# INTERPRETING SOIL & LEAF ANALYSES

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- Understanding a basic soil test
  - Soil test basics
  - Terms and definitions
  - Interpreting a soil analysis
- Understanding a basic leaf analysis
  - Leaf analysis basics
  - Optimum ranges
  - Interpreting a leaf analysis
- Understanding a basic irrigation water analysis



### SOIL TEST BASICS

- When should a soil sample be collected for analysis?
  - Before you plant a grove
  - At least every couple of years for an established grove
  - Timing isn't critical, but consistency from year-to-year is
  - Spring sampling is typical, but sampling with leaf analyses in the fall can aid in interpretation



## SOIL TEST BASICS

- How should a soil sample be collected?
  - For open ground, base your sampling on variability (soil textures, slope, aspect)
  - Sample from the rootzone 0-8 inches for avocados
  - Sample approximately halfway between trunk and canopy edge
  - Collect a composite sample from each irrigation block and/or soil type
    - Use a soil probe or shovel to collect individual samples
    - Place samples in a clean 5-gallon bucket and mix thoroughly
    - Variability dictates the number of samples to collect (10-20 is typical)





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#### SOIL ANALYSIS RESULTS

Test Description	Result	Units	Optimum Range		Gra	phical 1	Results Pre	esentation														
Primary Nutrients				Very Low	·Mo	derately Low	Optimum	Moderatel High	у	Very High												
Nitrate-Nitrogen	4.0	PPM	22 - 32				-															
Phosphorus	43	PPM	20 - 35																			
Potassium (Exch)	410	PPM	110 - 680	Second Second			Provent .															
Potassium (Sol)	0.851	meg/L	0.92 - 2.9			6%																
Secondary Nutrients																						
Calcium (Exch)	3150	PPM	3500 - 4600																			
Calcium (Sol)	5.27	meq/L	3.7 - 9.7			100						Hass So	il Analysi	is - P	rimary and	I Secondary	<b>Nutrients</b>					
Magnesium (Exch)	1460	PPM	350 - 700								DDD (	DDD (		T		DDI (		DDM		DDM	a	
Magnesium (Sol)	6.70	meg/L	2.8 - 5.8			and the second second	Sar	nple Area		Variety	Nitrate-N	PPM Phosphorus	Exch. I	ĸ	Sol. K	Exch. Ca	Sol. Ca	Exch. Mg	Sol. Mg	Exch. Na	Sol. Na	Sulfate
Sodium (Exch)	70	PPM	0.0 - 330							_		- noopnorae		_								
Sodium (Sol)	2.50	meg/L	0.0 - 15				SA-1 Block 1	West Hass		Hass	119	16			0.921 (25)	2810	28.6 (60%)	280	11.0 (2)%)		6.82 (14%)	17.5
Sulfate	4.39	meg/L	1.4 - 21			L	SA-2 BIOCK 1	East Hass		Hass	1.1				1.14 (4%)	2300	14.3 (52%)	309	7.40 (27%)	140	4.07 (175)	13.4
Micro Nutrients																						
Zinc	55.0	PPM	1.9 - 42	State of the local division of the		Sec. 2						Hass Soil	Analysis -	- Mic	cro Nutrien	ts and Base	e Saturation	1				
Manganese	27.9	PPM	3.2 - 64	and the second second					-											~		
Iron	28.1	PPM	19 - 60	Contractory of the	-		Sar	nple Area		Zinc	PPM	Iron	Copper	r	PPM Boron	meq/L Chloride	CFC meq/100g	CEC - Ca	CEC - Me	CEC - K	CEC - N	CEC - H
Copper	2.3	PPM	0.56 - 11						_	Zine	Manganese	non	copper		Boron	Chioride	CLIC	obe ou	CLOC Mg			che n
Boron	0.28	PPM	0.42 - 2.2				SA-1 Block 1	West Hass		10.6	5.8	8.0	14.0		0.396	3.76	16.8	83.3	13.7	2.09	1.16	< 1.00
Chloride	3.74	meg/L	0.21 - 4.8				SA-2 Block 1	East Hass		17.2	11.2	1/7.4	12.6		0.334	2.23	15.0	/8./	10.9	3.11	1.11	
CEC	29.0	meq/100g	14 - 35										Hass Soi	il Ana	alysis - Add	litional Ele	ments					
% Base Saturation										Units	dS/m		%		Tons/AF	Moi	sture		%			
CEC - Calcium	54.1	%	60 - 80				Sar	nple Area		pH	ECe	SAR	Limestor	ne	Lime Req	% Low	Opt High	Satur	ration			
CEC - Magnesium	41.4	%	10 - 20				CA 1 Dlask 1	West Hose		7.76	4.27	1.5	1.2			5.1		32.5 (Loom)				
CEC - Potassium	3.59	%	1.0 - 6.0	and the second second			SA-1 Block 1 SA-2 Block 1	East Hass		7.66	2.10	1.4	1.1			9.0		36.5 (Loam)				
CEC - Sodium	1.01	%	0.0 - 5.0				Good	ADDEED			Problem	Low	Hi	igh	Indicate	es physical cor	ditions and/or	phenological an	nd amendment r	equirements.		
CEC - Hydrogen	< 1.00	) %	0.0 - 3.0											0		1.7		1 0				
	1000			Strongly	Mo	derately	Near	Moderatel	ly	Strongly												
				Acidic	-	Acidic	Neutrai	Aikaline		Aikaime												
pH	7.39	Units	6.0 - 7.5	in the local		Training St																
Others				Satisfac	tory	Possil Probl	ble M em F	Ioderate roblem	Inc	reasing												
0.11.0.11.1.	1.10	10/	0.0. 2.0	_																		
Soll Salinity	1.19	d8/m	0.0 - 2.0																			
SAR	1.0		0.0 - 6.0																			
Limestone	< 0.10	) %	0.0 - 0.50	0	1	1 2	2	4	5	6												
				0	1	2	2	4	3	0												
Lime Requirement	0	Tons/AF			1.16																	
				Low	Mo	Low	Optimum	High	ly	High												
Moisture	37.3	%	5 5 - 38	Cinit Colorado			Prat Land and serve															
	51.5	10	0.0 00	Loamy	Sandy	Loan	n Silt	Clay	Clay	Organic												
				Sand	Loam		Loam	Loam														
Saturation	55.0	%	40 - 50																			
Good		Proble	m Indicates ph	veicel condi	tions and	/or pheno	logical and an	nendment requ	uireme	nts												



