



ESTABLISHING A NUTRITIONAL PROGRAM FOR AVOCADOS AND CITRUS

Stan Portugal, C.C.A.
AG RX, Goleta, California, U.S.A.

Over the past 30 years in working with perennial tree crops, especially citrus and avocados, I have used many different approaches of setting up nutritional programs for my grower customers. The approach that has evolved over these years is outlined below.

Diagnostic Steps and Approach:

First, a complete visual examination and inspection is made of the particular orchard with documentation made on all possible problems such as insect, weed and other pests, disease problems, cultural problems, type of scion and rootstock, etc. Depending on these findings, samples would be taken for nematodes and (*Phytophthora citricula* or *P. parasitica*) for citrus and (*Phytophthora cinnamomi* and *P. citricula*) for avocados. These would be taken and sent to a laboratory for analysis. These screenings must be determined before a reliable nutrient diagnosis can be conducted since they can often mask or complicate the findings.

Second, soil samples would be taken that are representative of the areas that are fertilized and managed separately. A minimum of 20 sub-samples are taken from within each management area or orchard block or location. The larger the area represented by each sample, the greater the possibility of wide variability within the area. These samples are collected to the rooting depth of the crop or about the depth of one foot. (They are analyzed for pH, organic matter, N, P, K, S, Ca, Mg, Na, Zn, Mn, Fe, Cu, B, cation exchange capacity, base saturation, free lime, soluble salts, etc.)

Third, leaf sampling is scheduled for each orchard, block, or growing area. The nutrient standards established by the University of California, Riverside, are set for the growing period from August 15 to October 15 of each year for both citrus and avocados. Most of the samples are taken during this time period because accurate diagnosis of comparative nutrient levels can only be determined at this time. If necessary, however, tissue samples are taken at other times if there are specific problems or if there is insufficient information available on a particular orchard. We rely very heavily on the information provided by Albion's T.E.A.M.(r) analysis program in determining our focus of the most important problems in each orchard sample. These plant analyses are particularly useful for determining the nutritional status of established, deep-rooted perennial crops, such as trees, since they can be compared to samples from previous years. Tracking these nutrient levels with computerized databases is done with a thorough analysis that is then presented to the grower.

Fourth, if recent water analyses have not been made, these are taken on all water sources to determine what interactions or problems that may interfere with proper nutrient uptake. Depending on these findings, amendments are recommended for the correction of any problems. In our area, very high levels of calcium carbonate and other mineral contaminants require the constant-feed injection of sulfuric acid-based fertilizers in order to keep the low-volume emitters and sprinklers clean and functioning. Obviously, this greatly impacts the type of liquid fertilizer and fertilizer system to recommend.

Fifth, reports are written and appropriate graphs made on the information gleaned from all of these analyses with a complete set of recommendations for correcting pest, disease, cultural, and nutritional problems for each grower. We believe that these analyses are the best guide to the wise and efficient use of pesticides, fertilizers, secondary and micronutrient foliar sprays, and soil amendments.

Our objective is to recommend the best management practices that will help growers in the production of optimum yields and high quality crops while maintaining environmental quality.

Grower Reporting and Notification:

After the reports are prepared, growers are notified and are presented with recommendations. They may either continue with their present program or make changes to correct problems affecting tree growth, tree health, yield, cost effectiveness, resource efficiency, etc. Depending on winter rainfall, for example, we may recommend dry fertilizer or liquid fertilizer blends that would correct nutrient deficiencies that exist.

Secondary and micronutrient deficiency problems are corrected with their inclusion in these fertilizer blends and by foliar applications. We have had great success with Albions' Metalosates® over the past five years. They are an integral part of our nutrient balance and correction programs. Generally, citrus requires two or three annual pesticide applications which provide great opportunities to correct zinc, manganese, calcium, and magnesium problems. These nutrients are tank-mixed in spring and fall full-coverage sprays by speed sprayer or hand crews of narrow-range spray oil and chlorpyrifos or avermectin for bud mite, silver mite, red spider mite and broad mites and red scale, ants and other pests.

