

California Avocado Association 1917 Annual Report 3: 78-83

SYMPOSIUM ON IRRIGATION

DISCUSSION LED BY DR. LESTER KELLER, YORBA LINDA

Dr. Lester Keller: I have 9 acres in avocados, 300 feet wide by 1400 to 1500 feet long, being planted in six rows. The source of water is approximately in the center of this tract, at the highest point. Irrigation pipes consist of a 2-inch main reduced to 1 1/4 inch which runs through the center of the tract, the long way. Coming off at right angles to this main, every 25 feet, are 3/4-inch pipes, this 3/4-inch pipe supplying the first two rows of trees. This is then reduced to 1/2-inch pipe supplying the second row, and to 24-inch pipe supplying the third row. Uprights extend above ground 2 1/2 feet from the tree. This distance should be corrected as it is sometimes too close. On top of this pipe I have placed a gas-cock instead of a faucet as it is more convenient. Pressure at the lowest point is about 40 pounds, and at the highest point is probably one-half of this amount. I always have plenty of pressure.

The first year I basined the trees and turned on the faucet with a slow stream, every ten days. The second year the basins were leveled, and the drip system started, watering the trees every two weeks. The drip runs for 48 hours, amounting to about two to three barrels of water per tree. The water goes on so slowly that it does not run off. A 1/2 inch pipe extends down from the faucet to one side or the other of the tree for distributing the water as it is required. About 36 hours after the water is turned off, the soil is cultivated lightly with a hoe rake to about 1 1/2 inches, making a dust mulch. With this treatment, the soil kept quite moist all summer.

Some of my land is too steep to plow. I simply dug holes for the trees, and have had the water running on this from the 15th of June almost continually. I have thus far discovered no sign of root rot or gum disease. These trees have made more growth than any others I have, and since these hillside trees are doing so well, I turned on the water on all the other trees for a run of about two weeks. The "norther" pushed over some of these latter trees which did not have stakes to protect them. This was on account of the soft ground.

I believe that the avocado needs water often, and lots of it. On a different type of soil, this amount of irrigation might give a water-soaked soil, but not in my case. I have had the water standing on my soil but have not been able to discover any disease or injury of any kind.

G. W. Beck: I have 10 acres in lemons interplanted with avocados, every fourth tree being an avocado. The oldest trees I have are five years old. I have always irrigated in furrows and find that they have taken the same amount of water as lemon trees. Occasionally the smaller trees get water once in two weeks and they have done pretty well under this treatment. Nursery stock, during the hot weather, received water once a month. I have a heavy clay soil, and by watering the trees once a month and with proper

cultivation, they are doing well.

I am afraid Mr. Keller is laying the foundation for trouble in the future by the use of too much water. Mr. Keller has a more porous soil but even that can have too much water. I think Mr. Keller will have trouble later on. I have seen trees planted in similar soil on hillsides which were drowned out by winter rains. With a light top, and clay subsoil, the water would come down the hillside and settle in the soil where the avocados were grown. The roots were all rotted out when removed.

A customer of mine, who bought a few trees complained that they were not doing well. On looking them up I found he had not been giving them enough water, and had just sprinkled them every day. The ground was very hard. One should use judgment in the application of water.

W. A. Spinks: Like Mr. Beck, I must differ with Dr. Keller as to the amount of water required. Several years ago I visited Honolulu and spent some weeks in investigating the avocado. I was much in the company of Mr. Higgins, who for fourteen years had been in charge of the department in the Experiment Station which had to do with the culture of avocados. He told me that his experiences led him to believe that the avocado required much less water than citrus trees. My own experience since that time has tended to confirm this belief. This year I had one row of eight-year-old trees which has received water but once, and they seem not much different from the others which have received water several times. They show a little less growth perhaps, and it must be remembered also that my soil is heavy, retaining the moisture a long time. I do not recommend so little water as only once during the summer, but cite this instance to show that the avocado in certain soils can live and apparently not suffer with very little water. I believe I have seen more definite damage done to avocado trees from over-watering than from under-watering.

