

TECHNICAL NOTE

USDA NATURAL RESOURCES CONSERVATION SERVICE PACIFIC ISLANDS AREA

Soil Quality Technical Note No. 1

SOIL TEST RESULTS INTERPRETATIONS AND RELATED SOIL FERTILITY ISSUES

Some of the field and state office people have been asked by our cooperators to help them interpret their soil test results on analyses run by the University of Hawaii soil testing lab. In October 1994, four of the soils professors put together the attached soil test interpretation guide sheet (Adequate Nutrient Levels in Soils and Plants in Hawaii). Although NRCS is not in the business of interpreting soil test results for fertility status, you may want to have this for your own reference and to copy for our cooperators' use should they inquire.

Soil test results are usually difficult to interpret because amounts in soils, needs by different crops and crop management are all factors in deciding fertilizer amounts. Footnote 3 and the terms "Heavy Soil", "Light Soil" and "A'a Land" attempt to address some of the variables in a general way.

The adequacy levels of the nutrients stated (for vegetable crops) are specific for the extractant used. If phosphorus was extracted by a technique other than "Modified Truog" (used here), the adequacy level would be different. Next, these values represent only the amount extracted, not the total amount of nutrient in the soil. This is especially true for phosphorous. Texture, clay mineralogy, organic matter, and pH dictate the ratio of P on the clay or OM surfaces and P in solution available for plant uptake.

This guide does not state the fertilizer application rates. The grower must work with the Cooperative Extension to best determine rates. In Hawaii, we have extreme differences in P fertilizer required to achieve adequate amounts of P in solution. As a general example, a Vertisol such as Lualualei Series may require about 40 to 80 lbs. per acre, and an Oxisol such as Molokai Series 100 to 300 lbs. per acre depending on past practices. Hilo soils (an Andisol) could easily be double Molokai's rates or more.

One can see then that P carried off of the field by erosion is much greater for the Andisols than for the other soils. Phosphorous leaching is generally not a problem in Hawaii except in the Tropofolists and sandy soils.

"Heavy soils" with bulk densities of "close to 1.0g / cm³" include mainly our Oxisols and Ultisols. "Light soils" include the Andisols (or Andepts in the old version of Soil Taxonomy). "A'a Land" is really referring to our thin Tropofolist in A'a rubble and would include the Tropofolist over pahoehoe as well. Sandy soils like Jaucus Series are not addressed.

Adequate Nutrient Levels in Soils and Plants in Hawaii (General Guide)

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This fact sheet presents a practical guide to the soil fertility status (Table 1) and sufficiency ranges for nutrients in tissues (Table 2) of some crops grown in Hawaii. This information is useful for targeting fertilizer application levels for sustained agricultural production and protecting our environment from pollution resulting from overapplications.

Soils of Hawaii are divided into three main groups: “heavy” soils developed from alluvial or volcanic rocks, “light” soils developed from volcanic ash, and a’ua lava land, predominantly composed of broken lava rocks mixed with some fine soil particles and organic matter. These groups were selected to simplify diagnosis, because soil bulk density, clay mineralogy, and other pertinent soil characteristics affecting soil fertility are relatively similar within each group but substantially different among the groups.

Table 1. Soil analysis levels generally considered adequate for three broad soil bulk density categories in Hawaii¹.

Soil property	Unit	Heavy soils ²	Light soils ²	A’ua land
Acidity ³	pH	5.8 – 6.2	5.8 – 6.2	5.5 – 6.2
Phosphorus ⁴	P (ppm)	25 – 35	50 – 85	80 – 100
Potassium ⁵	K (ppm)	200 – 300	200 – 400	400 – 600
Calcium ^{5,6}	Ca (ppm)	1500 – 2000	3000 – 4000	1500 – 2000
Magnesium ^{5,6}	Mg (ppm)	300 – 400	600 – 800	300 – 400
Salinity ³	EC (mmhos/cm)	< 3.0	< 3.0	

¹These levels are thought to be adequate for vegetable crops, while slightly lower levels may be adequate for tree crops and pastures. Crops with limited root volume or grown in media with a very low bulk density may respond to higher levels of soil-available nutrients.

²Bulk density of heavy soils = ~1.0 g/cm³, light soils = ~ 0.5 g/cm³.

³Measured as paste in distilled water. The desirable level of pH varies among crops. EC = electrical conductivity.

⁴Extracted with the Modified Truog Method (0.01 M H₂SO₄ + 0.02 M (NH₄)₂SO₄ with soil:solution ratio of 1:100).

⁵Extracted with neutral 1 M ammonium acetate with soil:solution ratio of 1:20.

⁶Ca and Mg are generally in the ratio 5:1.

*Replaces Agronomy & Soil Science Fact Sheet no. 3, 10/17/94.