Until the latest siege of the perseia mite has ravaged our avocado orchards, this crop was normally not sprayed for pests. But because of the lack of effective and registered pesticides, the control of this pest has been mainly biological. Therefore, one or two foliar spray applications of Zinc Metalosate, Calcium Metalosate, Iron Metalosate, and Boron Foliar are made, depending on the T.E.A.M. analyses, to these orchards. Because of the hilly terrain and the size of mature avocado trees, this has generally been accomplished by helicopter applications, however, some ground sprays by hand and automatic equipment is done. A follow-up series of tissue testing would be taken until the desired range of results are achieved.

Role of Acid-Based Fertilization:

Most of the soils in our area are alkaline in pH, ranging from 7.5 to 8.5. The irrigation water is also alkaline with high concentrations of carbonates, bi-carbonates, iron, manganese and other deposits. It is imperative that amendments be used to correct or neutralize these contaminants. This is of particular significance since our orchards all utilize low-volume irrigation systems on steep hilly terrain. Therefore, most of our nutritional recommendations are for the injection of sulfuric acid-based liquid fertilizers. These nutrient blends accomplish two major problems. First, the lower water pH will dissolve the contaminants that are the cause of most drip emitter and sprinkler plugging and allow them to be flushed out of the irrigation system.

Second, the introduction of this acid fertilizer will lower the water pH to a range of 5.5 to 6.5 where nutrient availability is greatest. This greatly aids in gaining a balance of plant nutrients. When these N,P,K,S blends are injected into the irrigation water, macro-nutrients are supplied in ample quantities, and the secondary and minor nutrient levels will be increased by the lowering of the soil solution pH. The irrigation system will also be cleared of mineral deposits, percolation and infiltration of the irrigation water into the soil will be increased, and a solid start to a balanced nutritional program will have been achieved.

Utilization of Constant-Feed, Automatic Liquid Injection Systems:

With consideration given to all of the above factors, the design of a fertilizer and soil amendment injection system that is capable of these corrections is extremely important. The most important component is that it must be able to constant-feed this acid-based fertilizer in every irrigation throughout the 8 or 9 month irrigation season. This, of course, would be necessary to keep the irrigation system clean and provide the acid solution needed for optimum nutrient uptake. But we have also found that this system of constant-feeding nutrients to perennial crops is the most cost-effective, efficient method of fertilizing these crops. This 'micro-feeding' of nutrients has resulted in a significantly reduced level of fertilizer required.

We believe this is also environmentally sound, because nutrients are taken up by the crop and not allowed to leach into groundwater supplies.

This is accomplished by the installation of completely automatic, computerized injection systems from the H.E. Anderson Company through their licensed distributor, Howard E. Hutchings Company. These units ratio-feed nutrients at the rate of 100 to 200 ppm nitrogen, depending on crop requirements, during the entire irrigation cycle. These systems also correct two other problems: First, the ratio feeding (ratio of water to fertilizer) provides optimum uniformity of nutrients in steep hillsides where water volume and pressure is highly variable from the top to bottom sections of these orchards.

Second, due to "controlled growth" of housing in Santa Barbara County which causes a chronic shortage of sufficient labor, these systems allow growers to utilize this vital resource in harvesting, irrigation and numerous other cultural jobs rather than in crop fertilization. We provide a service to our growers where we install, maintain, calibrate and up-date these systems each year to growers who purchase the units and utilize our fertilizer programs.

In conclusion, in addition to these fertilizer injection systems, we provide storage tanks for our recommended liquid fertilizers. Depending on the results of Albion's soil and tissue analyses, we deliver a constant supply of fertilizer for each orchard or ranch throughout the irrigation season at over 125 different injection stations. We and our growers are very pleased with the success of the Metalosates in the correction of many crop-limiting nutrient problems. We are indebted to all of the information and guidance provided by Albion's laboratories and personnel.