The drip system of irrigation is my own invention and I believe is valuable for certain kinds of work. It is especially important to save water and where the planting is on a hillside or any place that it is difficult to comply with ordinary methods. At the present time, the high price of pipe makes it rather impracticable.

J. T. Whedon: If I were planting a new grove, I would plant 30 feet apart, and 15 feet apart in the rows. The rows would run north and south, because in Yorba Linda, the "northers" blow from the east. This method of planting would give a windbreak in a few years every 30 feet. I would then run a line of pipe in the center of the rows with a stand 6 feet high in each square, and water by spray where the pressure is sufficient; otherwise I would run a furrow to each tree and use the basin system for both watering and fertilizing.

As a protection against sunburn, I use the Wickson formula for whitewash, 30 pounds unslaked lime, 5 pounds salt, 4 pounds tallow. Commencing with the third year, if the trees are not headed out too high, they will protect themselves against sunburn and aid very greatly against windstorm.

T. U. Barber: The constant drip irrigation which Dr. Keller is practicing will develop what are often termed water shoots, a soft fast growth which is very much more subject to damage by both frost and wind than the slower natural growth producing a hard and

resistant wood suitable for the best tree development. I am sure we all hope the winter will be mild so that Dr. Keller will not have to grow new trees.

Most of the irrigation systems in California are worked on a monthly distribution basis; therefore the orchards in which it would be possible to irrigate by the drip system are very limited.

The constant drip irrigation under discussion will show very poor results on any soil with a tight compact subsoil or in adobe land. The only place it is possible is on well drained sandy soil or side hills of light soil. The avocado will not thrive in soggy land even if this condition lasts only a few months.

J. T. Whedon: The subsoil is very important. The subsoil in my grove in Yorba Linda is heavy clay, the first foot being a sandy loam with the next five feet a heavy clay loam with more or less sand. Last January, a year ago, there were almost continuous rains. I lost nine large Harmans on account of poor drainage. The avocado will not stand poor drainage, but with good drainage it is a difficult matter to give them too much water.

Dr. Keller: Part of my soil is sandy silt to about 8 feet. The hillside is black loam with disintegrated granite and clay subsoil. The subsoil does not take water very well, although the surface takes it readily.

E. E. Knight: For the first two years there is no doubt but that the drip system is the best, as the water is needed close to the tree, also less water is used than under any other mode of irrigation. But as the roots extend farther, it is more difficult to distribute the water properly. Also in most drip systems the stand is placed too close to the trunk of the tree. It is soon covered by the branches and difficult to get at. If an orchard is to be piped along each row, the stand should be placed in the center between each four trees; from there the water should be conveyed with either a short piece of pipe or by some other means to the trees while they are still small. The stand is in this case, always easily reached, and should an overhead system be installed later, the stands will be in their proper place. By placing a bean-straw mulch under the trees, not only can much water be saved but at the same time the soil can be enriched.

The only sure way to know when to apply water to the trees is to test the soil for humidity; but this is quite a task, so I lift up the mulch and if the fish worms are working I know the soil is still in good condition. As soon as the worms seem to be laying off, I fill the basin once; never soak the soil. I irrigate every week or ten days during the warm weather but use less water per month than is used on citrus. The amount of water used and frequency of irrigations depends on the class of soil. Most any system will keep an avocado tree alive and growing, but what we all wish to know is which system gives the best results.

C. F. Booth: Before giving my experience in irrigation I will say that my soil is different from most others in which avocado trees are grown. It is a sandy loam on top but becomes a sandy clay loam below. The soil is not deep being only 3 to 6 feet to bed rock. Last year I irrigated about every thirty days, using the basin system around the trees, with no ill effects.

