HOW TO TAKE COFFEE LEAF AND SOIL SAMPLES

Proper fertilizer recommendations cannot be provided with just soil samples. Soil and leaf samples should be taken together at least once a year.

The sample(s) should be a representative of the area. Or, you can prepare a sample from trees with similar visible problems to determine if the problem is caused by a nutrition or pH imbalance. Select 4 or more trees. Mark the trees for sampling in following years or to return and manage the problem.

SOIL

Soil testing determines the level of nutrients (Phosphorus, Potassium, Calcium and Magnesium) and the pH, a measurement of acidity or alkalinity, of the soil.

HOW TO TAKE A SOIL SAMPLE

1. Avoid taking samples during or right after rain or following fertilizer application.
2. Label a clean, water-proof bag or container with your name, date, host plant, location from where soil was taken, and/or visual problem.
3. Midway between the trunk and the drip line (fig. 1) clear away the surface soil, debris (leaves, fruit, weeds, etc.) and any fertilizer residue.
4. Use a clean tool to dig down to approximately 6-12 inches or until you reach a mass of roots.
5. Collect ½ to 1 cup of soil per tree, combine and mix thoroughly.
6. Place a sample or subsample of at least 2 cups of soil in the labeled bag or container.

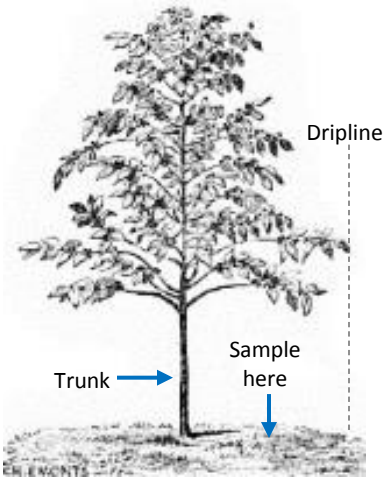


Fig. 1: Soil is sampled from the mid-point between the dripline (widest point of the branches) and the trunk of the tree.

LEAF

Leaf testing determines the level of nutrients (Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Iron, Sodium, Copper, Manganese, Zinc, Boron) found in the leaves and nutritional status of the plant.

HOW TO TAKE A LEAF SAMPLE

1. Avoid taking samples directly following a foliar and granular fertilizer application or drought.
2. Label a clean, plastic or paper bag with your name, date, host plant, location from where leaves were taken, and/or visual problem.
3. Take samples during flowering for best results. This gives you the opportunity to adjust fertilization prior to fruiting. Sampling during fruit development is ok, but not preferred.
4. Select a vertical that is in its second year of growth (first year of cherry production), and then count down from the top of the vertical to the 8th to 12th lateral branch.

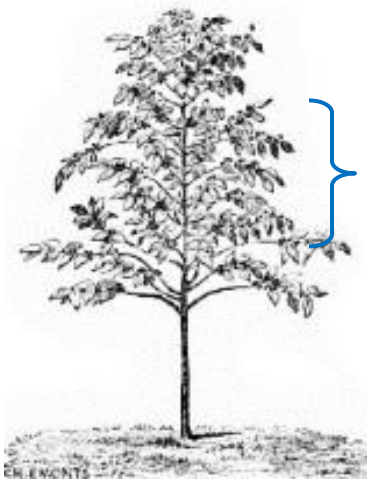
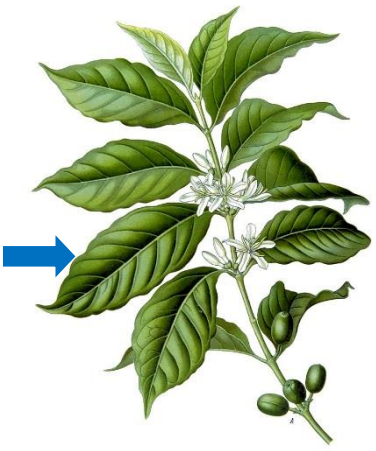


Fig. 2: Select laterals around the mid-point between the lowest and

5. Pick the most recently matured leaf from these laterals – usually the 3rd or 4th pair back from the branch tip. These leaves should be full-sized and have the same color and texture as older leaves.
6. Collect at least 15 leaves per sample.
    - Collect 1-2 leaves from at least 15 trees around the farm for a general, representative sample, OR
    - Collect 4-5 leaves per tree from at least 4 trees when attempting to diagnose a specific nutritional problem.
    - Place leaves in the labeled bag.



