



AVOCADO FERTILITY; RIGHT TIME RIGHT SOURCE RIGHT RATE RIGHT PLACE



Presented by Danny Klittich Ph.D., Agronomist



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 **Danny Klittich, PhD**

Agronomist

Dr. Klittich earned his PhD from UC Davis. He is the Redox Regional Agronomist for the California Coast. Dr. Klittich works extensively in avocados, strawberries, leafy greens, citrus, and wine grapes.

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AGENDA



- Introduction
- Fertility Planning – Time, Source, Rate, Place
- Primary Avocado Nutrient
 - N, K, Zn, Ca, C
- Questions and FAQ's

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Redox is a bio-nutrient company that focuses on sustainable plant nutrition.



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- old Package (Bovines)

January	February	March	April
		- Munga (Bov/Am) - MS (Bov/Am) - Roster (Bov/Am)	- Pire (Bov/Am) - MS (Bov/Am)
May - AN-20 (Bov/Am)	June - 0-10-0 (Bov/Am) - Pire (Bov/Am) - Roster (Bov/Am)	July - MS (Bov/Am)	August - Pire (Bov/Am)
September - MS (Bov/Am)	October	November	December

- Pire (Bov) Applications: How many recommended x2?
- MS/Munga not x2?



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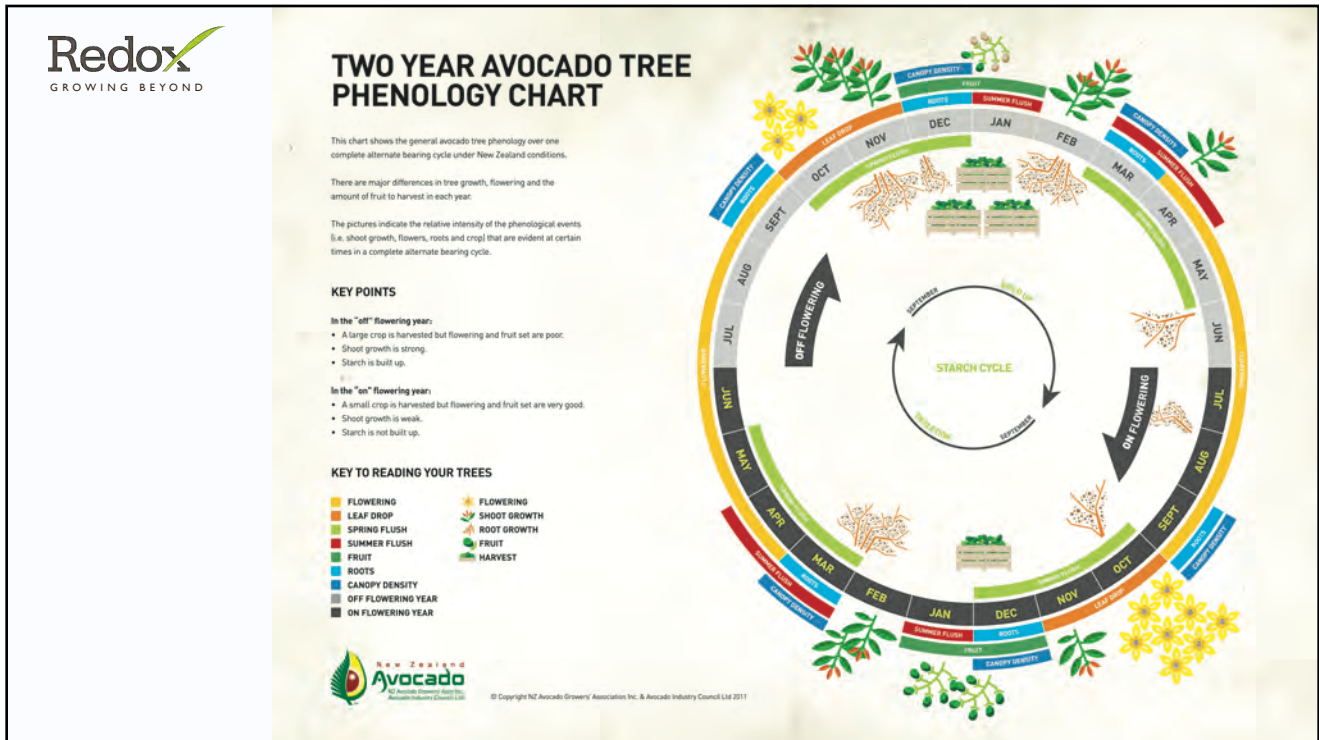


 **AG Rx**
AN EMPLOYEE OWNED COMPANY
486 Fertility Products



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Redox
GROWING BEYOND

AVOCADO PRODUCTION SOLUTIONS

Redox
REDOXCHEM.COM

GENERAL AVOCADO FERTILITY PROGRAM
Avocados, 2019

04/22/2019

STANDARD AVOCADO FERTILITY PROGRAM

This program is broken down month by month addressing the changing fertility needs of the tree over the year. This is a standard program and additional inputs may be needed for specific situations.

BLOOM SPRAY

APPLICATION TYPE
Foliar

Bloom sprays are a good time to deliver nutrition directly to developing buds and flowers. Supporting these tissues with calcium, potassium, and micronutrients can be beneficial to pollen viability and early fruit development/retention. (Timing: 25%-100% Bloom)

PRODUCT DETAILS

NAME	RATE
Supreme	2.0 lbs/Acre
Mainstay Si	0.5 gals/Acre

APRIL

APPLICATION TYPE
Soil Applied

April the tree is pushing bloom, setting fruit, and the roots are starting to push as the soils warm up. Some years this comes a little early so timing may vary year to year.

Potassium, boron, and calcium all play important roles in bud development and pollination. Phosphorus, calcium, and soluble carbon play a critical role in root development.

The following product blend addresses the needs of the tree at this point in the growth cycle.

PRODUCT DETAILS

NAME	RATE
dKAP	1.0 lbs/Acre
Mainstay Calcium	0.75 gals/Acre
Triplex Micro	1.0 lbs/Acre
Triplex Boron	0.25 lbs/Acre
Rootox	1.25 lbs/Acre

Proposal prepared on 04/22/2019

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Goal of Fertilization

1. Drive Yield (Size/Quality/Pounds)
2. Soil-Applied fertilizers during periods of high nutrient demand
3. Foliar-Applied fertilizers during periods of high nutrient demand that occur when soil conditions restrict nutrient uptake by the roots.
4. Properly timing fertilizer applications is critical!

“The goal is to... increases fruit set, fruit size, fruit quality and grower profit even when the tree is NOT deficient by standard tissue analysis”.


-Dr. Carol Lovatt, UCR



FERTILITY
PLANNING



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KNOW WHAT IS GOING ON IN THE SOIL

POSSIBLE DIFFENCENCY

pH: 6.3 EC: 15.66 % Organic Matter: 1.590%

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Results Priorities Glossary

Calcium >

Chem. Extraction Sol. Paste Extraction Base Sat. %

2002 (mod low) 377.1 (high) 63.92 (mod low)

Magnesium >

Chem. Extraction Sol. Paste Extraction Base Sat. %

310.9 (ok) 77.56 (high) 16.55 (ok)

Potassium >

Chem. Extraction Sol. Paste Extraction Base Sat. %

127.5 (low) 11.72 (very low) 2.09 (low)

Sodium >


Chem. Extraction Sol. Paste Extraction Base Sat. %

66.44 (ok) 80.91 (high) 1.84 (ok)

Phosphorus

Soil Reports Library Formulas Account

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KNOW WHAT IS GOING ON IN THE SOIL

POSSIBLE DIFFERENCY

WATER MOVEMENT

- CEC
- HIGH Mg, Na, Cl

SALT

ORGANIC MATTER

pH: 8.0 CEC: 24.12 % Organic Matter: 1.310%

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Results Priorities Glossary

Calcium >

Chem. Extraction	Sol. Paste Extraction	Base Sat. %
2432.25 (low)	49.83 (very low)	50.41 (low)

Magnesium >

Chem. Extraction	Sol. Paste Extraction	Base Sat. %
1193 (high)	30.51 (low)	41.21 (high)

Potassium >


Chem. Extraction	Sol. Paste Extraction	Base Sat. %
335 (low)	9.13 (very low)	3.56 (low)

Sodium >

Chem. Extraction	Sol. Paste Extraction	Base Sat. %
78.81 (ok)	17.86 (high)	1.42 (ok)


