

Fertilization of Avocados

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Mr. Chairman, Ladies and Gentlemen—Your president has said we have all been wondering about the problem of fertilizing avocados. The people in the Extension Service throughout the state are wondering, as are also the members of the Experiment Station staff. It is not a set and finished problem by any means.

Avocado fertilizing is seemingly a simple task although it sometimes during the year is quite an odorous one. But it is not a simple task; it is a very complex thing. For the sake of some of our many, many new growers, it was asked that we go into some of the basic principles of avocado fertilizing. Fortunately, so far we have had a lot of leeway in our fertilizer program. We must admit that our prices have been fairly satisfactory. We have had a little margin of profit whereby we could throw on fertilizer as we felt we could afford it. We have had a wide range of soil of a fair degree of natural fertility. So this fine point of just how much or how little do the trees need hasn't been a point of much concern. It is in the future that this is going to be an important factor.

A few years ago we thought we had to plant avocados on the hillsides. There is a much greater area of flat land and it is more easily farmed than hill land, and we know avocado growers are going to this deep flat land soil in Orange County.

Fertilizing Should Fit the Soil Type

It is important to learn how to fertilize most efficiently, with an adequate program and with the least cost we can put into it.

What do we know about avocado fertilizing today? Nothing is known basically about it except one or two facts. If we are going to fertilize avocado orchards, we should know something about the soil we are dealing with. We should know the physical characteristics and the chemical characteristics. That is important.

To mention one thing—lime. You have heard about lime, especially if you come from the East. I recall one case of a very intelligent man I knew— intelligent to the extent that he had earned a quarter of a million dollars in inventions—who put fifteen hundred pounds per acre on a soil where the trees were already yellow from excess of lime. In the East it is a fertilizer. It seldom is in Southern California.

We can also know that sulphur, for example, is a favorite in some areas. A man putting sulphur on high calcareous soils can spend money but never put on enough to counteract it or to change it to bring about an acid type of soil. So you can spend a lot of money on a piece of ground and not do you any good, and all you can do is just hope

that it might. If you know what your soil is to begin with, you can control some of the expense.

Now it is also important to know about the depth of soil and the origin of soils, because they all have different qualities of fertility. California is a new country and has new soils. Our soils are just in the process of breaking down to become soils in which plants can grow. In the East, geologically speaking, the soils are quite old. They have had lots of water by way of the summer rains, lots of leavening out and have lost much of their original fertility. So in the East we find a different program of fertilization necessary for plants than here on the Pacific Coast. Many of our soils are composed of coarse granular materials as sands, pebbles, and gravels. Those particular phases of soils are not fertile. The fertility comes in the clays and colloids and small particles in the soils. The more of those clay particles you have the more native fertility you have along with an accumulation of organic matter.

California does not have a lot of organic matter in its soils. The eastern soils have a lot of summer vegetation and under the native or natural conditions have accumulated organic matter more than our soils here in California. Organic matter imparts to the soils some fertility as it breaks down and becomes available to the plants. So, when you have a deep soil, you have a wide area or a deep area of accumulation of fertilizer. If you have a shallow soil you have a small area of good material which your plants need. We have witnessed this very often. Trees planted on virgin soils have been able to go for some years before they show any signs of nitrogen deficiency. By knowing the texture of your soil you can come closer to judging where you should begin in applying a fertilizer program. If you are on a light open sand without much clay, then you have to fertilize more heavily and should put on a lot more organic manures than you do on a soil that a lot of clay and a lot of natural native fertility.