- PPM = parts per million is a concentration value
  - 5 blue m&ms in a bowl of 1 million m&ms = 5 PPM blue m&ms
  - Average soils weigh 4 million pounds per acre-foot
  - Assuming most nutrient uptake is in the top 6-inches of soil
  - PPM x 2 = pounds per acre
- mg/L = milligrams per liter is a concentration value equivalent to PPM
  - 1 L of water = 1,000 mL = 1,000 g
  - 1 mL of water = 1 g = 1,000 mg
  - 1,000 x 1,000 = 1,000,000 a liter weighs 1 million mg

			Hass Soi	Analysis -	Primary and	I Secondary	Nutrients					
Sample Area	Variety	PPM Nitrate-N	PPM Phosphorus	PPM Exch. K	meq/L Sol. K	PPM Exch. Ca	meq/L Sol. Ca	PPM Exch. Mg	meq/L Sol. Mg	PPM Exch. Na	meq/L Sol. Na	meq/L Sulfate
SA-1 Block 1 West Hass SA-2 Block 1 East Hass	Hass Hass	119         Image: Constraint of the second sec	16 <b>(</b> 11 <b>(</b>	140 <b>1</b> 80 <b>1</b> 80	0.921 (25) <b>1</b> .14 (45)	2810 <b>2</b> 360 <b>1</b>	28.6 (60%)	280 <b>2</b> 80 309 <b>1</b>	11.0 (23%) 7.40 (27%)	40 <b>1</b> 40 <b>1</b>	6.82 (14%) 4.67 (17%)	17.5 <b>1</b> 3.4 <b>1</b>

Hass Soil Analysis - Micro Nutrients and Base Saturation

Sample Area	PPM Zinc	PPM Manganese	PPM Iron	PPM Copper	PPM Boron	meq/L Chloride	meq/100g CEC	% CEC - Ca	% CEC - Mg	% CEC - K	% CEC - Na	% CEC - H
SA-1 Block 1 West Hass	10.6	5.8 🔲	8.0	14.0	0.396	3.76	16.8 🔲	83.3	13.7 🔲	2.09	1.16	< 1.00 🗶
SA-2 Block 1 East Hass	17.2	11.2	7.4 🥌	12.6	0.334	2.23	15.0	78.7	16.9	3.11	1.11	< 1.00

