

Avocado Tree Nutrition

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President Griswold: Avocado nutrition is a very important question. We spend a lot of money for fertilizers and want to be sure we are doing the proper thing. We have with us Mr. Kenneth Smoyer, Assistant Farm Advisor of Los Angeles County, who will talk to us about Avocado Tree Nutrition.

Mr. President, Ladies and Gentlemen: If you don't mind I will get up here on the platform because I have a few exhibits I would like to show you. I hope you will bear with me if I get out of line with this microphone because like Eddie Cantor, I like to move up and down over the platform.

Why are we interested in avocado nutrition? I think you are interested primarily, along the line that George Hodgkin brought out this morning. You have had some good prices lately. We have no doubt that in the future the prices aren't going to be quite as good. Many old-timers remember the years we got about four cents per pound for avocados. There certainly is no reason to expect that such prices won't return again, and it is therefore, up to you growers to produce the most avocados you can produce, per acre, at the lowest cost.

Now, how can that be done? Well, if we are going to do that intelligently we have to know as much about our business as possible, and of course, as you recognize, comparatively little is actually known about avocado production. As you have been told this morning, we are still groping in the dark about avocados, but we can draw some conclusions from information we know with respect to other plants.

Nutrition doesn't mean just fertilizer. Nutrition means how the plant lives, what it takes up, how it takes it up, and many things like that. First of all, I want to go very briefly into a little of the physiology of the avocado tree, enough to give you an idea on which you may base some decisions with regard to your fertilizer program.

You avocado growers must do something in the orchard that will help you in the nutrition of the trees. We will start out here with a chart. Of course, extension people always have a chart. The chart isn't as large as it should be to let you folks in the back of the room have much advantage from it. I will try to call off a few of the things.

We find that in plants generally we have about fifteen chemical elements that are essential for plant growth. We know that the most recent one found is molybdenum, which made the fifteenth. We know we need these fifteen elements, but where do they come from; what are the values of these particular elements, and what can you as growers do to see that your trees have all of these particular elements that they need for a good healthy growth? We will go into that very briefly.

Along this line the physiologists tell us that if you dig a tree up, dig all the roots and take all the top and all the trunk, and put it in a great big oven and turn the heat on and dry it out, that after you have dried that thoroughly, you have lost about sixty-five per cent of the weight of that plant. That is the water you have driven off. The part that is left is what you are interested in. Of course, you are interested in that water you have driven off from the standpoint of irrigation, but what you have left is about thirty-five percent of the weight of the plant. What is that thirty-five per cent composed of?

The way the scientific men find out is to turn the heat up higher in the oven and burn the plant to an ash. They find out after they have burnt that plant, that they have left about five per cent of the dry weight. That five per cent actually has in it about three per cent of the oxygen from the air and the other two per cent are minerals from the soil. You have lost approximately ninety-five per cent of all the dry weight of that plant.

Now, that is a lot. Let's consider that first because it is the major portion of your plant. Where does the tree get that 95 per cent of dry weight? We find in the study of plants that the bulk of the organic matter, which is the part that is burnt off, comes from these four elements—carbon, oxygen, hydrogen, and nitrogen. The carbon and oxygen come from the air, the hydrogen and oxygen from water, and nitrogen from the soil. The bulk of your plant is made of those four things. You can do something about the nitrogen because that is in your fertilizer, which is under your control.

What can you do about the air? You might move somewhere else where you have nice good smog-free air—some growers may be handicapped by it but can't do much about it. You need good air to have a good plant-growing condition. Fortunately the air is free and that is the major portion of your tree. The water is not very expensive. The nitrogen is only a little expensive.

The rest of the elements we find come from the soil and those are the things that we can do something about. So we will be concerned with those now, that little two per cent of those elements from the soil. In order that we may understand how a tree gets these things, we should know something about the tree itself. If you know a lot about your business, you can make a t good decision. The man who makes good decisions is the man who makes the money. It isn't the person who goes out and spreads the fertilizer on the place. The man who knows what, when, and how to spread it is the man who makes the money. The man who makes these decisions should know all he can about his trees.

Just so you may have a bit of comparison, I brought some parts of a tree. I have a feeder root here, which is pretty small. We always like to get these specimens nearby. We went to a ranch in Los Angeles County run by a man by the name of Paul Bunyon who farms with a blue ox. He has an avocado orchard of fine healthy trees. This is the type of feeder root he grows. (Shows a 2-foot model of the tip of a feeder root).

We took a portion out of the trunk of one of his trees. (Shows section of a trunk).