This year having a much hotter summer, I irrigated every two weeks. The trees got along nicely until about September 1, when a large number of them—40 or 50

perhaps—developed what I have reason to believe is called black spot. Last year some children left a water hydrant running and flooded the basin around a young Lyon tree. The water must have been running three or four days before I discovered it. Some ten days or two weeks after that, a prominent Eastern nurseryman of wide experience, while looking over my place, noticed the Lyon tree and drew my attention to the leaves. They were spotted in the body of the leaf with purplish brown spots from the size of a pinhead to that of a dime. "That tree has black spot," said he. I told him of the basin being flooded for several days and he expressed the opinion that the disease was caused by too much water. So when my trees about September 1 of this year began showing those same purplish brown spots, I came to the conclusion that my soil is too tight to irrigate every two weeks.

The Lyon tree I have spoken of dropped all its leaves after they had turned brown and withered, and new weak looking leaf buds started to break; but after lingering until this spring it died. The leaves of the trees affected this year, have also dropped off, in some instances leaving the trees entirely bare. Some of the trees have already withered and died, while others have developed new young leaves. On some of the trees these new leaves are fresh and healthy looking, while on others the young leaves, sometimes before they are an inch long, begin to show the black spot around the edges and the leaves curl and wither and in a short time drop off. In extreme cases the tips of the limbs also wither and die.

I have not found the disease restricted to any particular variety of tree. It has appeared on some of each of the following: Northrop, Val de Flor, Harman, Queretaro, San Sebastian, Taft, Fuerte, Grande, Solano, Dickinson, Merito, Ameca, Sharpless, Lyon, Walker, and Meserve. None of the Puebla trees were affected, nor the Spinks, Perfecto, nor Montezuma. So I suppose those trees can stand more water than the others as they were all treated exactly alike. The trees introduced by Mr. Knight were generally immune, only two or three out of over fifty being slightly affected.

As an instance showing how little water an avocado tree can receive and yet live, I will say that last year while planting some trees, the bud was broken off one tree. The ball was thrown aside and lay on top of the ground exposed to the sun for six or seven weeks until it was as hard and dry as a bone. Through curiosity to see if it would grow, I planted the stump near a house occupied by a Japanese. The waste water from the house flowed by a few feet away. That was all the irrigation it ever got. It has never been cultivated and never fertilized. It is now nearly 10 feet high and looks better than any of the trees upon which I have devoted so much work and care.

From my experience I am convinced that the amount of irrigation required depends entirely upon the nature of the soil. Next year I shall irrigate perhaps as frequently as this year but I shall not use the basin system nor shall I use so much water.

E. E. Knight: Some varieties seem not to be affected with the mottle or brown leaf. Others are hardly ever free from this condition. I selected a tree in the center of my orchard and irrigated it from two to three times each week. It developed the brown spots, but in the center of the leaf, none around the edge. As a rule the brown makes its appearance at the end or on the edge of the leaves. I would offer as a suggestion that too much water affects the center and a lack of water the outside of the leaf.

Dr. Keller: I think that the spots on the edge of the leaf are from lack of water.

Mrs. J. T. Stewart: I have an avocado orchard of 15 acres which is not cultivated. For the first three years, this had the regular citrus cultivation. Last winter alfalfa was planted, leaving 3 feet on each side of the tree row. Shallow furrows were put in down the tree rows. The first cutting of alfalfa was used as a heavy mulch, with absolutely no cultivation. The water has been turned on often in the grove. The trees made a heavy bloom and growth this year. Those receiving much water set much fruit. I have not found that one can give avocados too much water. The ground is at all times very wet. The mulch is not removed and there is no cultivation. Trees have made the best growth this year, of any year before. Buds which were put in June, have made a wonderful growth. The water ran almost continuously on newly budded trees. The soil is a rich loam to approximately 30 feet, at least. The orchard is on a gentle slope. I have never lost trees from too much water.