						]	Hass	Soil Ar	alys	sis - Ad	ditior	al Elei	ment	S		
Sample Area	Ur	uits H	dS E0	/m Ce	S	AR	Lin	% nestone	To Lin	ons/AF ne Req	%	Mois Low	sture Opt	High	% Saturation	
SA-1 Block 1 West Hass	7.76		4.27		1.5		1.2		0		5.1		•		32.5 (Loam)	
SA-2 Block 1 East Hass	7.66		2.10		1.4		1.1		0		9.0				36.5 (Loam)	
Good			Pro	blem	Low			High		Indicat	es phy	sical con	ditions	and/or	phenological and amer	ndment requi



- meq/L = milliequivalents per liter a measure of charge concentration per liter
  - Calcium in soil solution calcium exists as Ca<sup>2+</sup> (Ca<sup>++</sup>)
  - Calcium in soil has a charge of 2
  - An equivalent of an ion is the atomic mass of the ion divided by the charge
  - Ca has an atomic mass of 40.08, thus an equivalent of Ca is 40/2 = 20
    - Converting between meq/L and PPM
      - PPM = equivalent weight x meq/L
      - o meq/L = PPM / equivalent weight
      - o 28.6 meq/L Ca = 20 x 28.6 = 572 PPM Ca

			Hass Soi	Analysis -	Primary an	d Secondary	<b>Nutrients</b>					
Sample Area	Variety	PPM Nitrate-N	PPM Phosphorus	PPM Exch. K	meq/L Sol. K	PPM Exch. Ca	meq/L Sol. Ca	PPM Exch. Mg	meq/L Sol. Mg	PPM Exch. Na	meq/L Sol. Na	meq/L Sulfate
SA-1 Block 1 West Hass	Hass	119	16 🥥	140 📖	0.921 (25)	2810	28.6 (60%)	280	11.0 (23%)	40 📖	6.82 (14%)	17.5 🔲
SA-2 Block 1 East Hass	Hass	7.1	11 🔵	180	1.14 (4%)	2360	14.3 (52%)	309 📖	7.40 (27%)	40 📖	4.67 (17%)	13.4 🔲
			Hass Soil A	analysis - M	icro Nutriei	nts and Base	e Saturation					
Sample Area	PPM Zinc	PPM Manganese	PPM Iron	PPM Copper	PPM Boron	meq/L Chloride	meq/100g CEC	% CEC - Ca	% CEC - Mg	% CEC - K	% CEC - Na	% CEC - H
SA-1 Block 1 West Hass	10.6	5.8	8.0	14.0	0.396	3.76	16.8	83.3	13.7	2.09	1.16	< 1.00

SA-2 Block 1 East Hass	17.2	11.2	7.4	12.6	0.334	2.23	78.7 🔲 16.9	3.11
				Hass Soi	l Analysis - A	ditional Elements		
Sample Area	Uni pH	its dS I E	S/m Ce SAR	% Limestor	ne Tons/AF Lime Req	Moisture % Low Opt H	igh Saturation	

	P	H	E	Ce		Lin	lestone	LI	ne keq	70	Low	Opt	High	Saturation
SA-1 Block 1 West Hass	7.76		4.27		1.5	1.2		0		5.1				32.5 (Loam)
SA-2 Block 1 East Hass	7.66		2.10		1.4	1.1		0		9.0	Control to a			36.5 (Loam)
Good		1 JUNE	Pro	blem	Low		High		Indicat	es phy:	sical con	ditions	and/or	phenological and amendment require

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< 1.00



#### EQUIVALENT WEIGHTS OF COMMON IONS

lon Type	Ion Name	Symbol	Atomic Mass	Equivalent Weight
	Calcium	Ca <sup>2+</sup>	40	20
SUO	Magnesium	Mg <sup>2+</sup>	24	12
Cati	Sodium	Na <sup>+</sup>	23	23
	Potassium	K+	39	39
	Bicarbonate	HCO <sub>3</sub> -	61	61
<i>w</i>	Carbonate	CO <sub>3</sub> <sup>2-</sup>	60	30
nion	Chloride	Cl-	35.5	35.5
<	Nitrate	NO <sub>3</sub> -	62	62
	Sulfate	SO42-	96	48



