California Avocado Society 1952 Yearbook 37: 77-82

THE FINE ART OF FERTILIZING AVOCADOS

Paul W. Moore
Farm Advisor,
University of California Extension Service, Los Angeles County

Fertilizing avocados is more of an art than a science. Comparatively little scientific information has been developed concerning the nutritional requirements of the avocado. Most of our knowledge of the effects of different fertilizer programs has been gained from observation and the experience of hundreds of growers rather than from carefully conducted experiments. Because these observations have been made over a period of many years on many soil types and in all the avocado districts, certain conclusions can be drawn regarding a safe fertilizer program.

Briefly stated, the demonstrated responses of avocados to various fertilizers show that the elements most likely to give results are nitrogen and in some cases zinc. On certain soils in San Diego County known to be low in phosphate, poor, unproductive citrus trees have made marked improvements when given phosphate fertilizers. Avocados on these same soils have not shown any recognizable phosphate deficiency symptoms. It would probably be good practice however to occasionally apply phosphate fertilizers to such soils.

CALIFORNIA SOILS ARE FERTILE

Most of our avocado soils appear to be supplied with enough of all the other essential elements to last for many years. The data in Table I will illustrate this fact. They show three things:

(1) The total amount of some of the more important elements necessary for plant growth in an acre of soil 2 feet deep. This is one of the typical southern California avocado soils of granitic origin.

(2) Also shown is the amount of each element removed each year by a 10,000 lb. crop of avocados.

(3) In the last column is shown the number of years (crops) that would be required to exhaust each element if the entire amount were available to the trees.

One of the first things you will note is the difference in the supplying power of the soil for the different elements. Thus if all of the nitrogen were equally available from the time that the orchard was planted until it was entirely used up, it would be exhausted in a little over 100 years. At the other extreme, there is enough iron in the soil to last more than one million years. However, plants cannot extract all of these nutrients and one would expect deficiency symptoms to develop long before the *total* supply of any of these elements was exhausted.

.

TABLE I

Removal Of Plant Nutrients From A Typical California Soil By A 10,000 Pound Crop Of Avocados And The Number Of Years Required To Exhaust The Supply

	Amount in 2 Acre Ft.	Lbs. Removed in 1 Crop of 10,000#/acre	No. Years to Exhaust Supply
1. Nitrogen	4,000	30	133
2. Phosphorus	8,030	9	892
3. Potassium	121,500	58	2,096
4. Copper	241	0.1	2,410
5. Sulfur	8,050	2.55	3,137
6. Magnesium	49,400	3	16,466
7. Calcium	140,000	1	140,000
8. Manganese	6,820	0.021	324,762
9. Iron	196,800	0.15	1,312,000

Much of the *total* supply of some nutrients is combined in rock and sand particles. These elements can be utilized by the plant only after the rock decomposes into more simple minerals. If available forms of these essential elements are used more rapidly than they are replenished by the decomposition of parent rock particles, nutrient deficiencies may develop. Some of these elements are made unavailable to plants by the alkaline reaction of our soils and it frequently becomes necessary to fertilize or use some other means of furnishing the tree with these elements, long before the supply in the soil is exhausted.

Two points might be emphasized here. In terms of what an avocado crop removes from the soil, the total potential supply of many elements is large. On the other hand the available supply of these nutrients is not inexhaustible and may need replenishing in time. It would appear that one need not be overly concerned about immediately restoring the relatively abundant elements such as calcium (lime), potassium, magnesium, iron or sulfur. If an occasional application of manure is made to your orchard soil, you can take comfort in the fact that relatively large amounts of these elements are restored to the soil.

One should keep in mind that we fertilize to make up for deficiencies in the soil rather than to feed the tree directly with all its nutrient requirements. Our very best soils supply everything the trees require. These soils require no fertilizer. Most of our soils sooner or later become deficient in nitrogen. This deficiency can be supplemented by the application of nitrogen carrying commercial fertilizers or by high grade manure.

