Avocado Fertilization

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Introduction

- Avocados have few mineral deficiencies
- Surface feeder roots are efficient at recycling nutrients back into the tree
- Nitrogen should be applied every year, occasionally zinc and sometimes phosphorus, potassium and calcium (maybe)
- Leaf analysis is normally used to determine mineral deficiency or excess
- Liquid fertilizer injection is the normal way to apply fertilizers

A New Grower's Quick Guide

- Hass avocados usually require 1.5 – 2.0 lbs actual nitrogen per tree per year
- Usually applied as a liquid fertilizer divided between 6 to 9 applications per year
- A hand-applied suggestion would be
  - 6 lbs triple 15 per tree in late February or early March (= 0.90 lbs actual N)
  - 3 lbs calcium nitrate (15.5-0-0) in June (= 0.47 lbs actual N)
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  - Total 1.83 lbs actual N/tree/year

Zinc

- Leaves are mottled, showing yellowing between the veins
- Small leaves
- Zinc sulfate can be
  - Applied by helicopter in May, 8 lbs/acre in 20 gallons water
  - Through the irrigation system
  - Or, hand applied around each tree every 3-5 years

Chloride Tip-Burn

- Not a mineral deficiency, but an excess of salinity due to
  - Saline irrigation water (wells or reclaimed water)
  - Poorly leached soils (salt accumulates in the root-zone)
  - Under-irrigation
  - Over application of manures and fertilizers
  - Water turned off during escrow

Required Mineral Nutrients

- 16 mineral nutrients
- C, H, O
- N, P, K (primary macro-nutrients)
- Ca, Mg, S (secondary macro-nutrients)
- Micro-nutrients….Zn, Fe, Mn, Cu, B, Mo, Cl

Wt.(lbs) Mineral Nutrients Removed in 10,000 lbs Avocados/Acre

- N 35.6
- P 5.4
- K 60.4
- Ca 0.8
- Mg 3.3
- S 3.5
- B 0.04
- Fe 0.09
- Zn 0.04
- Mn 0.02
- Cu 0.01

Leaf Analysis

- Sampling
  - Leaves taken in August-October period
  - 5-7 month-old leaves sampled
  - Non-fruiting branches
  - Sample good blocks vs. poor blocks in separate samples

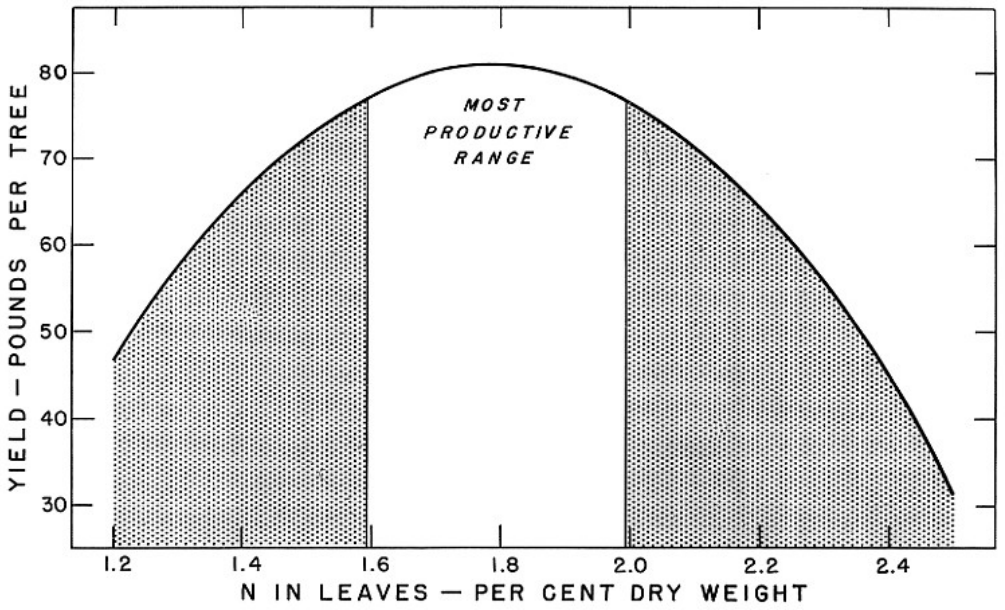
Table 2. Ranges of Elements for Interpretation of Leaf Tissue Analyses for Avocado