Nitrogen and Organic Matter Most Important

California soils are characterized by two definite things, a shortage of nitrogen and a shortage of organic matter. First, we will consider the matter of nitrogen. We can see the signs of shortage of nitrogen in trees, the turning yellow of the leaves or the lightening of the color. That has been proved by all of you and everyone concedes it to be a fact, and we all apply nitrogen. Now what kind of nitrogen do we have to apply for avocados? Everybody has a different idea. everybody seems to be just about right. It works in a good many cases, but actually what we know about avocados is limited. We have more information on that matter with citrus. We start the avocado fertilizer program based on what we have learned from research programs on the handling of citrus trees. We started using two to three pounds of nitrogen per tree for the full grown tree. It has been well proved now that as far as citrus and other plants are concerned that the plant doesn't care just where it gets the nitrogen. We have a wide range of materials developed. Nitrate of soda, sulphate of ammonia, liquid ammonia, and cal-Nitro, and a lot of other things. Sodium nitrate has 16 percent nitrogen and a lot of people swear by it. Sulphate of ammonia has about 20 1/2 percent nitrogen. We will take those two as examples.

You can use either one of them, but which one should you use? First of all, thinking of

this economical program, use the one that is cheapest per pound of nitrogen. That is a simple thing to find. Divide the cost per ton of the materials by the percentage of nitrogen in it, and you will come out with a figure that shows. Whichever is smaller is the cheaper.

Next, is what is going to happen to that material when you put it on the soil. Nitrates are very soluble, very leachable in getting into water and moving through the soil. Possibly they are not too good a thing to use on light sandy soils through which water penetrates. It is better if used on heavier types of soil where the water doesn't move quite so fast and leaching is not so great. The ammonia compound apparently doesn't go through the soils as rapidly. It ties up in the surface and is made available to the plant as succeeding irrigations are put on. So, in considering the type of nitrogen, you should consider the type of soil you have. Also in relation to that as I mentioned before, the method of application which you use.

We believe—I say we believe, but we can't prove it—but we believe that the first application of fertilizer in the year should be broadcast because we like to think of the soil as a storehouse which we try to keep supplied. We fertilize the acreage rather than the individual tree. We put on an amount on the basis of an individual tree just as a measuring stick, but apply it all over the ground to get at all the other roots. This application feeds the cover crop and you get a better crop so you can get more organic matter on the soil. Applying it in the furrows is just as satisfactory. Many growers do it, putting it only in the furrows, and fertilize their trees year in and year out. They never fertilize on the slope of the terrace or in the tree row, but they do a good job just in the furrows.

There are also the organic or concentrated organic fertilizers—fish meal and blood meal. They are good fertilizers in themselves, fairly high in nitrogen, but on the average quite expensive and generally not used in citrus or avocado orchards. They are used in vegetable growing to keep from having to go back and put on a lot of extra applications. You put it on once and you can forget it. Vegetables are fairly shallow rooted and need the nitrogen in that area for a period of time.

Then there are the manures. There are a lot of differences in manures, differences that the average grower doesn't recognize. For example, a real good better-than-ordinary dairy manure will run one percent of nitrogen. Pure droppings from poultry yards from underneath the cages will run as high as four percent nitrogen. Therefore that type of material is worth four times as much to you as the dairy manure. It also carries a higher percentage of organic material. It runs 70 percent compared to the 30 percent in the dairy manure. Don't pass that up to buy the cheaper manure even though it may run to twice as much because it is worth four times as much. We as growers of avocado trees have passed up those fine fertilizers that are actually cheaper and allowed the truck crop, the Japanese gardeners, to get a corner on that fertilizer and we pay a higher price for a poorer fertilizer.

There are lots of other kinds. Hog manure is excellent fertilizer, but one which doesn't get you by too well with your neighbors; but it is a good fertilizer. Ordinary rabbit manure can be picked up at the rabbitries around here. Lots of that fertilizers is going to ordinary gardeners and runs two percent nitrogen.

Cultivation Reduces Organic Matter

Now, we do need organic matter in our soils in California, primarily to overcome the physical damage we do to the soil by cultivation. The principal use for the organic matter is the more we cultivate the soil the more organic matter we need. Now, a wheat cover crop will furnish organic matter that is just as good as the manure you purchase. It has a further value in that it brings in additional nutrients from the outside. It runs from three to one percent of phosphate and around the same amount of potash—good things to put on your soil especially on light sandy soils.