Soil Reports Library Formulas Account

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4 R's

- Right Time
- Right Source
- Right Rate
- Right Place



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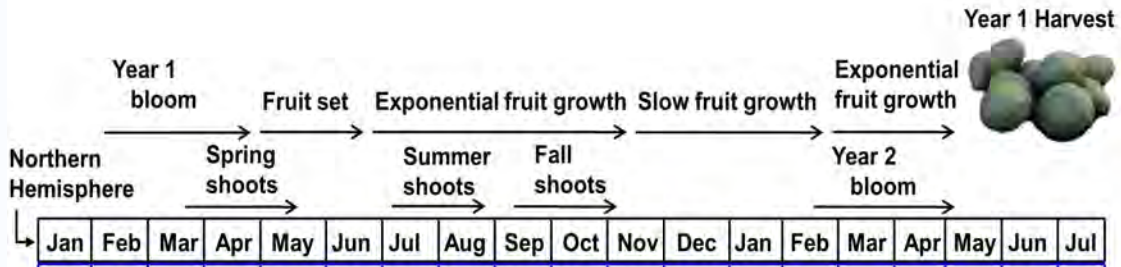
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Right Time



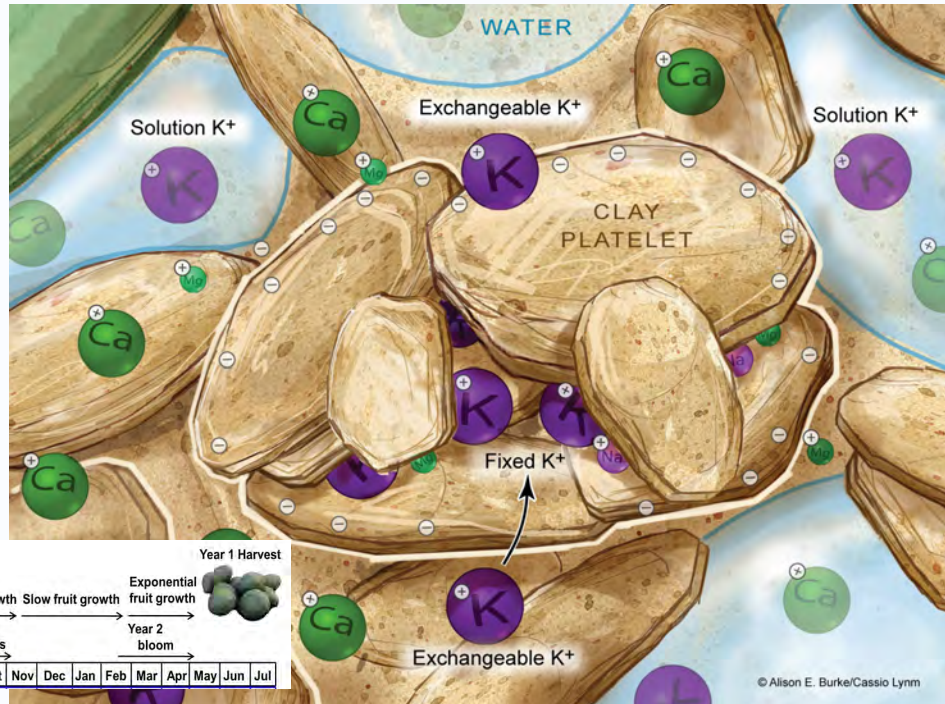
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Right Time



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Redox
GROWING BEYOND

Right Source

- Solubility
- Anion/Cation
- Cost per Unit
- Cost per acre
- Cost per appl.
- Bio-Availability




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Redox
GROWING BEYOND

Right Rate



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Tissue Tests

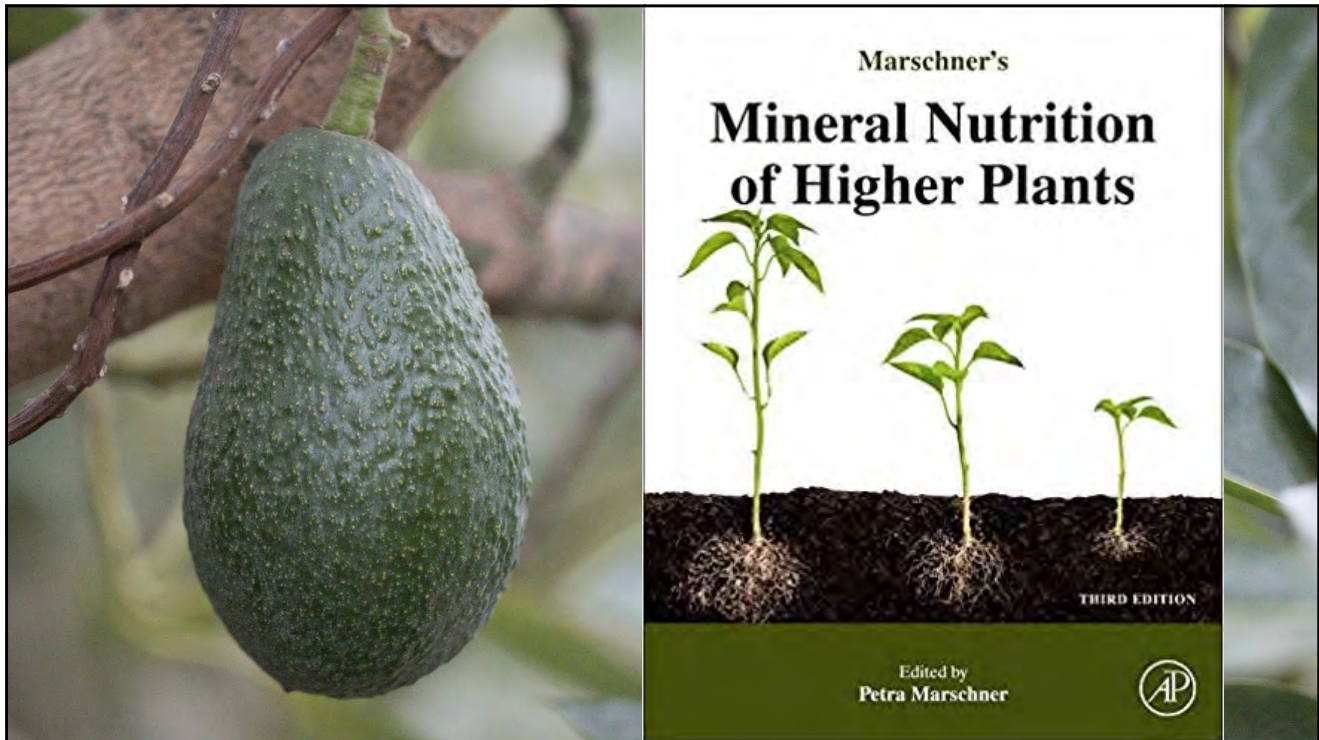
HASS PLANT TISSUE ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation				
				Deficient	Low	Ample	High	Excessive
Macro Nutrients								
Total Nitrogen (Leaf)	2.34	%	2.4 - 2.6					
Phosphorus (Leaf)	0.16	%	0.080 - 0.44					
Potassium (Leaf)	1.44	%	1.0 - 3.0					
Calcium (Leaf)	1.5	%	1.0 - 4.5					
Magnesium (Leaf)	0.485	%	0.25 - 1.0					
Micro Nutrients								
Zinc (Leaf)	24.3	ppm	30 - 250					
Manganese (Leaf)	34	ppm	30 - 700					
Iron (Leaf)	80	ppm	50 - 300					
Copper (Leaf)	25	ppm	5.0 - 65					
Boron (Leaf)	108	ppm	12 - 100					
Sodium (Leaf)	0.005	%	< 0.25					
Nutrient Ratios								
Nitrogen:Potassium	1.63		1.7 - 2.2					
Nitrogen:Phosphorus	14.6		11 - 23					
Phosphorus:Zinc	65.8		20 - 50					
Potassium:Magnesium	2.97		1.5 - 3.5					
Nitrogen:Calcium	1.56		0.90 - 2.0					

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MACRONUTRIENTS

- Nitrogen – NH_4^+ , NO_3^-
- Phosphorous – $\text{PO}_4^{=}$
- Potassium – K^+
- Calcium – Ca^{++}
- Magnesium - Mg^{++}
- Sulfur - $\text{SO}_4^{=}$