E. E. Knight: Mrs. Stewart could not run water that way if she cultivated the orchard.

E. A. Chase: I have been in the irrigating business twenty-five years. If I could have the money I have paid for water for this purpose, I would be quite rich. Most persons run water according to what they can get. Porous soil does not retain surplus water; hence is not damaged by it. The same amount of water applied to heavier soil might be in excess of what is beneficial. There is nothing about which we have had less actual knowledge in growing things out of the ground, than as to the necessary water to give best results. It has been mostly, if not wholly, guess work. In the last year or two there has been considerable work done in the way of testing soil moisture and through these methods we may be able to learn something as to the quantity of water required to give best results on different soils.

Wm. D. Stephens: I have been experimenting with the culture of the avocado for about six years. On my home place in Montebello, I have a deep rich clay loam soil of unvarying character for at least 6 feet in depth. For the past two years I have not irrigated oftener than once in six weeks and on several occasions have extended the periods to ten weeks. I usually cultivate the ground deeply twice, and in addition keep the ground around the trees stirred deeply with a forked hoe between irrigations. The distance across my grove is about 700 feet and I let the water run slowly, requiring about three days for the water to get through the furrows when it is at once shut off. At no time have my trees shown any wilting of the foliage or any visible indications that the trees lacked the proper amount of moisture and I challenge a comparison with any trees of equal age in the State, both as to size and vigor.

J. T. Whedon: How does Mr. Stephens account for the growth of the avocado in Mexico and South America without cultivation?

Mr. Stephens: Several years residence in the plateaus of southern Mexico where the avocado flourishes at its native best, side by side with the orange, lemon and lime, have satisfied me that there is not the slightest ground on which to base a comparison between the absolute lack of care under which all varieties of trees and fruits flourish in the tropics and the care and treatment essential to the best development of the same trees and fruits here in California.

I wish to state that in the municipality of Atlixco, State of Puebla, Mexico, where the finest native seedling avocados in the world are found, it would be a very difficult task to gather together a finer exhibit of fruits than has been shown at either of our last three conventions. Many of these Atlixco trees are upward of one hundred years old; yet a yield of more than 1000 to 1500 fruits per year from one of these very large and ancient trees is the rare exception. Here we have trees less than twenty years old that far exceed such production and yield a grade of fruit that compares at least favorably with Atlixco's very finest.

There the rainy season lasts in normal years from early in June to the last of October, the total precipitation varying from 60 to 100 inches. The topography consists of rolling and sloping mesas giving always abundant and rapid drainage. The natural growth of a multitudinous variety of trees and plants is rapid and rank, and results in a continuous deposition of decaying vegetation which obviously enriches the soil and keeps it so covered that the sun's rays rarely reach the bare ground. Thus, it will be readily appreciated that under such conditions, the shiftless methods employed in those countries cannot logically be cited as any dependable guide to the treatment we should give the tree here where our conditions of soil and climate are so radically different.

It might be well for the gentlemen who advocate irrigation every ten or fifteen days and no cultivation, to review the development of the citrus industry during the past forty years and more. Remember that the orange, lemon, and lime are growing prolifically in the tropics, side by side with the avocado, and thriving and bearing in at least an equal ratio to the avocado; yet in production or quality of fruit do not approach our groves here in California. What would have been the results to our great citrus industry in California if the treatment advocated by these gentlemen for the avocado had prevailed? Would you gentlemen recommend that we give our citrus trees this same dose of water every ten days and no cultivation? I submit that it is as logical a suggestion in one case as in the other, and in conclusion I would like to predict that if some of our American energy and intelligent methods of cultivation, pruning, and general care were introduced into the avocado groves in their native homes, a vast improvement both in quality and production of fruit would result.

In a later discussion, Professor M. E. Jaffa stated that as a comparison, 25 per cent of oil was obtained from olives not over-irrigated, 18 per cent being obtained from olives which were over-irrigated. This he thought might in some measure apply to avocados.