One thing we must look forward to—we don't know under our heavy irrigation program when we have worn out some of this native fertilizer, and some day we might come to the place where we wish we had been applying manure regularly. The Extension Service has always believed that a good fertilizer program should include about half of your nitrogen program in the form of manure. Farmers have been using it for a good many thousands of years. It is good to use and it might be a safe program. However, we do know that in this present time when manure is high, that you can pass up a few years' application and not see a bit of difference in your orchard, provided you apply sufficient of the chemical nitrogen to make up the nitrogen you would have gotten in manure.

The question of applying manures, the timing of it, and where you should put it has been a controversial subject. As far as the evidence goes, if you have had an adequate program in the past and haven't been starving your trees, it doesn't make much difference what time of year you put it on. You can put it on any time and it gradually works in and becomes available to the soil or available to the trees and it will do you just as much good. Ordinarily, it is put on in the fall of the year so it can break down over the winter and become available in the spring. But with a good overall program you can put it on any time. It should be spread over the entire acreage, and it is not necessary to turn it under the ground, with this one exception. If you have fresh manure, high in ureas and volatile materials, then there is a saving by turning it under the ground because you save those ammonias that would be volatilized into the air. Old manure lying out in a corral for four or five months has little left to be lost to the air and you can apply it to the top and let it lie. That will fit those people who don't go in and cultivate any more. They have a permanent cover or the trees are so close and tight they never have to cultivate. There is no evidence that you have to turn it under the ground. If you do turn it under, it breaks down much faster than if you let it lie on the surface.

How About Potash and Phosphorus?

There has been a lot of questioning and there still is on the matter of phosphate and potash. In most cases we can say flatly and definitely that phosphate and potash have not given economical responses to their application. That is, the growers have not gotten back in improvement or increase in returns to the orchard an amount equal to or greater than the cost of the fertilizer and its application. I know we have heard at these meetings in the past years of growers who have said, "I have used phosphates and potash successfully." We don't deny that at all. However, there are certain precautions we must consider in the use of material like that. First of all we know in California our

big problem is to get the phosphate and potash into the tree. For years citrus growers have tried to apply it. They have applied it on citrus but have been wondering how they can get it into the tree. Eight months ago I attended the Fertilizer Institute and one of their research men said, "Our big problem is to get phosphate and potash into the tree. We might then get some results, but so far we haven't been able to get it into the tree, barring one or two occasions under special conditions." In the citrus orchard they have not been beneficial. With avocados they may possibly be beneficial.

I just draw a parallel here to show a possibility. The avocado is a shallow-rooted plant. The roots grow near the surface of the ground. You can apply your phosphate and potash possibly on the root. The tree might get it. We can't think of zinc. We know we have a zinc deficiency. I know of any number of cases where the grower has applied zinc sulphate to the soil and corrected the mottled leaf. Application to the soil doesn't always correct mottled leaf. It may be that that zinc sulphate applied to the soil was applied directly in contact with the avocado root or roots and they were able to take up sufficient zinc sulphate. It may be that is possible also with phosphate and potash.

The growers that I have talked to who have used phosphate and potash successfully have done it in one way. They have got a mixed fertilizer and spread it over the entire orchard and next year had a good crop and an increasing production on the young orchards. "A good fertilizer! It is the potash and phosphate that did it."

Let me state one case of a grower of citrus to show how growers can talk themselves into things without analyzing their whole problem. I was talking to him about our extension program on fertilizer. He said, "I agree one hundred percent except for one thing—the use of phosphate on citrus." I said, "How was that?" "I got a so-and-so orchard. It was run down. I put ammonia phosphate on that orchard, pruned it, changed the irrigation system. I put a lot of organic matter on it. I did the pest control work and the orchard came out beautifully. See what phosphate did?"