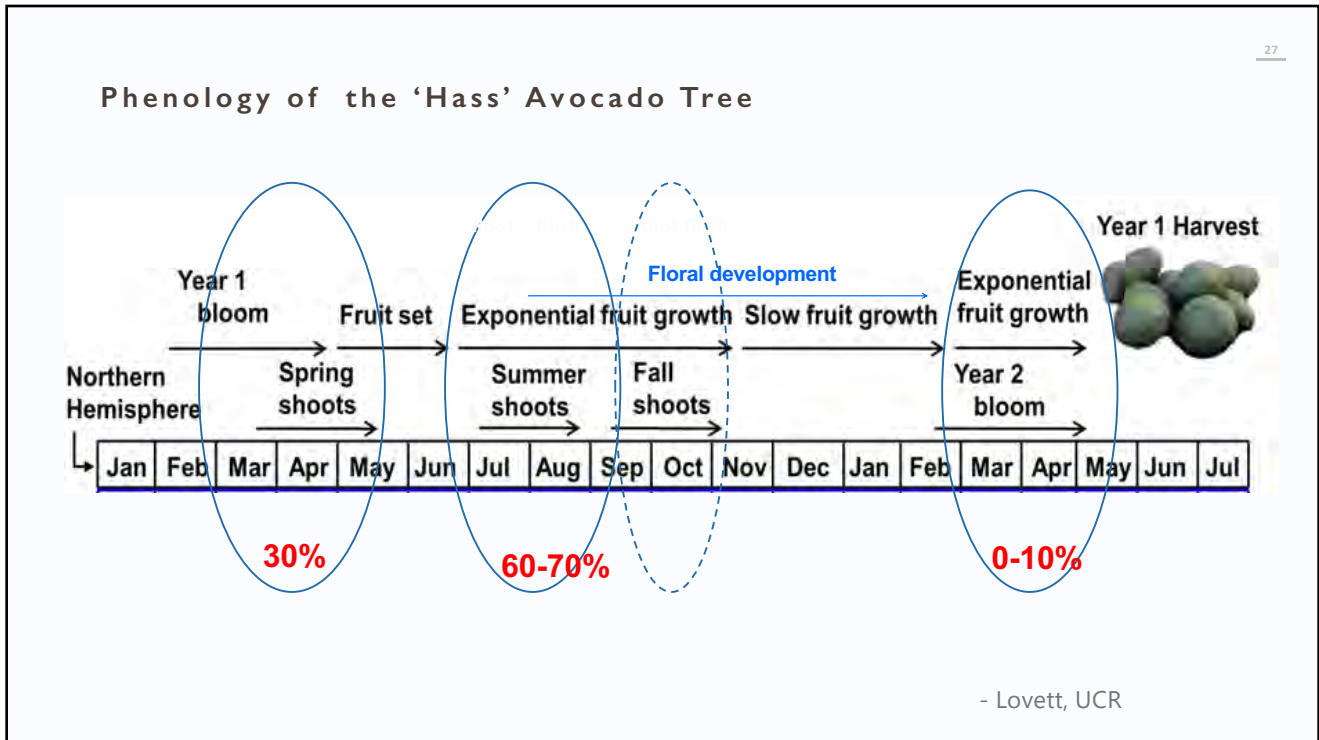
OTHER NUTRIENTS

- Cobalt – Co^{++}
- Nickel – Ni^{++}
- Silicon – $\text{Si}(\text{OH})_4$

MICRONUTRIENTS

- Zinc – Zn^{++}
- Manganese - Mn^{++}
- Iron - Fe^{++} , Fe^{+++}
- Boron – $\text{B}(\text{OH})_3$
- Copper - Cu^{++}
- Molybdenum – $\text{MoO}_4^{=}$
- Chlorine – Cl^-
- Sodium – Na^+

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NITROGEN

NO₃⁻ NH₄⁺

- Component of every plant cell
- Second to Carbon, Nitrogen is required in largest amount
- Key element of DNA and RNA
- Key component of amino acids
- Component of chlorophyll molecule
- Synthesis of proteins for growth and yield

Vegetative Growth

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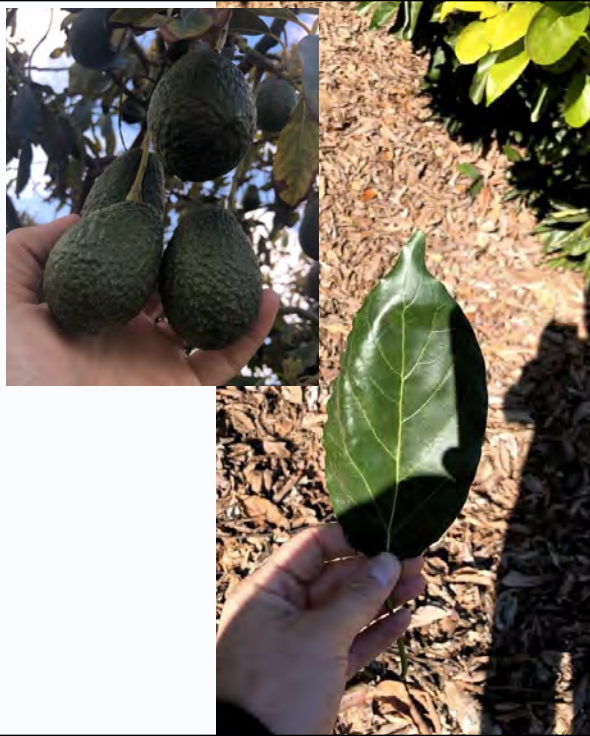


POTASSIUM

K+

- Nutrient transport
- Solute and water movement
- Stomata control
- Transport of Sugars
- Cofactor of many enzymes
- Protein regulation
- Increases resistance to Stresses