OBSERVE YOUR TREES

Your trees are open books. If you learn to read them you will be able to tell their nutrient needs at a glance. For example, nitrogen deficiency is indicated by pale green or yellowish green leaves. This is in contrast to the normal dark green color of leaves

formed under an adequate supply of nitrogen. In advanced cases even the veins turn yellow.

One should not confuse the symptoms of low nitrogen with chlorosis or iron deficiency. Under conditions of iron deficiency, leaves are a pronounced yellow between the veins. The veins however remain green. Usually some branches are more chlorotic than others. Some branches on the same tree may be unaffected.

NITROGEN NEEDED

Observation and experience indicate that the nitrogen requirement of avocados is definitely lower than that of citrus. Under conditions where citrus trees show marked leaf symptoms of nitrogen deficiency, avocados have been known to thrive. There are perhaps thousands of dooryard avocado trees throughout southern California that have never been fertilized but still grow vigorously and produce good crops. Avocados grown in permanent Bermuda grass sod maintain good leaf color and bear satisfactory crops when fed amounts of nitrogen which would be inadequate to maintain citrus trees. A few commercial avocado orchards can be found that have received no fertilizer whatever for several years but are still thriving and producing good crops. However, most commercial orchards will benefit from nitrogen fertilizers.

Whether or not it will pay you to use nitrogenous fertilizers will depend upon the nature of soil.

Trees on deep fertile soils may require relatively small amounts of fertilizer to maintain good production. This is especially true during the early life of the orchard. Trees on shallow, sandy, or poor soils usually require more. In either event leaf color and tree vigor can be used as reliable indicators of soil fertility. Experience suggests that as long as trees are growing vigorously and have dark green foliage that soil nitrogen is adequate and that the application of additional nitrogen carrying fertilizers is of questionable value. Every grower should determine for himself the requirements of his orchard.

If pale leaf color indicates its need, a basic application of about 100 Ibs. per acre can be applied. This amount can later be adjusted upward or downward as tree condition dictates. Another approach would be to try different amounts on a few trees or a few rows and observe the results.

Extensive observations show that an adequate fertilization program for bearing avocados consists of an application of 100 Ibs. to 200 Ibs. of actual nitrogen per acre each year. The lower amount is usually sufficient for young orchards on fertile soils. The larger amounts may be necessary to maintain full bearing trees or orchards on poor, shallow or sandy soils. If half of the nitrogen comes from manure, which is in itself a - good "complete" fertilizer, adequate amounts of phosphate, potash and other nutrients will be added.

Such a 50-50 program is hard to beat. Chemical sources of nitrogen are usually more efficient and less expensive. Thus if one half of the nitrogen comes from this source and the other half is supplied in manure, one can be certain of preventing the depletion of other soil nutrients. In addition, the organic matter will have certain beneficial effects

upon soil tilth.

Table II shows the amounts of the commonly used fertilizers needed to supply 100# of actual nitrogen and may be used to determine amounts to apply.

Table III shows the comparative value of manures generally used by avocado growers in southern California and the amount of each kind required to supply 100 Ibs. of nitrogen. The table also shows the quantity of phosphate and potash carried in the same amount of manure.

TABLE II

Amounts of Chemical Fertilizers Required To Supply 100 Lbs. Of Nitrogen

Ammonium Sulfate	488 lbs.
Ammonium Nitrate	300 lbs.
Calcium Nitrate	645 lbs.
Sodium Nitrate	625 lbs.
Anhydrous Ammonia	122 lbs.
Ammo. Phos (16-20)	625 lbs.

TABLE III

Fertilizer Value of Manures

		Lbs. N*	Lbs. P*	Lbs. K*
5 tons or 325 cu. ft.	Dairy (dry)	100	50	180
2½ " " 150 " "	Hog	100	105	50
1⅓ " " 75 " "	Poultry (droppings)	100	85	43
2½ " " 150 " "	Poultry (No. 1)	100	95	60
2½ " " 175 " "	Rabbit	100	65	60

*N - Nitrogen; P - Phosphate; K - Potash

WHEN AND HOW

Chemical fertilizers may be applied at any time of the year. A common practice is to broadcast them evenly over the surface of all the soil occupied by roots. This is done toward the end of the rainy season, usually in February. Fertilizer spread at this time of the year will be dissolved by rains and taken into the soil where roots can absorb it.

