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Leaf and soil analyses as guides for

Citrus Fertilizer Practices

in southern California orchards

Leaf and soil analyses are the best means of determining fertilizer needs for citrus orchards. On the basis of an initial orchard evaluation and preliminary leaf and soil analyses, current nutrient and salinity status can be assessed, and the grower can be advised whether his present fertilizer and soil management practices are right or wrong. Such analyses will tell him whether he is spending too much for nitrogen or not enough; whether he is applying fertilizers that are not needed; whether the levels of the minor elements should be built up or decreased; whether too much exchangeable sodium or potassium is building up in any part of the root zone; whether the soil is acid enough to require lime, or alkaline enough to require sulfur or gypsum, and whether to use acid- or alkaline-base nitrogen fertilizers.

Detailed studies of soil conditions and leaf analysis in citrus orchards show that, even in high-yielding and well-managed orchards, changes are sometimes indicated to help keep the orchards productive, anticipate possible nutritional troubles before they occur, and, in some cases, reduce fertilizer costs.

Three points are important in initiating a program of leaf and soil analysis: *1*, the need for thorough initial orchard and soil evaluation; *2*, the absolute necessity of securing proper and representative leaf and soil samples and insuring correct handling and analytical procedures; and *3*, continuity.

In the case of large operations, involving hundreds of acres, leaf and/or soil analyses are already being made in company-owned laboratories, usually by a trained horticulturist or agronomist.

For the smaller operator, a number of commercial laboratories specializing in agricultural analyses and consultation are available, as are commercial agricultural consultants. These are listed with farm advisor offices.

As the use of leaf and soil analysis increases, and expands to include other crops, current commercial facilities will be enlarged. Groups of growers may wish to establish cooperative laboratories on an area basis.

In getting started on a leaf and soil analysis program, acceptable leaf and soil sampling and handling techniques and accurate analyses are essential. Grab samples of leaves or of soils and application of quick-test methods are a waste of time, and the information derived is likely to be unreliable or actually misleading.

Another requirement, at least at the outset, is that a fairly complete leaf analysis be made. Ideally, an analysis of the soil should include not only pH and total soluble salts, but exchangeable bases, phosphate, and nitrate. If some unusual condition is suspected, soil and leaf analysis may need to go even farther at the outset. Also needed is a general orchard and management appraisal.

Another point that requires emphasis is the need for continuity in the program. Much valuable information will emerge from an initial orchard appraisal, but periodic check-ups are needed to determine whether practices changed as the result of analysis are producing the de-

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Single Value Citrus Leaf Analysis Standards Consistent with Top Performance[1]

(Based on 4- to 7-month old spring cycle orange leaves from fruit bearing terminals)

Element	Percent in dry matter of leaf	Element	Ppm in dry matter of leaf
Calcium(Ca)	5.00	Boron(B)	75.00
Magnesium(Mg)	0.40	Copper(Cu)	5.00
Potassium(K)	1.00[2]	Iron(Fe)	60.00
Sodium(Na)	0.05	Manganese(Mn)	35.00
Nitrogen(N)	2.40	Molybdenum(Mo)	0.20
Phosphorus(P)	0.12	Zinc(Zn)	25.00
Sulfur(S)	0.30	Arsenic(As)	<0.05
Chloride(Cl)	0.05	Bromine(Br)	<100.00
		Chromium(Cr)	<0.10
		Fluorine(F)	<20.00
		Lithium(Li)	<0.50
		Cobalt(Co)	<0.40
		Nickel(Ni)	<0.40

[1] These are the citrus leaf values toward which fertilizer and soil management practices should be aimed. Obviously their attainment will not necessarily guarantee maximum performnace for many other factors will influence yield and quality, as for example: moisture supply, insect infestation and insect control methods, soil microbiological conditions, climate, disease, variety and rootstock, and physical soil conditions.

[2] For smaller fruit, potassium levels should be at about half this percentage.

Some Tentative Soil Analysis Standards[1]

Measurement	Range consistent with excellent citrus performance
pH—(on 1:2.5 soil water suspension)	5.5–7.5
Soluble salts in saturation extract as measured by electrical conductivity—ECx10[3] (Millimhos)	0.2–1.9
Exchangeable bases as per cent exchange capacity	
(a) Calcium (Ca)	60.0–70.0
(b) Magnesium (Mg)	20.0–35.0
(c) Potassium (K)	5.0–10.0
(d) Sodium (Na)	Less than 5.0
Magnesium; Ratio Exchangeable $\frac{K}{Mg}$ (K and Mg expressed in milliequivalents/100 g. soil)	0.10–0.30
Phosphorus	
(a) Water soluble (by Bingham method)	1.00–4.00 ppm in dry soil
(b) 0.5 M. NaBicarbonate method (Olson, et al.)	More than 11 ppm in dry soil
Potassium	
(a) Exchangeable in milliequivalents (me/100 g. soil)	More than 0.25
(b) As per cent exchange capacity	5.0–10.0
Nitrate Nitrogen (N) in ppm dry soil	More than 5.0

[1] While these values are consistent with excellent citrus yields and quality, they, of course, do not guarantee it. Likewise satisfactory performance will be found in situations where there is considerable departure from these standards. As with leaf analysis standards, they are simply goals toward which soil management practices should be pointed.

ANALYSES

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Example of Leaf and Soil Analysis Values in a Mature High Producing Navel Orange Orchard

Nature of Orchard: Mature navel orchard in Arlington Heights area.
Age: About 64 years.
Average production for 3 years (1945–48): 7.2 field boxes/tree.
Size and quality: Excellent.