Fruit Sizing

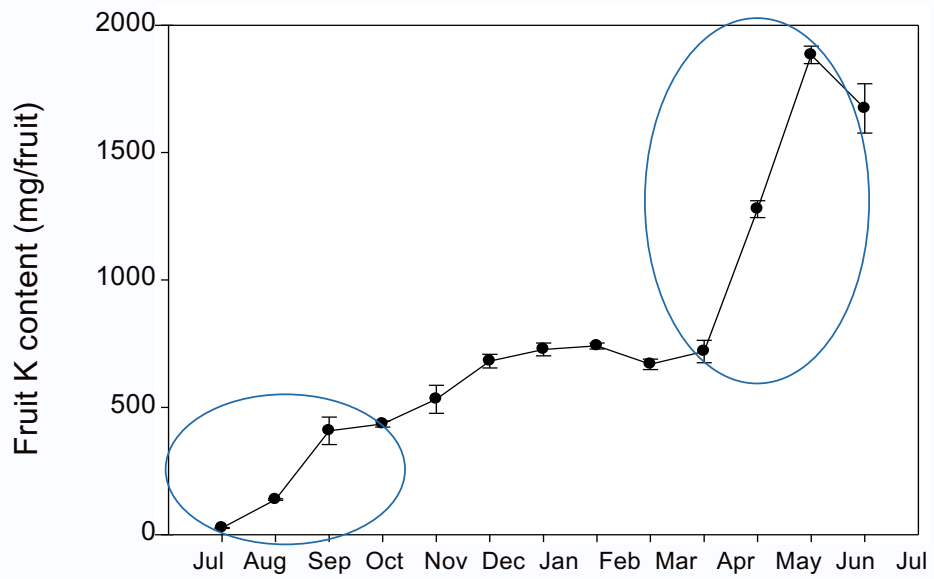


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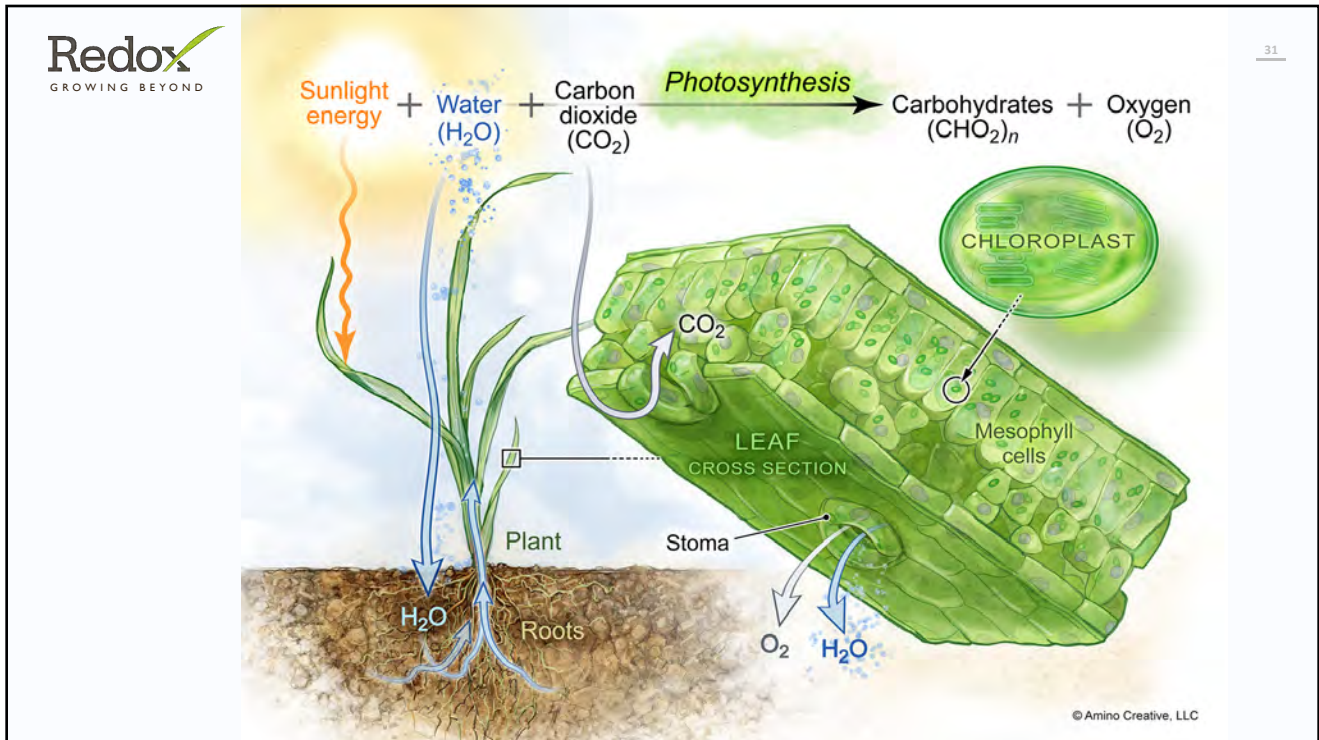


Fruit Potassium Content



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30



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diKaP™
INCREASES PLANT RESPIRATION

GUARANTEED ANALYSIS


Available Phosphate (P₂O₅) 31%

Soluble Potash (K₂O) 50%

- ✓ Increases plant respiration and antioxidant production
- ✓ Improves stomatal conductance
- ✓ Improves phosphorus and potassium nutrition

ABIOTIC STRESS DEFENSE

32


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GROWING BEYOND WITH REDOX 33


NUTRIENT
MANAGEMENT

Rx Platinum™ Improves K Nutrition





AVOCADO




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GROWING BEYOND WITH REDOX 34

 WHO	 WHAT	 WHERE	 WHEN
Grower Cooperator, Redox R&D	Rx Platinum was applied season long at the same frequency and per acre cost as the grower standard KTS program. Trial was replicated across 8 paired blocks ranging in size from 2-10 acres each.	[Need Location]	Fall


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GROWING BEYOND WITH REDOX 35


KEY OUTCOMES


Tissue analysis showed no difference in %K between Rx Platinum™ and KTS samples. All samples were in the “Ample” range. Field observation showed similar fruit sizing and less summer drop in Rx Platinum™ blocks.

Tissue Analysis



Sample	%K Level
Rx Platinum™	~1.0
Grower Standard	~1.0

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GROWING BEYOND WITH REDOX 36

ZINC

Zn²⁺

- Enzyme Structural Component
- Ribosome Structure
- Protein, and Lipid Synthesis
- Carbohydrate Metabolism
- Auxin Synthesis (Small Leaves)
- Cell Membrane Integrity

Fruit Size



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GROWING BEYOND

TriPlex™ Zinc
IMPROVES ZINC NUTRITION

GUARANTEED ANALYSIS

Zinc (Zn) 25%

- ✓ High Zinc content
- ✓ Enhances Zinc uptake due to L-amino acid chelation
- ✓ Improves Zinc movement within the plant
- ✓ Contains soluble carbon

YIELD & QUALITY

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Redox

GROWING BEYOND WITH REDOX 38

YIELD &
QUALITY

TriPlex Zinc™ IMPROVES YIELD

AVOCADO

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GROWING BEYOND WITH REDOX 39



RESEARCH OBJECTIVE


Evaluate the addition of TriPlex Zinc™ to grower standard program.




EVALUATION PARAMETERS


- Yield (lbs)
- Size

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GROWING BEYOND WITH REDOX 40




WHO



WHAT



WHERE



WHEN

**Tim Klittich,
CalPoly SLO &
Cooperating
Grower**

TriPlex Zinc™ was applied at 1.4 lbs/acre in April through October on top of the grower standard program of UN32 and KTS.

Control blocks received no additional zinc. Two blocks were treated and two control. Tissue test indicated orchard was sufficient in zinc.

Goleta, Ca

**Spring through
Fall**

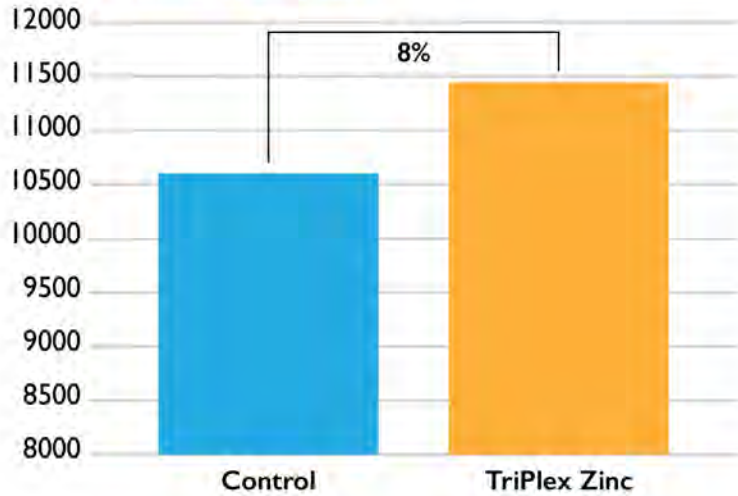
40



KEY OUTCOMES

Yield was higher by 8% in TriPlex Zinc™ treated blocks. Size classes were also shifted into the 40's and above size classes. Return on Investment was 690%.

Pounds per Acre



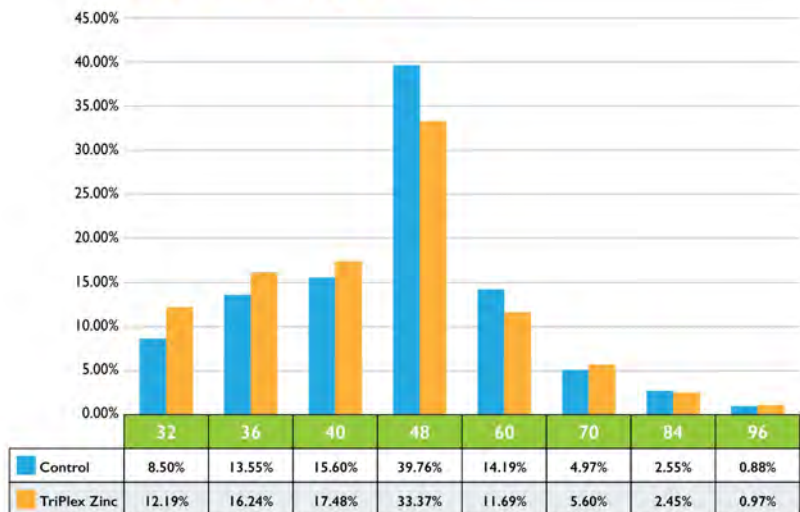
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KEY OUTCOMES

Yield was higher by 8% in TriPlex Zinc™ treated blocks. Size classes were also shifted into the 40's and above size classes. Return on Investment was 690%.