For summer applications, fertilizer may be broadcast if the orchard is irrigated with sprinklers or is placed in the furrow bottoms if furrow irrigation is practiced. In either case the fertilizer will be dissolved and carried into the soil in the following irrigations.

On loamy or heavy soils all of the fertilizer may be applied at one time. On the more open, sandy, easily leached soils split applications are preferred. One third to one half of the annual requirement is usually broadcast in February. The remainder is applied later at one or more times during the growing season—June and August.

Manure may also be spread at any time of the year. Timing is not critical. Where an adequate fertilizer program is followed, there is always an available supply of nutrients in the soil and trees can draw on the supply as needed.

YOUNG TREES

Young trees require special care to get maximum growth during the first few years. This is especially true where sandy or infertile soils are involved. Under these conditions frequent, light applications of the nitrogen carriers are desired. One method used successfully by many growers is to use 1 tablespoon of sulfate of ammonia or ammonium nitrate per tree every other irrigation during the irrigation season. The amount can be increased and the interval lengthened during the second year. Growers are cautioned not to mix manure or fertilizer in the holes at the time of planting. Root systems may be damaged by this practice. A better practice is to apply the fertilizer to the soil surface in the basin or furrows. Best results can be expected only if a constant supply of moisture is available. Young trees should never be allowed to dry.

ZINC NEEDED TOO

Zinc is the only other nutrient deficiency that most avocado growers will have to correct. It is not widespread but where it occurs it reduces yields in proportion to its severity. In advanced cases fruit may be unmarketable because of its small size and off shape.

Zinc deficiency is easily recognized by its characteristic leaf symptoms. The leaves are mottled with light green to light yellow areas between the veins, starting at tip and the margin of the leaf and working toward the mid rib and base. The line between the lighter areas and the remaining dark green areas is relatively definite. The more severe the deficiency, the smaller the leaf and the greater the mottling.

The distance between the leaves on the stems is shortened. This gives the branch a bushy appearance, particularly on terminal growth. New growth is stunted. The tree produces less and less fruit as the deficiency becomes more pronounced.

It is more economical to correct zinc deficiency with foliage sprays than by application of zinc carrying fertilizer to the soil. When even the slightest symptoms appear it is advisable to treat the trees with a spray made from either of the following spray formulas:

5 lb. zinc sulfate		
2½ lbs. hydrated lime		
(or soda ash)	or	2 lb. zinc oxide
100 gallons water		100 gallons water

OTHER DEFICIENCIES

Cases of iron deficiencies are rare and usually occur on soils excessively high in lime. No really practical way is known to correct lime induced iron deficiency.

No clear cut symptoms are recognized for deficiencies of any of the other elements. In some soils known to be low in Phosphate, leaves may be less green than normal. However, it is not yet known whether or not the lack of Phosphate is the cause of the pale color. It might be emphasized again that where manure is used regularly, Phosphate levels are adequate to maintain good tree condition.

WHAT WAS SAID

California soils contain ample amounts of most of the plant nutrients.

The function of fertilization is to supplement deficiencies in the soil— not to feed the tree directly with all its nutrient requirements.

The most common deficiencies suffered by avocados are nitrogen and zinc. Iron chlorosis occurs infrequently. Deficiency symptoms resulting from a lack of other nutrients have not been recognized in the field.

A sound fertilizer program for avocados is:

An annual application of 100 to 200 Ibs. of actual nitrogen per acre for mature trees. Proportionately less for smaller trees.

One half of the nitrogen should be supplied from manure and one half from chemical sources.

Spray trees showing zinc deficiencies with neutralized zinc sulfate or zinc oxide.