7. Submit leaf samples to your nearest extension office on Mondays or Tuesday mornings before 10:00 am. Wipe off any water moisture on the leaves with paper towels and keep in the refrigerator if you are unable to bring the sample to an extension office for a few days.
8. Do not freeze samples.
9. Do not leave samples in the sun.

COSTS

The charge for a basic soil test or S2 is $12. For the leaf analysis, the charge ranges between $20 for a T1 and $27 for a T1 and T2. A T1-N (total nitrogen) and T2 is recommended for most common leaf sampling analyses. Please see the UH CTAHR ADSC analysis document for all fees and services at http://www.ctahr.hawaii.edu/site/downloads/adsc/price_list.pdf

Bring all samples to the nearest UH CTAHR Extension Service Office. Soil and leaf samples are sent to the Honolulu ADSC lab early in the week (Mon/Tues) to allow for travel time, receipt of all samples and processing prior to the weekend. All CTAHR labs and offices are closed on weekends and holidays.

RESULTS

The results, including fertilizer recommendations, are mailed directly to the grower in 2- 4 weeks. For any sample inquiries, please have the Job Control Number and name of the person or farm on the form receipt available.

QUESTIONS

If you have questions regarding your soil and leaf samples or results, contact the Agricultural Diagnostic Service Center at tel: (808)956-6706, fax: (808)956-2592; or by email at adsc@ctahr.hawaii.edu.

Andrea Kawabata

UH CTAHR Cooperative Extension Service

Adapted from V. Easton-Smith's Extension Publication May 2016

Cooperative Extension Service
C/T/A/H/R
College of Tropical Agriculture & Human Resources
University of Hawaii at Manoa

Agronomy and Soils
Nov. 1997
AS-3*

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

Y. N. Tamimi, J. A. Silva, R. S. Yost, and N. V. Hue
Department of Agronomy and Soil Science

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'a 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 Hawaii[1].

Soil property	Unit	Heavy soils[2]	Light soils[2]	A'a 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	

[1]These 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.
[2]Bulk density of heavy soils = ~1.0 g/cm^3, light soils = ~ 0.5 g/cm^3.
[3]Measured as paste in distilled water. The desirable level of pH varies among crops. EC = electrical conductivity.
[4]Extracted with the Modified Truog Method (0.01 *M* H_2SO_4 + 0.02 *M* $(NH_4)_2SO_4$ with soil:solution ratio of 1:100).
[5]Extracted with neutral 1 *M* ammonium acetate with soil:solution ratio of 1:20.
[6]Ca and Mg are generally in the ratio 5:1.

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

Table 2. Suggested "sufficiency" nutrient levels in tissues of selected crops.