% of Grade I Packout by Size Class



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Amino Acid Chelation

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Amino Acid

Side chain
Carboxyl group
H₂N
OH
Amino Acid

Metal ion
Chelation
H₂N
N₂H

© Alison E. Burke/Cassio Lynn

Metal Ion
Amino Acid
Amino Acid

Plant can use metal ions and amino acids

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GROWING BEYOND

CALCIUM

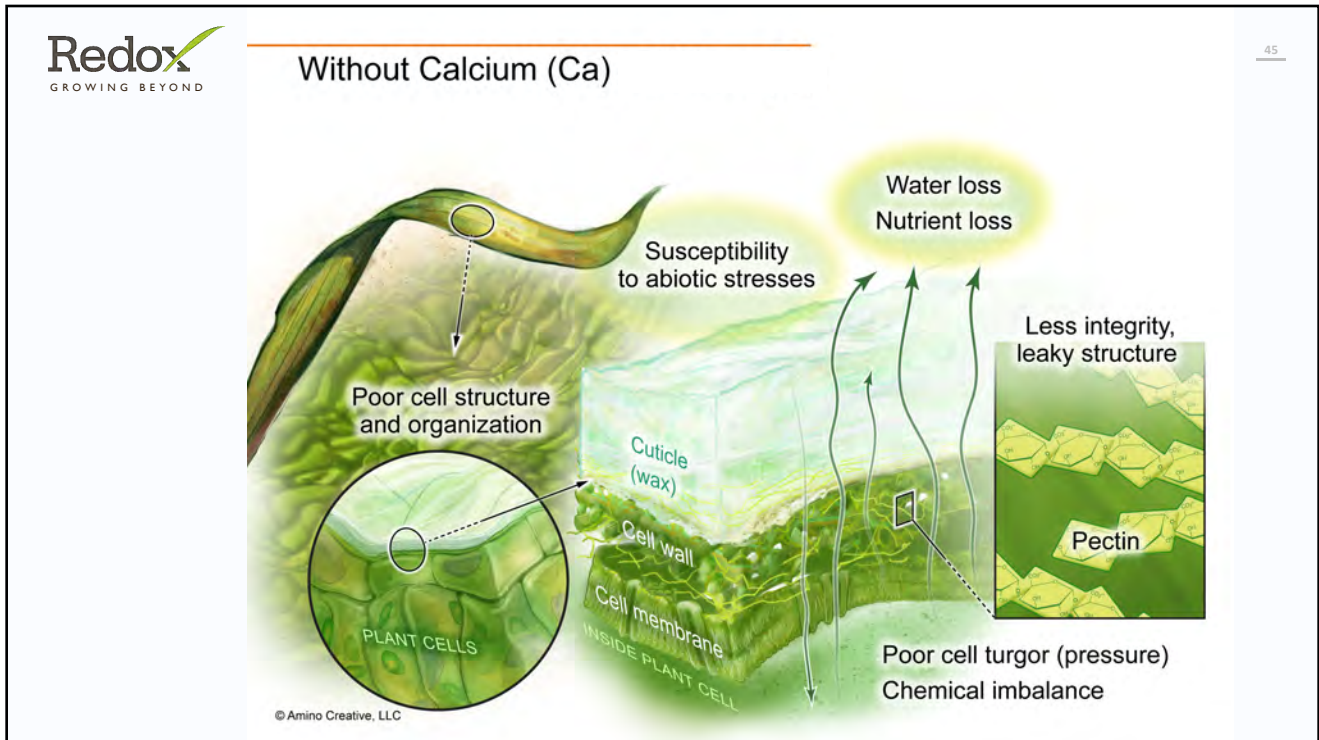
Ca²⁺

- Cell wall strength
- Plant structure, holds cell walls together
- Secondary messenger
- Inactivates enzymes that break down cell walls
- Reduces susceptibility to disease
- Increases fruit firmness

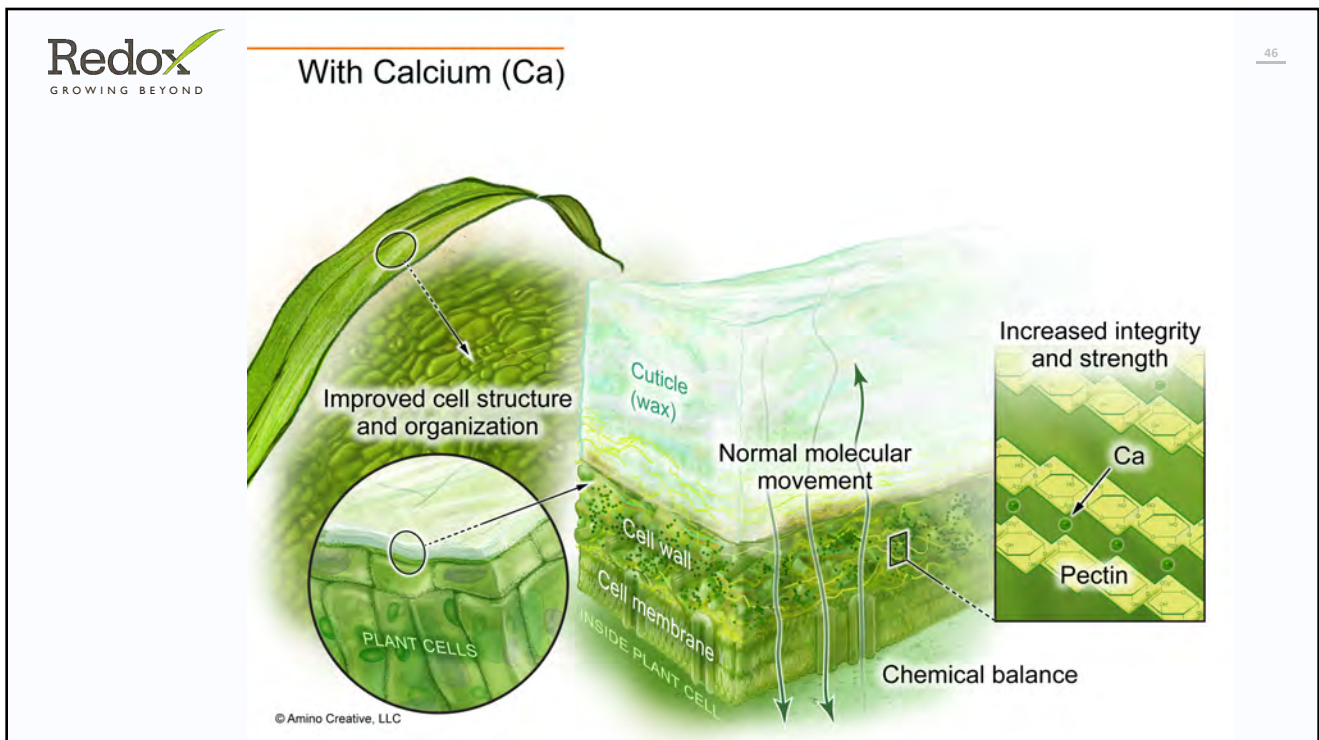
Fruit Quality and Tree Resilience

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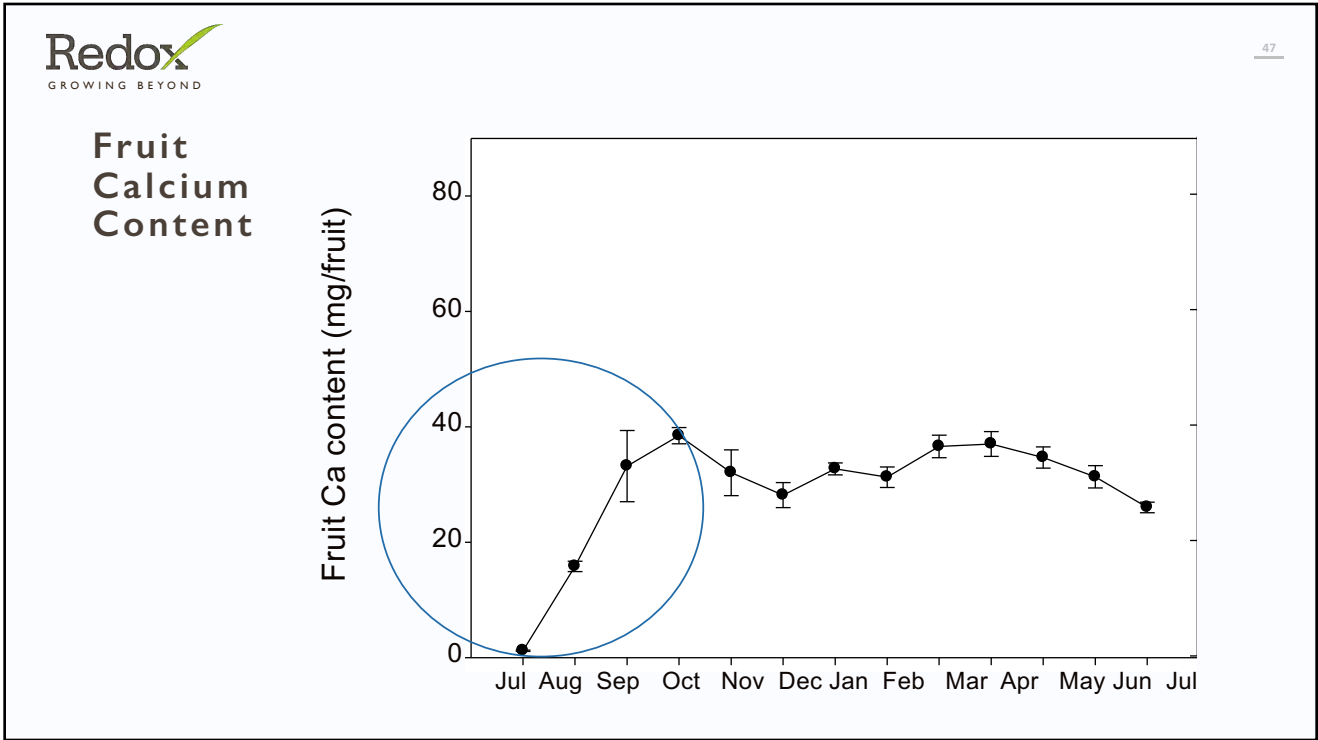
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Redox
GROWING BEYOND