- CEC = cation exchange capacity a measure of the quantity of cations that can be held by a soil, reported as meq/100 g
  - Cations are held by the negative charges on clay particles and organic matter
  - Common cations are:
    - Calcium (Ca<sup>2+</sup>)
    - Magnesium (Mg<sup>2+</sup>)
    - Potassium (K<sup>+</sup>)
    - Ammonium (NH<sub>4</sub><sup>+</sup>)
    - Sodium (Na<sup>+</sup>)
    - Hydrogen (H<sup>+</sup>)
  - High CEC value = greater nutrient storage capacity of the soil
  - Cations in soil solution are in dynamic equilibrium with cations adsorbed on soil particles





- Exchangeable nutrients ions held on the soil complex that may be replaced by other ions of like charge.
  - Exchangeable nutrients are not leachable
- · Soluble nutrients ions in the soil solution that can be readily absorbed by plant roots.
  - Soluble nutrients are leachable

			Hass Soi	l Analysis -	Primary and	d Secondary	<b>Nutrients</b>					
Sample Area	Variety	PPM Nitrate-N	PPM Phosphorus	PPM Exch. K	meq/L Sol. K	PPM Exch. Ca	meq/L Sol. Ca	PPM Exch. Mg	meq/L Sol. Mg	PPM Exch. Na	meq/L Sol. Na	meq/L Sulfate
SA-1 Block 1 West Hass SA-2 Block 1 East Hass	Hass Hass	119 <b>1</b> 19 <b>7</b> .1	16 <b>(</b> 11 <b>(</b>	140 <b>1</b> 80 <b>1</b> 80	0.921 (2%) <b>1</b> .14 (4%)	2810 <b>2</b> 360 <b>1</b>	28.6 (00%)	280 <b>1</b> 309 <b>1</b>	11.0 (23%) 7.40 (27%)	40 <b>1</b> 40 <b>1</b>	6.82 (14%) <b>1</b> 4.67 (17%) <b>1</b>	17.5 <b>1</b> 3.4 <b>1</b>

#### Hass Soil Analysis - Micro Nutrients and Base Saturation

Sample Area	PPM Zinc	PPM Manganese	PPM Iron	PPM Copper	PPM Boron	meq/L Chloride	meq/100g CEC	% CEC - Ca	% CEC - Mg	% CEC - K	% CEC - Na	% CEC - H
SA-1 Block 1 West Hass	10.6	5.8	8.0 🤇	14.0	0.396 🔲	3.76	16.8 🔲	83.3 🗩	13.7	2.09	1.16	< 1.00
SA-2 Block 1 East Hass	17.2	11.2	7.4 🥌	12.6	0.334 🔲	2.23	15.0	78.7	16.9	3.11	1.11	< 1.00

				Hass Soll A	nalysis - Ad	ditional Elements	\$	
Sample Area	Units pH	dS/m ECe	SAR	% Limestone	Tons/AF Lime Req	Moisture % Low Opt	High	% Saturation
SA-1 Block 1 West Hass	7.76	4.27	1.5	1.2	0 🔲	5.1		32.5 (Loam)
SA-2 Block 1 East Hass	7.66	2.10	1.4	1.1	0	9.0		36.5 (Loam)
Good		Problem	Low	High	Indica	tes physical conditions	and/or	phenological and amendment

ments



- pH a measure of acidity and alkalinity; a measure of the hydrogen ion concentration
  - Based on a log scale
    - a pH of 6 is 10x more acid than a pH of 7
    - a pH of 8 is 10x more alkaline than a pH of 7







- EC electrical conductivity; a measure of the salinity of a solution
  - Pure water does not conduct electricity, but water with salts dissolved in it does
    - A salt is a material that when dissolved in water (or soil solution) releases a cation and an anion
      - Sodium chloride (Na<sup>+</sup>, Cl<sup>-</sup>); calcium nitrate (Ca<sup>2+</sup>, 2NH<sub>3</sub><sup>-</sup>); potassium nitrate (K<sup>+</sup>, NH<sub>3</sub><sup>-</sup>)
  - The more salts in a solution, the better it conducts electricity and the higher the EC
  - Reported as decisiemens per meter (dS/m)
- $EC_e = extract EC a$  measure of the EC of the soil solution extract
- $EC_w$  = water EC a measure of the EC of water