Now, that is actually the case, and it is a thing we can often talk ourselves into. He was honest about it. He felt sure phosphate was what had done it! If you are going to try a new material, be sure that when you put it on that it is the only thing different that you do on that particular piece of ground. Don't put it over the whole orchard. Put it on a little bit of ground, and watch it for several years. Put on plenty. Don't put on two or five pounds. Put it on strong—ten to fifteen pounds to twenty-five pounds. Those things stick very tightly in our soil and don't go through them readily. Also, if you are going to put on mixed goods, don't put your regular nitrogen program over the whole orchard and then put this on with the nitrogen, because that means your experimental plot gets that much more nitrogen. Be sure the plot gets no more nitrogen, and nothing different except the phosphate and potash and prove it to yourself.

I know the men at the Research Station aren't sure we don't need potash and phosphate. They believe that if we could get it into the tree we might get responses. We will have to learn that with avocados. It hasn't yet been worked out as far as our avocado program is concerned.

Use Wise Economy in Fertilization

Now, when we have a little extra money, we have to get into an overall program of research on each individual orchard. You can look at this map. Look at all the different colors, the different types of soils. If you were closer to the map you could see very tiny little islands, maybe twenty or thirty acres in a spot. That doesn't mean that the soil is exactly like that in the whole area. There may be three or four different types of soil in that plot. These soils are variable, as we well know. Because your neighbor farms a certain way is no reason for you to farm the same way. If you have a good overall program and spend a lot of money, you might get away with it. The day may come when we will have to have a more economical program. Citrus people are talking about it. It behooves us now to find out how economical we can be on our avocado production, and you fellows are the ones who can do it. Experiment a little. Have a lot of fertilizer plots and get some good ideas on what a fertilizer program should be. You are going to have to try it on your own place, not only for potash and phosphate, taut for nitrogen.

Avocados Need Less Nitrogen Than Citrus

It is indicated that we don't need as much nitrogen as we have been in the habit of putting on in the past. Apparently half of what we use for citrus is satisfactory. We use two to three pounds of nitrogen on citrus and one to one and a half pounds per tree on avocados. We have orchards where we have had citrus and avocados growing together where the citrus trees have showed nitrogen starvation but the avocados have grown beautifully in that spot. A few years ago, I did work in the city of Los Angeles. They have a lot of avocados in town lots there; they like them. They have never fertilized their avocado trees at all. They irrigate it, it grows up, they play under the tree, and I have rarely run across one of these trees with nitrogen starvation. Apparently they don't need very much or they can feed a lot closer, to a lot lower level in the soil, than the citrus. The evidence is that you don't need as much as citrus. That is important today. Fertilizer is scarce.

It seems that for the overall industry picture, not only of avocado growers, but for the farmers as a whole, nobody uses more nitrogen than he absolutely needs today. As you well know, there just isn't enough available to take care of all the orchards and truck farms. Now is the time to keep the cost down. But remember this: You might even then get into trouble if you are on a very weak or poor soil with little native fertilizer in it. You can be helpful in cutting the program down. Also you growers who are on very deep soils and who have had adequate fertilizing program, and without any fertilizing. I have seen a lot of orchards get by with nothing more than running water over them. It isn't going to hurt you who are on good soils to pass up a fertilizer program if you have had an adequate program in the past. I'm afraid my neck is out a long way on that.

We get down to one or two more things here. If you cultivate your soil a lot, apply some barnyard manures but buy the cheapest form you can find. Remember that the highest cost per ton may be the cheaper per actual unit value to you. You need nitrogen but apply less than you usually have been applying—one to one and a half—in some cases more, but buy it in the cheapest form you can find. If you are going to apply phosphate and potash do it on an experimental basis. Experiment also with the amount of nitrogen

you do need on small plots in your orchard with the idea of looking into the future when you may have to cut your production cost 15 to 25 percent to stay in the business. Research people will pursue that course, but it is a long-time picture; and the more people working on it, the better. Really, we know very little about avocado fertilizing.