Mainstay™ Calcium
IMPROVES CALCIUM NUTRITION

YIELD & QUALITY

GUARANTEED ANALYSIS

Calcium (Ca) 20%

- ✓ Improves cell wall structure
- ✓ Increases fruit firmness
- ✓ Increases fruit quality

Redox Mainstay Calcium
GUARANTEED ANALYSIS

Redox Mainstay Calcium
GUARANTEED ANALYSIS

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YIELD &
QUALITY

MAINSTAY CALCIUM
DELIVERS SUPERIOR PLANT
ASSIMILATION



avocado

Mainstay Calcium employs microencapsulation technology to improve plant calcium nutrition through low soil tie-up and high plant absorption.



WHO

Avocado grower



WHAT

Mainstay Calcium applied at a total rate of 1.75 gal./acre over six weeks through micro-sprinklers



WHERE

Ventura County, California



WHEN

Summer



RESEARCH OBJECTIVE

To highlight the efficiency of low rates of Mainstay Calcium on avocado.



EVALUATION PARAMETERS

- Tissue Ca analysis

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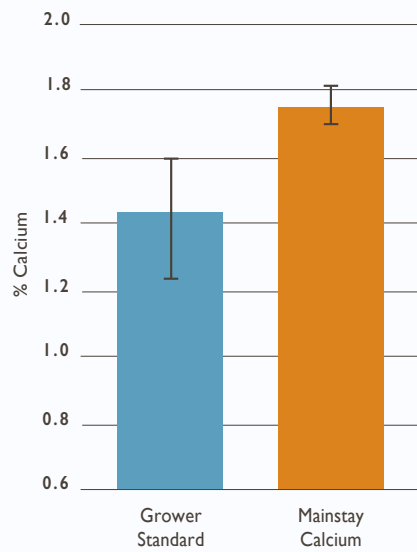


KEY OUTCOMES

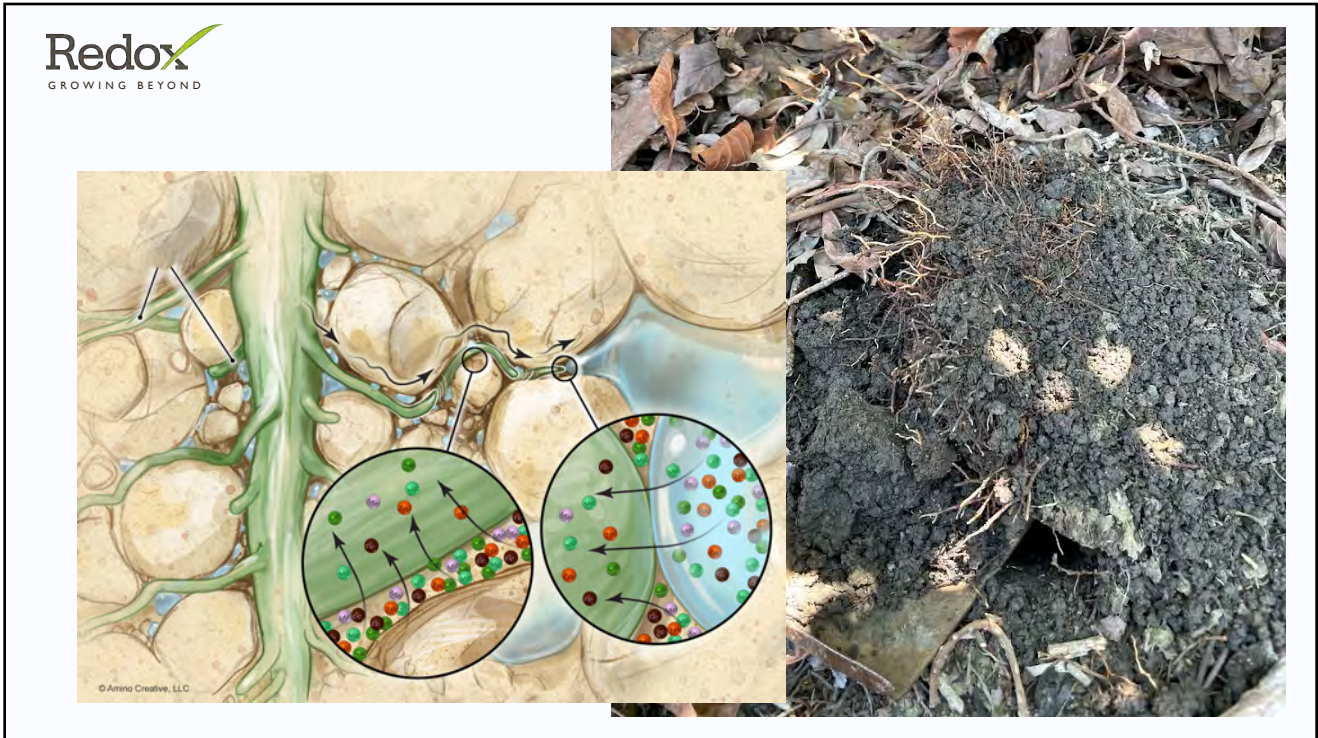
Mainstay Calcium increased tissue Ca levels by 22% over grower standard.

Nitrogen inputs were able to be decreased mid-season reducing excessive vegetative growth and pruning costs.