		Ranges for Mature Trees		
Element	**Unit**	**Low**	**Sufficient**	**High**
Nitrogen (N)				
Hass	%	<1.8	2.0 - 2.2	>2.2
Fuerte	%	<1.6	1.6 - 2.0	>2.0
Phosphorus (P)				
Fuerte	%	0.05 - 0.07	0.08 - 0.25	0.26 - 0.3
All Others	%	0.05 - 0.09	0.10 - 0.25	0.26 - 0.3
Potassium (K)	%	0.35 - 0.74	0.75 - 2.0	2.1 - 2.9
Calcium (Ca)	%	0.50 - 0.99	1.00 - 3.00	3.1 - 4.0
Magnesium (Mg)	%	0.15 - 0.24	0.25 - 0.80	0.9 - 1.0
Sulfur (S)	%	0.05 - 0.19	0.20 - 0.60	0.7 - 1.0
Boron (B)	Ppm	20 - 49	50 - 100	>100
Iron (Fe)	Ppm	20 - 49	50 - 200	>200
Manganese (Mn)	Ppm	15 - 29	30 - 500	>500
Zinc (Zn)	Ppm	<20	30 - 150	>150

Nitrogen

- Nitrate is mobile in the soil and is absorbed readily into roots, leaches readily
- Ammonium is bound to the surfaces of soil particles and is not leached readily, slowly converts to nitrate
- Most fertilizers are a combination of nitrate and ammonium

Nitrogen Deficiency – General Yellowing of leaf and Reduction in Yield of Fuerte



Nitrogen Application Timing
research from Dr Carol Lovatt, UC Riverside

- Control trees: nitrogen was applied at 1.25 lb/tree/year, divided into 0.25 lbs in January, February, April, June, July, Nov.
- Treatments: the same but there was an extra 0.25 lb applied in each of these months
- The best yield occurred when the extra N was applied in April or in November (next slide for data)

Four-year trial by Lovatt

	N applied	average fruit wt/tree of
Control trees (1.25 lbs/year)		128.7lb
Jan	extra 0.25 lb	123.4
Feb	extra 0.25 lb	123.4
April	extra 0.25 lb	158.0
June	extra 0.25 lb	117.0
Nov	extra 0.25 lb	168.3

Table 3 Amount of Actual Nitrogen per Tree per Year (Mature Grove)

				Amount of Fertilizer to Apply per Tree		
Spacing	**# Trees/**	**Actual N/acre (lbs)**	**Actual N/tree (lbs)**	**Triple 15**	**Ammonium Nitrate**	**Urea**
				15-15-15	34-0-0	46-0-0
15' x 20'	145	200	1.4	9.3	4.1	3.0
20' x 20'	109	200	1.8	12.0	5.3	3.9
20' x 40'	54	200	3.7	24.7	10.9	8.0

Mulches and Manures

- High carbon mulches (wood chips and straw) decompose slowly, bacteria in the soil tie up nitrogen in order to decompose the mulches, these may require a nitrogen soil application to offset this problem
- Manures are sources of nitrogen, but they vary from 1% N (horse manure) to 3% N (composted chicken manure) (more info on page 23)

Nitrogen Deficiency

- Lack of vegetative vigor
- Pale, green small leaves
- Reduced yields
- Premature defoliation
- Leaves with yellow veins (severe deficiency)

- Root rot has the same symptoms, how can you tell the difference?

Cover Crops for Organic Production

- Should be a legume that can fix N from the air
- Can they contribute in avocado production?
  - Should be turned under, but this can't be done in avocado culture due to the shallowness of the roots
  - Too much shading on the ground to grow cover crops

Advantages of Fertigation

- Most groves have low volume irrigation systems
- Water is distributed uniformly, good fertilizer distribution
- Manager has flexibility in timing applications
- Less fertilizer needed because all of the fertilizer is applied to the wetted area, where the roots are located
- Labor costs are lowered
- On steep slopes, this is the only practical method of fertilizer application

Injection Equipment

- Differential pressure tanks (Batch Tanks)
- Venturi devices
- Positive displacement pumps

- Also needed:
  - Backflow prevention device
  - Tanks that can hold chemical fertilizers

Zinc

- Avocado has a small but essential requirement for zinc
- Leaf mottling between veins, small rounded fruit, shortened internodes
- Zinc deficiency can be a chronic problem in organic groves where high phosphorous manures are used

Zinc Deficiency

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Zinc Deficiency

Boron Deficiency

Boron Deficiency