 SAR – sodium adsorption ratio – describes the relative activity of sodium (Na) ions to Ca and Mg in soil solution or water

 $SAR = \frac{1}{Ca + Mg}$ 

- As the SAR increases
  - permeability of soil decreases
  - the risk of sodium toxicity increases
- SAR < 3 is desirable, not to exceed 4</li>



Na causes soil particles to disperse



#### **INTERPRETING A SOIL ANALYSIS**

Test Description	Result	Units	Optimum Range		Gra	aphical F	Results Pre	esentatio	n	
Primary Nutrients				Very Low	·M	oderately Low	Optimum	Modera High	tely 1	Very High
Nitrate-Nitrogen	4.0	PPM	22 - 32							
Phosphorus	43	PPM	20 - 35							
Potassium (Exch)	410	PPM	110 - 680							
Potassium (Sol)	0.851	meq/L	0.92 - 2.9			6%				
Secondary Nutrients										
Calcium (Exch)	3150	PPM	3500 - 4600							
Calcium (Sol)	5.27	meq/L	3.7 - 9.7				34%			
Magnesium (Exch)	1460	PPM	350 - 700			Real Property				
Magnesium (Sol)	6.70	meq/L	2.8 - 5.8				Part States	44%		
Sodium (Exch)	70	PPM	0.0 - 330							
Sodium (Sol)	2.50	meq/L	0.0 - 15			A Read of the	16%			
Sulfate	4.39	meq/L	1.4 - 21							
Micro Nutrients										
Zinc	55.0	PPM	1.9 - 42	1000						
Manganese	27.9	PPM	3.2 - 64	and the second party of						
Iron	28.1	PPM	19 - 60		1					
Copper	2.3	PPM	0.56 - 11		-					
Boron	0.28	PPM	0.42 - 2.2							
Chloride	3.74	meq/L	0.21 - 4.8					-		
CEC	29.0	meq/100g	14 - 35							
% Base Saturation										
CEC - Calcium	54.1	%	60 - 80	-245-12						
CEC - Magnesium	41.4	%	10 - 20							
CEC - Potassium	3.59	%	1.0 - 6.0			Sector many				
CEC - Sodium	1.01	%	0.0 - 5.0	and the second second						
CEC - Hydrogen	< 1.00	%	0.0 - 3.0							0. 1
				Acidic	y M	oderately Acidic	Near Neutral	Alkali	ine	Alkaline
pH	7.39	Units	6.0 - 7.5							
Othors				Satisfac	tory	Possib	le N	Ioderate	In	creasing
omers						FIODIC		Toblem	1	roblem
Soil Salinity	1.19	dS/m	0.0 - 2.0							
SAR	1.0		0.0 - 6.0							
Limestone	< 0.10	%	0.0 - 0.50							1 6
				0	1	2	3	4	5	6
Lime Requirement	0	Tons/AF								
				Very Low	M	oderately Low	Optimum	Modera Hig	tely h	Very High
Moisture	37.3	%	5.5 - 38	(PROFILE)			Proto and a street			
				Loamy Sand	Sandy Loam	Loam	Silt Loam	Clay Loam	Clay	Organic
Saturation	55.0	%	40 - 50							
outurution	55.0	70	10 50	-						

- A soil test tells you:
  - The capacity of your soil to act as a reservoir of nutrients
  - Whether your nutrients will be available or unavailable (pH)
  - Potential salinity issues
  - Potential water infiltration issues



#### LEAF ANALYSIS BASICS

- Leaf analyses are a snapshot in time that tell you how well your nutrition program is working, comparing leaf analyses over time is very beneficial
- Sample in late summer to early fall (mid-August mid-October)
- Sample healthy, mature, spring flush leaves (4 to 6 months old) from non-fruiting, non-flushing branches
  - Do not sample terminal leaves or the worst looking leaf on a branch
- Sample areas based on fertilization blocks (typically an irrigation block)
- Collect 30-40 leaves from across a block, being sure to take samples from all four quadrants of the trees (N, S, E, W)
  - Criss-crossing a block on several diagonals is a good way to ensure your sample represents the block
- Leaf samples should be stored in <u>paper</u> <u>bags</u>, not plastic, and stored at room temperature until delivery to the lab