If you want to see a cross-section of the leaf, you tear a leaf across the end. You can't see much in it, can you? So we took a small portion of a leaf from this Bunyon ranch, and you get an idea what the cross section of a leaf looks like. (Shows a model of the cross section of a leaf). Your leaf, stem, and root—how are these related to the job of

taking up foods from the soil and from the air? Let's start with the top of the tree. We have a green leaf. The leaf absorbs carbon dioxide from the air, getting the carbon and the oxygen it needs and takes them down into these cells. Here, in the presence of the green matter you see, and lots of good clean sunshine, and along with water and nitrogen, taken up by the roots from the soil, puts it together in forms that the plant can use. Then through the trunk it is distributed all over the tree to the places where it is needed for growth. You can see now why the trees need lots of good green leaves.

Why do you care about leaves? If you prune off too many leaves, you reduce your food manufacturing equipment. If you plant trees too close together you don't have enough leaves. They can't get enough sunshine and you reduce the food-making processes of the plant. So we need lots of good green leaves on the tree—large dark green ones.

We find that down under the ground where very few of us care to look are many roots, "we hope." Most places we do find them. We have here a section of a growing tip, a little tip that represents about a thirty-second of an inch on the tip of a root, which is called the root cap. It is that little tip, primarily, that absorbs the water and the mineral nutrients from the soil. This little tip—why is it important? It shows that the more roots you have, the more tips, and the more chances your tree has of absorbing these minerals and water from the soil to send up to the top.

Now, when the water and minerals go to the top of the plant, they go in a certain direction. This little white strip here is called the cambium. Out here is the bark and inside is the wood. The water and minerals move up in a narrow band just inside the cambium. The inner wood usually fills up with gum and other materials and is not active. The nutrients move up into the top of the tree where they combine with the carbon dioxide. The products thus formed then move down through the inner bark just inside the cambium. As they move, they are distributed and stored in all parts of the tree where they are available for utilization in growth processes.

Having considered the entire tree, we now have to consider how these processes are to be serviced. We should conduct our management in such a way that these processes may be serviced most efficiently.

We now may consider what you as growers can do to help these processes take place. Mr. Wilson Popenoe mentioned the matter of the heavy clay soil, on which he does not find avocados growing. Many of us have tried to grow them on heavy soils with poor results. What can be done about these heavy soils? You can't make a good soil out of a poor soil. You may farm as best you know how on a poor soil, but you cannot economically change the soil enough to make it into a good soil. Now, that sounds pretty tough, but Jim France has talked to you about it before. Don't expect to grow good avocado trees on poor avocado soil.

One thing you can do about your soil is to leave it alone. We know that cultivation compacts soil. So don't cultivate any more than you have to. See that you have sufficient organic matter on the soil if you cultivate, because you want your soil to take water well, to remain open enough for the roots to grow rapidly. How can you do these things in an avocado orchard? I, personally, believe that the non-tillage system is by far the best to meet these requirements.

It is true that on shallow soils you don't get deep roots and you want to develop soil conditions that will permit many roots to grow with lots of feeder roots to take up the minerals. Also, manage that soil properly by irrigating it properly. I believe that in California many of our farmers do not allow their ground to dry out sufficiently between irrigations. We must recognize, of course, that some of you are on irrigating schedule and can't do just as you wish. However, the wider the fluctuation you can get in your soil moisture the better the conditions are for the soil to adjust itself to fit the needs of the tree. So watch your soil carefully but let it dry out. As long as that soil doesn't reach the wilting point, your plant will grow normally. If it stays at or below the wilting point too long, then you damage your trees.

Dry the ground out and keep off your soil. Don't cultivate too often. Allow the organic matter such as leaves and weeds to collect over the orchard. If you must cultivate excessively so you don't have many weeds growing, you might have to add expensive manures as a source of organic matter to keep your soil in good tilth.

Manage your trees so that they have plenty of sunlight, open the orchard up. Stop the crowding, which you all recognize shades out the lower limbs and reduces the leaf area.

One other thing you can do, of course, and which we mentioned before, is to put nitrogen in the ground. See that your tree has all the nitrogen it needs. You will have to determine what amount that is. But on the average about a pound and a half of **actual nitrogen** per tree is sufficient.

Another thing you can do concerns zinc deficiency. You can spray zinc sulfate on the tree and correct mottle-leaf. You will get much larger and darker green leaves which will manufacture more plant food for your trees.

That, very briefly, is a story that will fill many books and there are exceptions to some of the points given. You should be interested in knowing how your tree works and then adjusting your management program to fit it, thinking of the minimum adjustment or minimum expenditure that may produce the most fruit per acre. We can produce fruit much cheaper than we have if we will just keep in mind and accept the facts that have been proved by the scientific men at the research stations regarding the things that have been developed along this line.

Accept the scientifically proved facts and do the things that are suggested as a minimum. Then if you think some of these things that are for sale on the market look reasonably good to you and the salesman has some good talking point, say to him, "I will buy a little of that and put it on a small plot of ground. If that does me any good in comparison with the rest of the orchard. I will buy all you recommend for my place."