Nutrient	Unit	Crop											
		Beans[1,2,6]			Corn[1,2]			Cucumber[1,6]			Tomato[1,6]		
N	%	3.0	–	4.5	2.6	–	4.0	3.5	–	4.5	3.0	–	4.5
P	%	0.30	–	0.70	0.25	–	0.50	0.4	–	1.0	0.25	–	0.75
K	%	1.5	–	4.0	1.5	–	3.0	2.8	–	4.5	3.0	–	5.0
Ca	%	1.5	–	2.5	0.3	–	0.8	1.8	–	4.0	2.0	–	3.0
Mg	%	0.20	–	0.80	0.3	–	0.8	0.4	–	1.2	0.40	–	0.60
S	%	0.15	–	0.40	0.16	–	0.50	0.30	–	1.0	0.40	–	1.2
Fe	ppm	50	–	300	50	–	250	50	–	300	100	–	200
Mn	ppm	50	–	300	35	–	200	50	–	400	40	–	250
Zn	ppm	20	–	200	35	–	100	25	–	300	20	–	50
Cu	ppm	5	–	30	6	–	20	8	–	20	5	–	20
B	ppm	30	–	75	10	–	25	30	–	100	25	–	100
		Chinese cabbage[1]			Lettuce[1,6]			Kikuyugrass[2]			Bermudagrass[1,5]		
N	%	3.5	–	4.0	2.5	–	4.0	2.5	–	3.0	4.0	–	6.0
P	%	0.40	–	0.60	0.40	–	0.60	0.20	–	0.30	0.20	–	0.60
K	%	4.5	–	7.5	4.0	–	7.5	2.0	–	3.0	1.0	–	3.0
Ca	%	2.0	–	6.0	1.5	–	2.3	0.25	–	0.40	15	–	1.0
Mg	%	0.30	–	0.70	0.36	–	0.50	0.25	–	0.40	0.20	–	0.60
S	%	(0.50	–	1.0)[2]	(0.25	–	0.50)[3]	0.20	–	0.30	0.20	–	0.50
Fe	ppm	40	–	200	50	–	200	75	–	300	50	–	350
Mn	ppm	25	–	200	25	–	150	50	–	300	25	–	300
Zn	ppm	20	–	200	25	–	150	25	–	150	20	–	250
Cu	ppm	5	–	25	7	–	25	10	–	25	5	–	50
B	ppm	60	–	100	23	–	50	10	–	25	6	–	30
		Banana[1,3]			Papaya[1]			Coffee[1,4]			Macadamia[1,2,4]		
N	%	2.6	–	4.0	1.0	–	2.5	2.5	–	3.5	1.5	–	2.5
P	%	0.2	–	0.4	0.20	–	0.40	0.15	–	0.30	0.07	–	0.12
K	%	3.0	–	5.0	3.0	–	5.0	2.0	–	3.0	0.50	–	1.5
Ca	%	0.4	–	0.8	1.0	–	3.0	0.8	–	1.6	0.50	–	1.0
Mg	%	0.25	–	0.80	0.40	–	1.2	0.30	-	0.50	0.08	–	0.15
S	%	0.20	–	0.80	(0.30	–	0.80)[3]	0.20	–	0.40	0.15	–	0.30
Fe	ppm	80	–	200	25	–	100	75	–	300	30	–	300
Mn	ppm	200	–	1000	20	–	150	50	-	500	30	–	1000
Zn	ppm	20	–	200	15	–	40	15	–	150	15	-	50
Cu	ppm	6	–	25	4	–	10	10	–	30	5	-	10
B	ppm	10	–	50	20	–	50	25	-	75	40	–	80

Crop index tissues and sources from which critical-level data were adapted:

[1]Beans: uppermost, most recently fully developed trifoliate leaf. Coffee: 4th pair of leaves back from growing tip. Cucumber: leafblades with midribs, 5th leaf from tip, at pre-fruit stage. Lettuce: pre-heading wrapper leaves. Papaya: petiole from most recently mature leaf. Tomato: compound leaves adjacent to top inflorescence at pre-fruit stage. J.B. Jones, Jr., B. Wolf, and H.A. Mills (1991) Plant analysis handbook. Micro-macro Publishing Inc., Athens, GA.

[2]Corn: whole ear-leaf at early tasseling. Chinese cabbage: fully mature wrapper leaf. Macadamia: recently fully mature leaf. Kikuyugrass: terminal growth to include 5th–6th leaf. Y.N. Tamimi and D.T. Matsuyama, unpublished.

[3]Banana: strips from middle of 3rd leaf. Reuter and Robinson (1968) Plant analysis. Inkata Press, Australia.

[4]N.V. Hue, unpublished; Fox and Hue, 1989, J. Plant Nutr.; Hue and Nakamura (1988) J. Plant Nutr.; Hue, Fox, and McCall (1988) J. Plant Nutr.

[5]Bermudagrass (mostly Tifgreen and Tifdwarf for putting greens): leaf clippings. C.L. Murdoch, E.N. Okazaki, and D.T. Shigeta (1983) HITAHR Research
Extension Series no. 025.

[6]Vegetables grown under tropical/subtropical conditions. Fox, R.L., and H. Valenzuela (1992) In: IFA World fertilizer use manual. International Fertilizer Industry Association. p. 293–337.