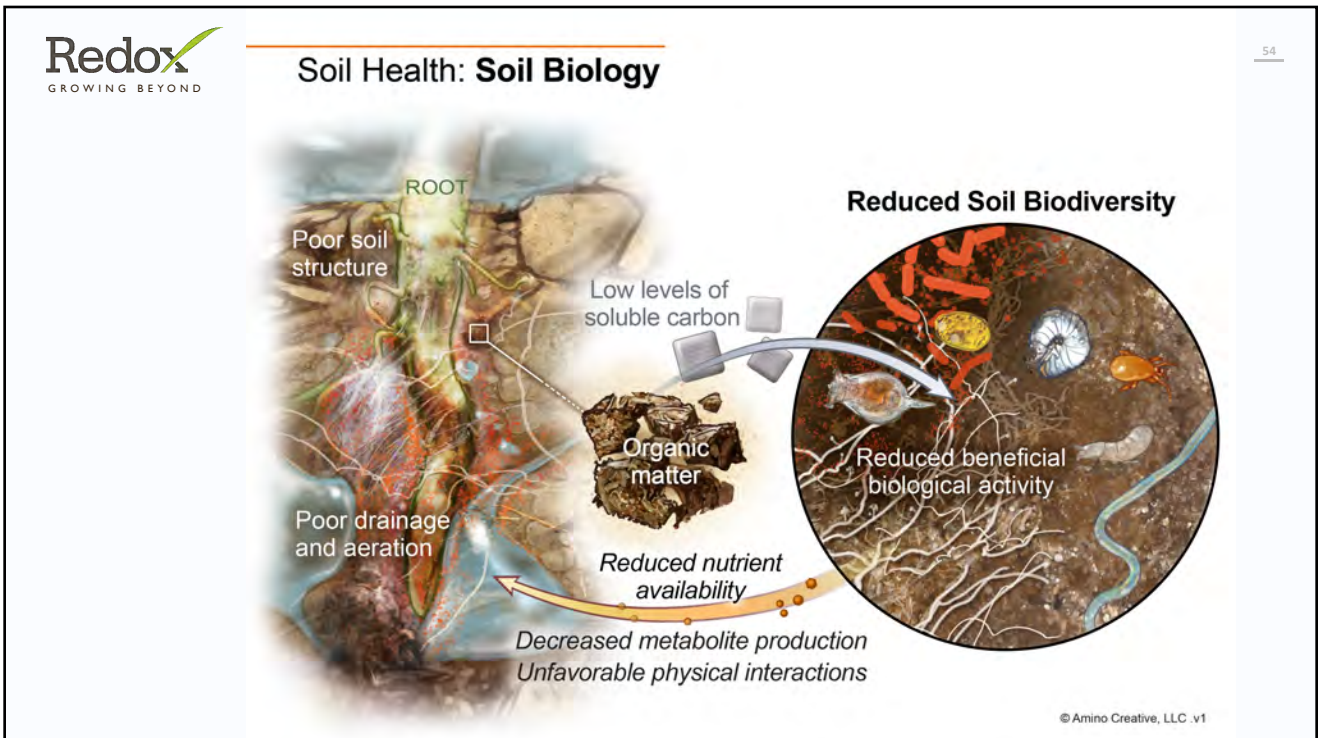
IMPACT OF MAINSTAY CALCIUM ON AVOCADO TISSUE CALCIUM



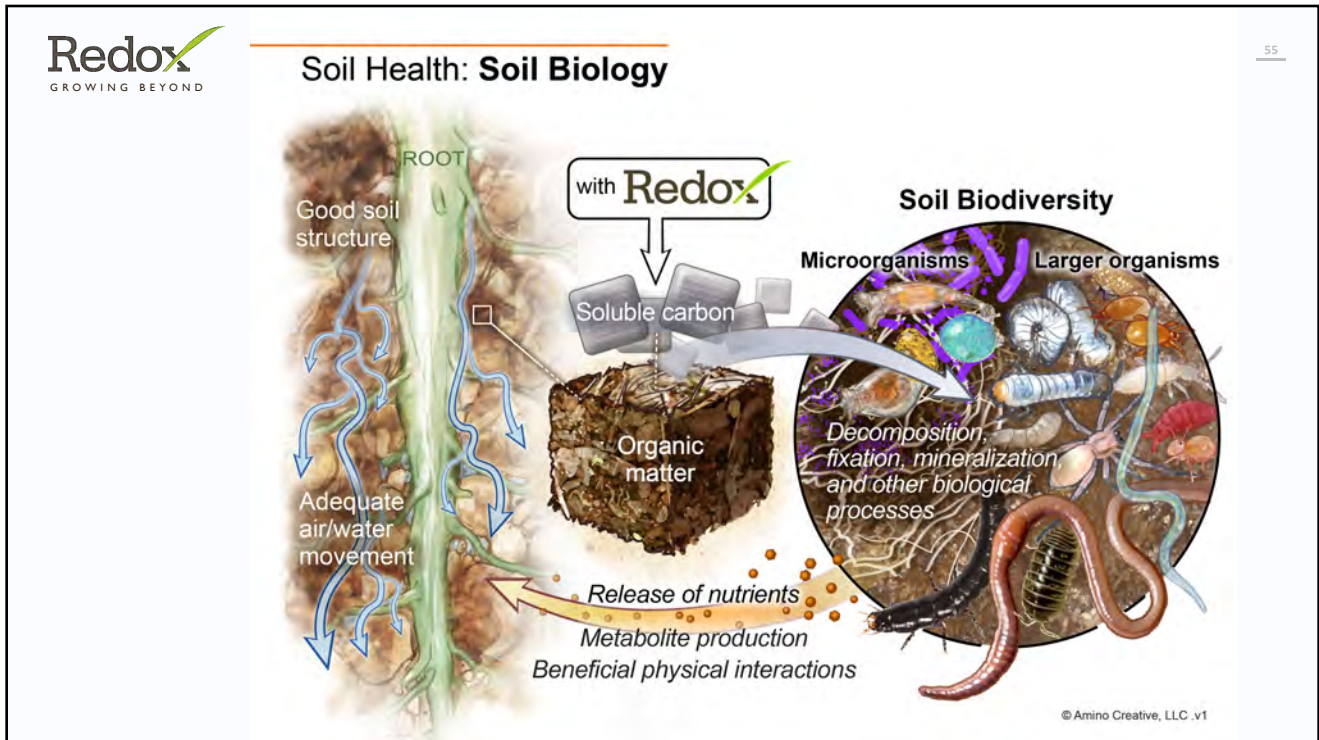
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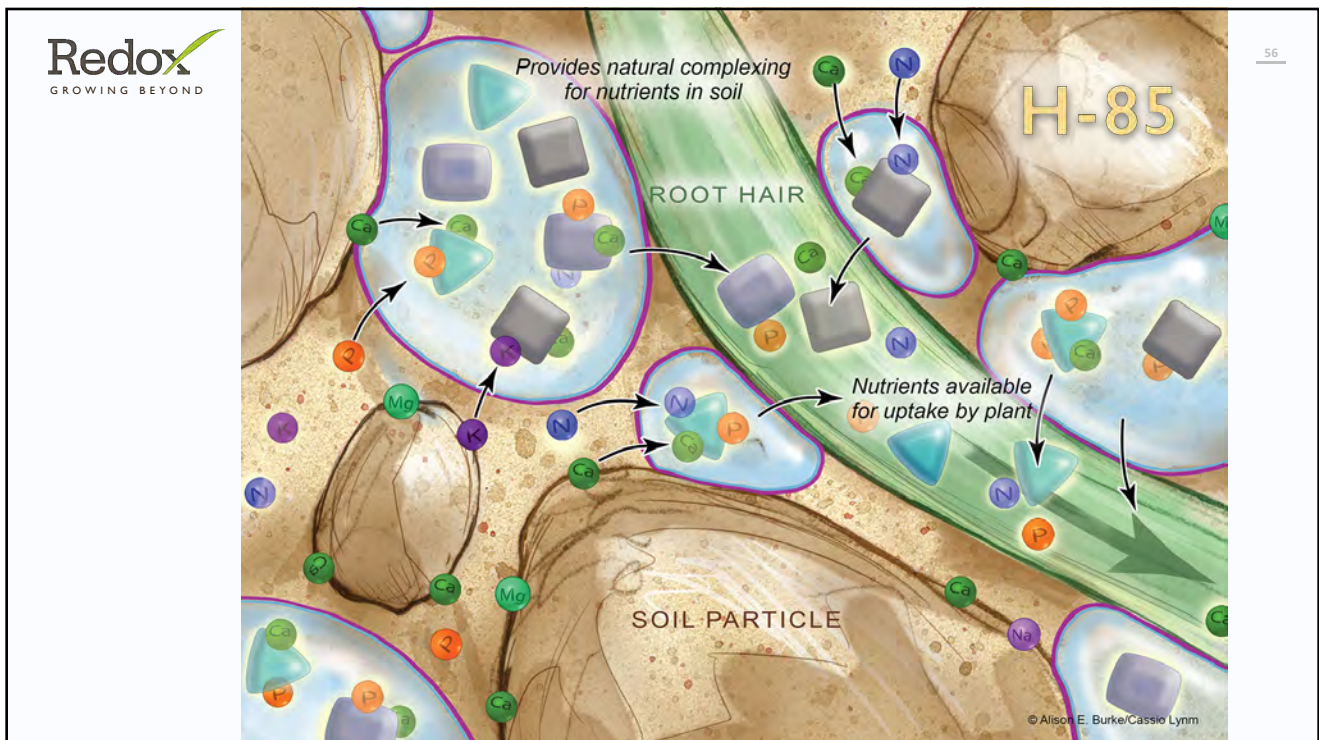
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SOIL HEALTH



H-85™ Flowable
INCREASES MICROBIAL DIVERSITY

GUARANTEED ANALYSIS


Soluble Potash (K₂O) 5%
ALSO CONTAINS NON-PLANT FOOD INGREDIENT(S)

12%..... Humic Acid

- ✓ Improves soil microbial diversity and soil health
- ✓ Improves nitrogen efficiency
- ✓ Contains diverse soluble carbon fractions
- ✓ Organic Formulation: 50% Humic Acid, 18% K



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GROWING BEYOND WITH REDOX 58

SOIL
HEALTH


H-85 IMPROVES
 CROP CONDITIONS

avocado




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Redox GROWING BEYOND WITH REDOX 59




WHO

Colegio de Posgraduados




WHAT

H-85 and a conventional humic product applied to farmed soil



WHERE

Uruápan, Michoacán, Mexico



WHEN

Application at early spring root flush

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Redox GROWING BEYOND WITH REDOX 60



RESEARCH OBJECTIVE

To measure the impact of H-85 on avocado plant growth and on microbial activity in the soil.



