until you reach the outer edge of the sprinkler's throw. Then run your sprinkler for an hour and see what you have. I don't like to give you any set figures on water penetration because there is so much variation due to soil type and other conditions, and you are going to find out what it is for your soil anyway, but if you figure that an inch of rainfall, or its equivalent in sprinkler irrigation, will penetrate a foot of soil you will probably not be far off. It is a good enough estimate for you to make your first test. Suppose that you wish to replace the moisture in the top two feet of soil and you have determined that your sprinklers apply water at a rate of 1/2 inch per hour. Give your sprinklers a four hour run; turn them off and about twelve hours later make tests with your soil auger and see what the penetration has been. You may find that you need a longer run or a shorter run. In any case it is just a matter of arithmetic and from here on out you are on your own. The same general principles apply to furrow irrigation. It is not the water that runs by the tree that counts, but the water that penetrates and spreads beneath the soil. The soil auger test is again indicated both for depth of penetration and spread between furrows. If your soil is well underdrained you will be surprised at how little the spread amounts to. A most common fault is the failure to use enough furrows between the tree rows. I suggest that you run water in furrows at least

six hours before making your tests. Test at both the upper and lower ends of the furrows as well as in between.

Getting Water Out of the Soil

So far this article has concerned itself with the problems of getting water into the soil in proper amounts. Now we had better consider how it gets out. Just plain surface evaporation into the air accounts for a good deal of the loss of water from the top few inches whether cultivated or uncultivated. On heavily mulched soil it is the mulch that loses this evaporated water. The balance of the usable soil water is also lost by evaporation into the air but it is done by evaporation through the leaves of plants and is called transpiration rather than evaporation. The water that passes out of the soil by transpiration through avocado leaves is the beneficial use of the water for which we have paid our money and given our effort. That is more than can be said for weeds and Bermuda grass which also transpire huge quantities of water. Sometimes considerable water is lost by surface runoff if applied too rapidly, or lost by underground drainage if applied in too large amounts. Such losses you can and should control.

The rate of loss by evaporation, and use by transpiration, varies greatly with weather conditions. During cool cloudy weather it is relatively slow and your irrigation periods should be spaced farther apart; in hot dry weather with low humidity it is rapid and you will need to irrigate more frequently. I urge you to use your soil auger consistently for at least one season. After that you may have developed sufficient judgment and "feel" so that you can get along without its constant use. Even then it is well to use it once in a while to check your judgment.

The rate at which water is used by the trees seems to be controlled almost entirely by conditions above the soil and not by the amount of water in the soil. The trees do not seem to use water faster when the soil is filled to field capacity than when it is approaching the wilting point. Greatest surface evaporation however takes place immediately after irrigation. The soil dries out the most rapidly in the area where there are the most roots. Your soil auger tests will have shown you that this is probably in the top two feet. Don't kid yourself that avocado roots are all on the surface however. Where soil conditions are favorable the roots will go down as far as the winter rainfall penetrates, and available plant food goes with the water. This lower area dries out more slowly but it is a reserve supply, money in the savings account so to speak, and will carry your trees along in fine shape after the surface roots have dried out and have become inactive. See to it that the moisture in the lower 3rd or 4th or 5th foot of soil (if you have that much) is replenished as needed.

It has not been my purpose to tell you how and when to irrigate but to try and help you get a mental picture of what takes place in the soil in regard to soil moisture so that you can do your own thinking and arrive at your own conclusions.

Individual Problems Most Diverse

There are many practical considerations that may prevent you from doing as well as you know or would like to do. Perhaps your water supply, water delivery, or irrigation

equipment is inadequate for your needs. Unless your orchard is fully covered with a permanent sprinkler system and you have a large enough water supply to operate it at once, it may take you a good many days to get over the entire orchard. You may have to start irrigation before you should, in order to get over the orchard before some of it becomes too dry. If you have this situation irrigate just one side of the trees at a time. The next irrigation you wet the other side and so on throughout the season. -This method also has been the salvation of some orchards where the owner has consistently applied too much water at a time.

I have tried to comply with the request of the Editor and write this article in as simple language as possible and still cover the basic principles of good irrigation practice. I hope that it will be helpful to you. I realize that I probably have not answered all the questions you may have in your mind. It is not a handbook for irrigation practice. However if it helps you to understand the problems involved and encourages you to do some investigation of the problem as it applies to your own grove it may be of some use to you.

If you find that this type of article is helpful and if you will make known your desire, I will attempt to complete the Editor's request for "Basic Plain Stuff" on other phases of good orchard management in next year's Yearbook.