#### OPTIMUM RANGES

• There is a debate about optimum ranges, they should be used as guidelines until you have developed a history for your grove

Nutrient	UC Range	Crowley Range*	Fruit Growers Lab					
N%	1.6 – 2.3	2.25 – 2.5	2.2 - 2.4					
P%	0.10 - 0.25	0.1 – 0.15	0.08 - 0.44					
K%	0.75 – 2.0	0.7 – 0.9	1.0 - 3.0					
Ca%	1.0 - 3.0	1.8 – 2.0	1.0 - 4.5					
Mg%	0.25 - 0.80	0.6 - 0.9	0.25 – 1.0					
S%	0.20 - 0.60	0.45 – 0.53	***					
CI%	< 0.25	**	< 0.25					
Na%	< 0.25	**	< 0.25					
B ppm	50 – 100	38 – 60	12 - 100					
Zn ppm	30 – 150	50 - 80	30 – 250					
Mn ppm	30 – 500	110 – 145	30 – 700					
Fe ppm	50 – 200	55 – 80	50 - 300					
Cu ppm	5 – 15	4 – 7	5 – 65					
* See the Fall 2015 issue of From the Grove magazine, www.californiaavocadogrowers.com/publications								
** Cl, although an essential plant nutrient, is very toxic to avocados and should be kept as low as possible; Na is not an essential plant nutrient and should be kept as low as possible.								
*** S, although an essenti	al plant nutrient, is not inclu	ded in FGL's standard tissu	e analysis.					



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#### INTERPRETING A LEAF ANALYSIS

		HA	ISS PLANT TIS	SUE ANA	LYSIS				
Test Description	Result	Units	Optimum Range	(	Graphical Results Presentation				
Macro Nutrients				Deficient	Low	Ample	High	Excessive	
Total Nitrogen (Leaf)	2.31	%	2.2 - 2.4						
Phosphorus (Leaf)	0.19	%	0.080 - 0.44						
Potassium (Leaf)	0.675	%	1.0 - 3.0						
Calcium (Leaf)	1.45	%	1.0 - 4.5						
Magnesium (Leaf)	0.96	%	0.25 - 1.0						
Micro Nutrients									
Zinc (Leaf)	22.5	ppm	30 - 250						
Manganese (Leaf)	34	ppm	30 - 700						
Iron (Leaf)	51	ppm	50 - 300						
Copper (Leaf)	11	ppm	5.0 - 65						
Boron (Leaf)	14.4	ppm	12 - 100						
Sodium (Leaf)	0.011	%	0.0 - 0.25						
Chloride (Leaf)	0.111	%	0.0 - 0.25						
Nutrient Ratios									
Nitrogen:Potassium	3.42		1.7 - 2.2				and the second		
Nitrogen:Phosphorus	12.2		11 - 23						
Phosphorus:Zinc	84.4		20 - 50						
Potassium:Magnesium	0.702		1.5 - 3.5						
Nitrogen:Calcium	1.59		0.90 - 2.0						

Good

Problem



#### LEAF ANALYSIS HISTORY



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#### **IRRIGATION WATER ANALYSIS**

		Gene	ral Irrig	gation Sui	itability A	nalysis				
Test Description	Result				Graphical Results Presentation					
Cations	mg/L	Meq/L	% Meq	Lbs/AF	Good	Possible Problem	Moderate Problem	Increasing Problem	Severe Problem	
Calcium	264	13	52	720	**	-				
Magnesium	103	8.5	33	280	**					
Potassium	4	0.1	0	11	**					
Sodium	87	3.8	15	240						
Anions										
Carbonate	< 10	0	0	0						
Bicarbonate	420	6.9	28	1100	**					
Sulfate	635	13	54	1700	**					
Chloride	77	2.2	9	210						
Nitrate	145	2.3	9	390						
Nitrate Nitrogen	33			90						
Fluoride	0.5	0.026	0	1						
Minor Elements										
Boron	0.30			0.82						
Copper	< 0.01			0.00						
Iron	0.38			1.0						
Manganese	< 0.01			0.00						
Zinc	< 0.02			0.00						
TDS by Summation	1740			4700						
Other										
рН	7.3			units						
E. C.	2.08			dS/m						
SAR	1.2									
Crop Suitability										
No Amendments	Poor					in the second				
With Amendments	Poor									
Amendments										
Gypsum Requirement	0.0			Tons/AF						
Sulfuric Acid (98%)	24		C	oz/1000Gal	Or 58 oz/	1000Gal of	urea Sulfur	ric Acid (15	6/49).	
Leaching Requirement	17			%						
Test Description		R	esult		Graphical Results Presentation					
Chemical					Sligh	t	Moderate	Se	evere	
Manganese	<	0.01	n	ng/L						
Iron	0	.38	n	ng/L		and the second				
TDS by Summation	17	740	n	ng/L						
No Amendments										
pН	7	.3	υ	inits						
Alkalinity (As CaCO3)	3	40	п	ng/L			The second second			
Total Hardness	10	080	n	ng/L				AND INCOME.		
With Amendments										
Alkalinity (As CaCO3)	(	58	n	ng/L	INCLASSING MAD					
Total Hardness	(	58	n	ng/L						
pH	5.4	- 6.7	u	nits	And in case of the local division of the loc					