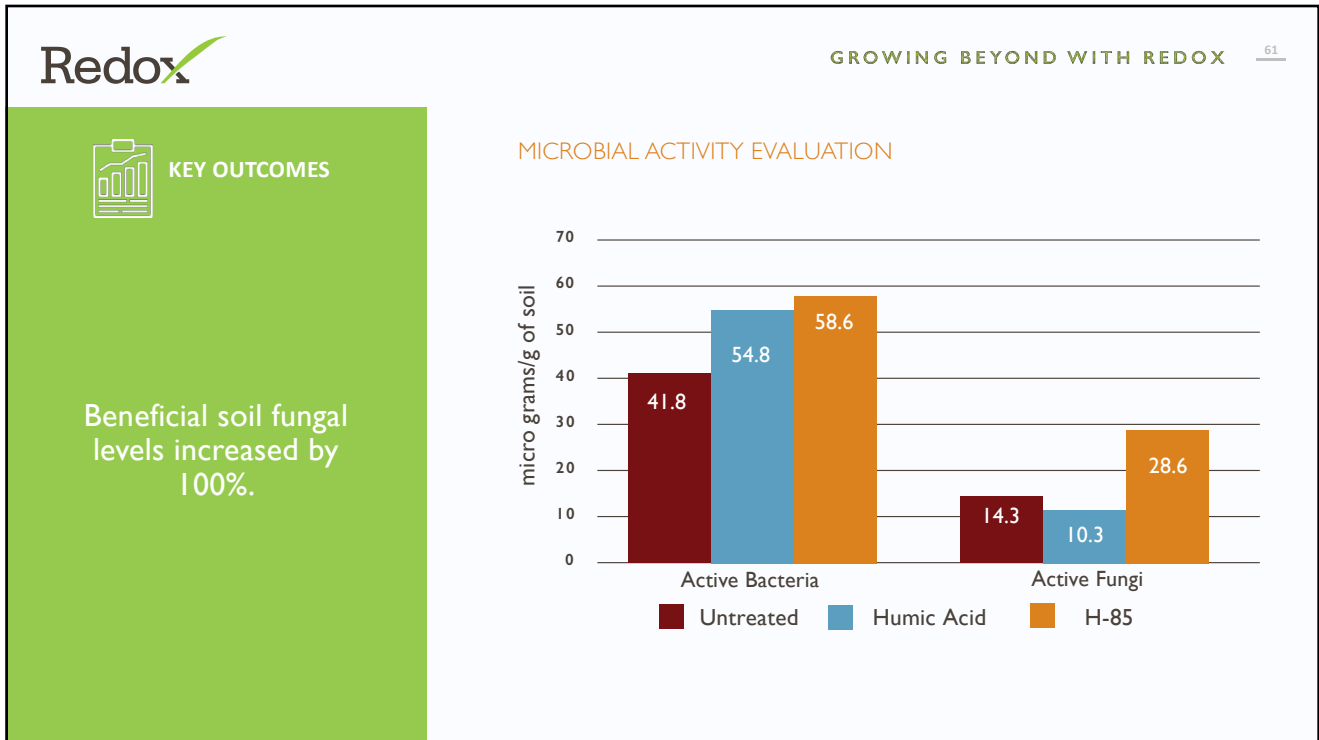
EVALUATION PARAMETERS

- Relative soil biological activity
- Root mass volume

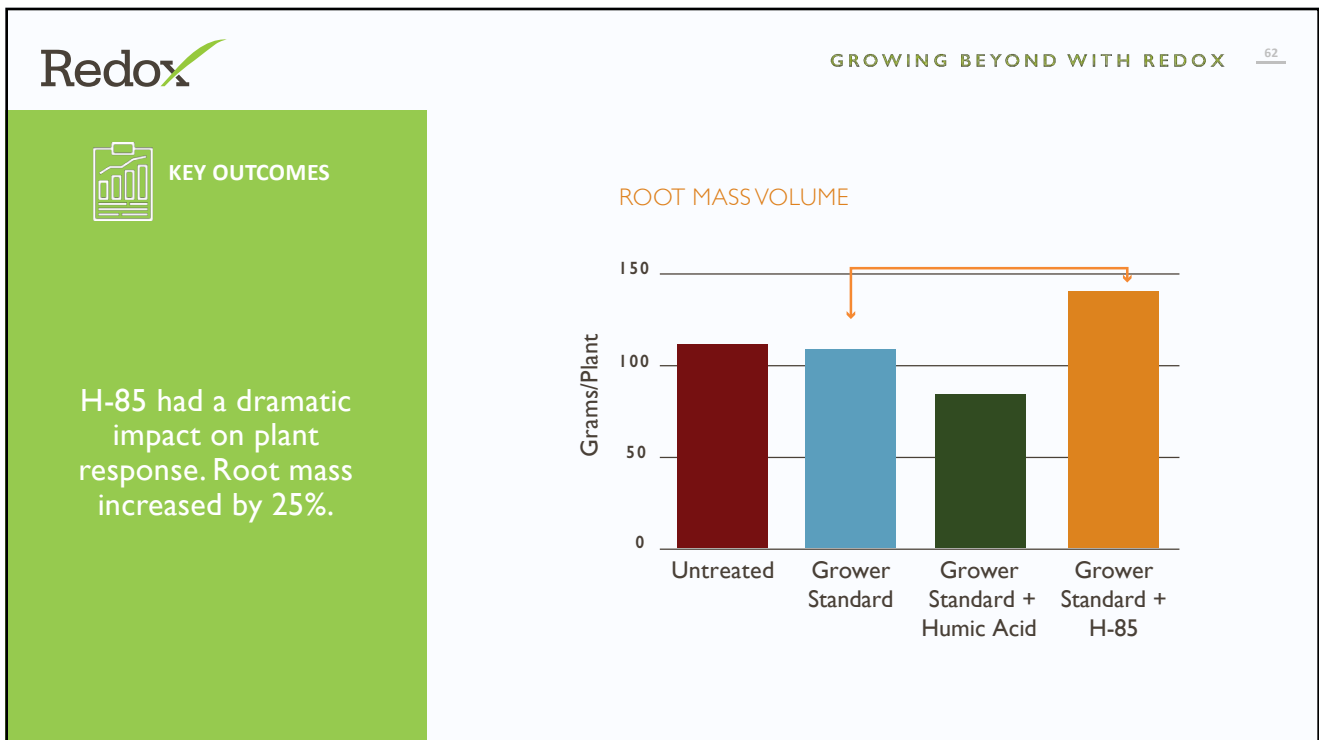
REDOX PROGRAM

PRODUCT	RATE
H-85	10 lbs. active ingredient per acre
Conventional humic acid	10 lbs. active ingredient per acre

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PINE TREE RANCH AVOCADO FERTILITY PROGRAM
Avocados, 2021 Proposal prepared for California Avocado Commission



02/28/2021

AVOCADO FERTILITY PROGRAM

TOTAL ACRE
11

This program is broken down month by month addressing the changing fertility needs of the tree over the year. This is a standard program and additional inputs may be needed for specific situations.


MARCH (EARLY BLOOM DEVELOPMENT)

APPLICATION TYPE
Chemigation

Early season fruit sizing is hard to achieve but relies heavily on zinc and potassium. The trees have a lot of vigor and potential to push more size as the weather warms. The following blend addresses fruit sizing.

PRODUCT DETAILS


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Summary

1. Fertilize based on tree phenology; not calendar date.
2. Fertilize to meet the tree's needs during periods of high nutrient demand.
3. Fertilize based on crop load, including inflorescences and young developing fruit, last year's mature fruit, and your goals for next year's crop.
4. Use leaf analysis to evaluate the success of your fertilization program and to identify problems.
5. Do not fertilize to replace what a previous crop used.
6. Maintain healthy roots for water and nutrient uptake.
7. Healthy trees deal with stress better (less fruit drop, better size, etc.)



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THANK YOU!

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FAQ'S

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