ANALYTICAL SERVICE FEES

AGRICULTURAL DIAGNOSTIC SERVICE CENTER
University of Hawai'i at Manoa
1910 East West Road, Sherman Lab 134
Honolulu, HI. 96822
PH.: 956-6706 FAX: 956-2592

PLANT DISEASE

Code		Price per sample
D1	General Diagnosis and Bioassay for VIRUSES, BACTERIA, or FUNGI	$ 12.00
D2	Plant or Soil Analysis for NEMATODES	$ 12.00
D3	Disease Analysis for FUNGI SPECIES	Price dependent on actual cost.

FEED AND FORAGE

F1	Dry Matter/ Moisture	$ 7.00
F2	Ash	$ 7.00
F3	Crude Protein (CP)	$ 7.00
F4	Crude Fat (EE)	$ 7.00
F5	Neutral Detergent Fiber (NDF)	$ 7.00
F6	Acid Detergent Fiber (ADF)	$ 7.00
F7	Lignin (PML)	$ 15.00
F8	Cellulose (C)	$ 20.00
F9	Minerals (B, Ca, Cu, Fe, Mg, Mn, Mo, P, K, Na, Zn)	$ 18.00
F10	F1 thru F8	$ 42.00
F11	F1 thru F9	$ 52.00

INSECT IDENTIFICATION

I1	General Diagnosis	$ 7.00
I2	Insect Identification-Slide Mounted	$11.00

SOIL ANALYSES

S1	pH and Salinity	$ 6.00
S2	pH and EXTRACTABLE NUTRIENTS (Ca, Mg, P, K)	$12.00
S3	ANY ONE of the following:	$ 7.00
	TC – Total Carbon N – Total Nitrogen	
	NH_4 – Ammonium Nitrogen NO_3 – Nitrate Nitrogen	
	B – Boron	
S4	TC and N– Total Carbon and Total Nitrogen	$10.00
S5	Cation Exchange Capacity	$ 25.00
S6	Mehlich III Extract; DTPA Extractable Micronutrients	$ 17.00
	Cu (Copper), Fe (Iron), Mn (Manganese), Zn (Zinc)	
S7	Metals (Acid Digest)	$ 50.00
	As (Arsenic) Cd (Cadmium) Cr (Chromium) Cu (Copper) Fe (Iron) Mo (Molybdenum)	
	Ni (Nickel) Pb (Lead) Se (Selenium) Va (Vanadium) Zn (Zinc)	
S8	S2 + S6 (Extractable Nutrients)	$ 22.00
S9	S7 + S8 (Extractable Nutrients Plus Metals)	$ 57.00
S10	Particle Size Distribution (% Sand, Silt, Clay)	$ 30.00
S11	Test for presence of soil	$50.00

PLANT TISSUE ANALYSES

T1 ANY ONE of the following: …… $ 7.00

N – Total Nitrogen NO_3-N – Nitrates C – Total Carbon

S – Sulfur Si – Silicon

T2 All of the following: ……. $ 20.00

B (Boron) Ca (Calcium) Cu (Copper) Fe (Iron)

K (Potassium) Mg (Magnesium) Mn (Manganese) Na (Sodium)

P (Phosphorus) Zn (Zinc)

T3 Total Nitrogen (N) and Total Carbon (C) ……. $10.00

T4 Metals (See list of Metals under Soil Analyses)…….. $ 25.00

IRRIGATION WATER AND NUTRIENT SOLUTIONS

W1 pH and Salinity …….. $ 6.00

W2 ANY ONE of the following: …… $ 7.00

N (Total Nitrogen) NH_4-N (Ammonium Nitrogen) NO_2-N (Nitrite Nitrogen)

NO_3-N (Nitrate Nitrogen–acid preserved sample, refrigerated)

*Other elements by arrangement

W3 All of the following: …… $ 15.00

B (Boron) Ca (Calcium) Cu (Copper) Fe (Iron)

K(Potassium) Mg (Magnesium) Mn (Manganese) Mo (Molybdenum)

Na (Sodium) P (Phosphorus) Zn (Zinc)

W4 Metals (Acid Preparation) ……..…… $ 25.00

See list of Metals under **Soil Analyses**.