- 1 acre-foot of water weighs ~2.7 million pounds
  - mg/L = ppm
  - ppm x 2.7 = lb/AF
  - 3 AF of water per year = 710 pounds of Na added to soil annually

$$SAR = \frac{Na}{\sqrt{\frac{Ca + Mg}{2}}}$$

- N @ 3 AF per year = 270 lb
- Cl @ 3 AF per year = 625 lb
- Ca @ 3 AF per year = 2150 lb
- Mg @ 3 AF per year = 850 lb



#### **IRRIGATION WATER ANALYSIS**

		Gene	ral Irrig	gation Sui	itability A	nalysis				
Test Description	Result				Graphical Results Presentation					
Cations	mg/L	Meq/L	% Meq	Lbs/AF	Good	Possible Problem	Moderate Problem	Increasing Problem	Severe Problem	
Calcium	264	13	52	720	**					
Magnesium	103	8.5	33	280	**					
Potassium	4	0.1	0	11	**					
Sodium	87	3.8	15	240						
Anions										
Carbonate	< 10	0	0	0						
Bicarbonate	420	6.9	28	1100	**					
Sulfate	635	13	54	1700	**					
Chloride	77	2.2	9	210						
Nitrate	145	2.3	9	390						
Nitrate Nitrogen	33			90						
Fluoride	0.5	0.026	0	1						
Minor Elements				-						
Boron	0.30			0.82						
Copper	< 0.01			0.00	=					
Iron	0.38			1.0	E					
Manganese	< 0.01			0.00						
Zinc	< 0.01			0.00						
TDS by Summation	1740			4700					_	
Other	1740			4700						
Other	7.2				_					
pn E C	2.08			units						
E. C.	2.08			dS/m	COLUMN STATE		and the second second			
SAR	1.2									
Crop Suitability										
No Amendments	Poor						a state of the state			
With Amendments	Poor					The second second				
Amendments										
Gypsum Requirement	0.0			Tons/AF						
Sulfuric Acid (98%)	24		C	oz/1000Gal	Or 58 oz/	1000Gal of	f urea Sulfu	ric Acid (15	/49).	
Leaching Requirement	17			%						
Test Description		R	esult		Graphical Results Presentation					
Chemical					Sligh	t	Moderate	Se	evere	
Manganese	<	0.01	n	ng/L						
Iron	0	.38	n	ng/L	and the state of the	and the second second				
TDS by Summation	17	740	п	ng/L						
No Amendments										
рН	7	.3	n	inits						
Alkalinity (As CaCO3)	3	40		ng/L	Concession of the local division of the loca	The other states		COLUMN STREET		
Total Hardness	10	080	n	ng/L						
With Amondmonte	10		I	15, D						
Alkalinity (As CoCO2)		58		ag/I						
Total Hardness		20	п	ig/L						
notal fiardiless	5.4	67	n	Ig/L						
рп	5.4	- 0./	u	INITS						

- Leaching requirement is based on  ${\sf EC}_{\sf w}$  and the target  ${\sf EC}_{\sf e}$ 

 $LR = EC_w / [(5 \times EC_e) - EC_w]$ 

- Back calculating, an LR of 17% would allow for an  $EC_e = 3.0$
- Avocado yield decline starts at  $EC_e$ = 0.4 dS/m
- This water would be toxic to avocados!!!

# THANK YOU

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