16. SOIL ANALYSIS

Used wisely, soil analysis can be very valuable in determining optimum fertilizer programs. Soil analysis has its best application as a pre-plant guide for row and field crops, but can also be useful in orchard and vineyard crops (see later).

Soil tests are available for most plant nutrients; test results for some nutrients are more reliable than others. The most widely used soil tests are for P, K and Zn; these tests can provide excellent guidelines for planning a fertilizer program (soil K tests have limitations - see chapter on K).

Soil tests for nitrogen should be interpreted with caution. There are many forms of N in the soil, some of them of very low availability to plants; biological activity causes changes in the forms of N in the soil. Nitrate-N is readily available to plants and a soil nitrate test can give good pre-plant information if soil is sampled shortly before planting. For years, the University of California refrained from recommending soil nitrogen tests because of the interpretation hazards but U.C. has recently come out with the following tentative guidelines for soil nitrate:

N RESPONSE PROBABILITY AS RELATED TO SOIL NITRATE LEVELS

	– ppm Nitrate Level in Soil –	
Probability of N response	Cool season crops	Warm season crops
Response likely	0 - 15 ppm	0 - 10 ppm
Response unlikely	over 25 ppm	over 15 ppm

The above table will undergo modifications and refinements as additional information becomes available. It should be remembered that the first irrigation after sampling will change soil nitrate values significantly and a follow-up sample could be helpful. Also, high soil nitrate is often associated with high salinity (EC) levels. With high soil salinity, nitrate is less available to plants; therefore a high soil nitrate reading at a low soil salinity indicates a better soil nitrogen status than a high soil nitrate level at high salinity.

Soil tests are also useful in pH control, salinity-alkalinity diagnosis and detection of toxic elements, especially boron. Knowledge of the lime content of soil is necessary in selecting proper soil amendments, if needed. Some fieldmen, myself included, carry around a dropper bottle of dilute hydrochloric acid for a quick field evaluation of lime content - a drop or 2 of acid will cause soil to fizz if lime is present in significant quantity (muriatic acid, 1:10 dilution can be used as can lemon juice or vinegar).

Soil Sampling

The most accurate soil analysis in the world is no better than the sampling method used to take the sample. Take care to get a good, representative sample. For pre-plant analysis on row crops, 20 to 30 1" diameter cores taken to a depth of 8 to 12" should be composited to make about a 1 quart sample for an area. When sampling to diagnose problems, take the sample from the area where the problem is occurring. For example, if a germination problem exists, sample soil from around and just below the seed - this

might mean the 2 to 4" level. If a water penetration problem exists, the top inch, or possibly the top millimeter of soil should be sampled.

When sampling for salinity-alkalinity, remember that hot spots (or alkali spots) can occur; take care to sample such areas separately. Better yet, get an aerial photo of the field during the growing season. Such a photo can aid in sampling and can eliminate the need for much sampling and analysis since it can delineate the hot spots needing attention.

Analysis Methods

The wide variety of soil analysis methods used can cause bewilderment when it comes to interpreting results. The best bet is to stick with the analysis methods recommended in your area - consult your extension service for this information. Insist that the lab use the recommended methods, or else take the sample to another lab.

There is some sentiment towards standardizing soil test methods throughout the U.S. There are difficulties involved in this, but more uniformity than presently exists would be desirable.

Soil Analysis for Orchards and Vineyards

The University of California's opinion on the value of soil analysis for orchards (and vineyards) has been, and is, that it is useful for pH, salinity-alkalinity, and toxicity (Na, Cl, B) determinations but is of little value in assessing nutrient status because of the difficulty of getting a representative soil sample. A more enlightened view (on pecans, but applicable to all tree and vine crops) is ex- pressed by Darrell Sparks of Georgia:

"Regardless of the limitations of soil analysis, employment of this method is necessary if the nutrient status of the pecan grove is to be fully understood. For instance, if a soil test from a grove with zinc deficient trees indicates soil zinc is adequate, the zinc is probably unavailable to the tree and correction will most likely have to be by foliar application. If on the other hand, the test indicates zinc is low in the soil, there is a greater possibility of the deficiency being corrected by soil application. In short, while the levels of nutrients in the tree are of much greater immediate concern, soil levels can also be essential information in correcting imbalances and ascertaining possible future problems."

Sparks concludes that "in predicting the nutrient status of pecan trees, leaf analysis is superior followed by soil analysis. The nutrient status of the grove can best be predicted by using both methods in combination."

Sparks is correct. In diagnosing K deficiency, for example, the combination of leaf and soil analysis should be used. Low levels of K in leaves can be caused by stress for water - if the leaf levels of K are low and the soil levels high, water stress would be the prime suspect. Soil analysis can also help to refine interpretation of low or deficient leaf levels of other nutrients.

Summary

Soil analysis is a valuable tool if its limitations are recognized. Used in conjunction with leaf analysis it becomes a more powerful tool. Precise fertilizer recommendations cannot be made based on current soil tests but good guidelines can be established.

Correlating recommendations with observed field responses for a crop will help to fine tune recommendations on a given piece of ground.

General Reference

Reisenauer, H.M. (ed.) **Soil and plant-tissue testing in California.** University of California Extension Bulletin No. 1879. April 1976.