

Management Tools for Fertilization of the 'Hass' Avocado

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Expanding Export Opportunities for Avocados

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The California Avocado Commission is working with the U.S. government on market-opening efforts for California avocados in China, Japan, and the European Union to help ensure export opportunities exist for California avocados in years when production and U.S. avocado imports are both high. On the import side, the Commission is working on keeping a provision in the new Trade Promotion Authority legislation, which would help ensure import-sensitive treatment for the U.S. avocado tariff in future U.S. trade agreements.

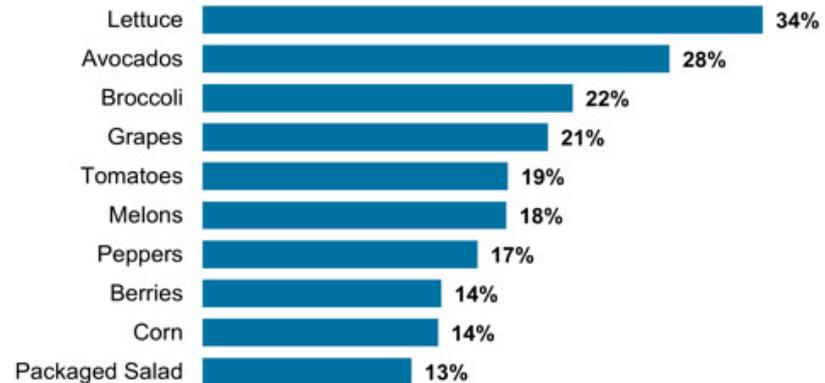
China

The Commission's efforts with respect to China are about opening the Chinese market to California avocados for the first time. China prohibits entry of California avocados on the basis that it has not yet undertaken a pest analysis to

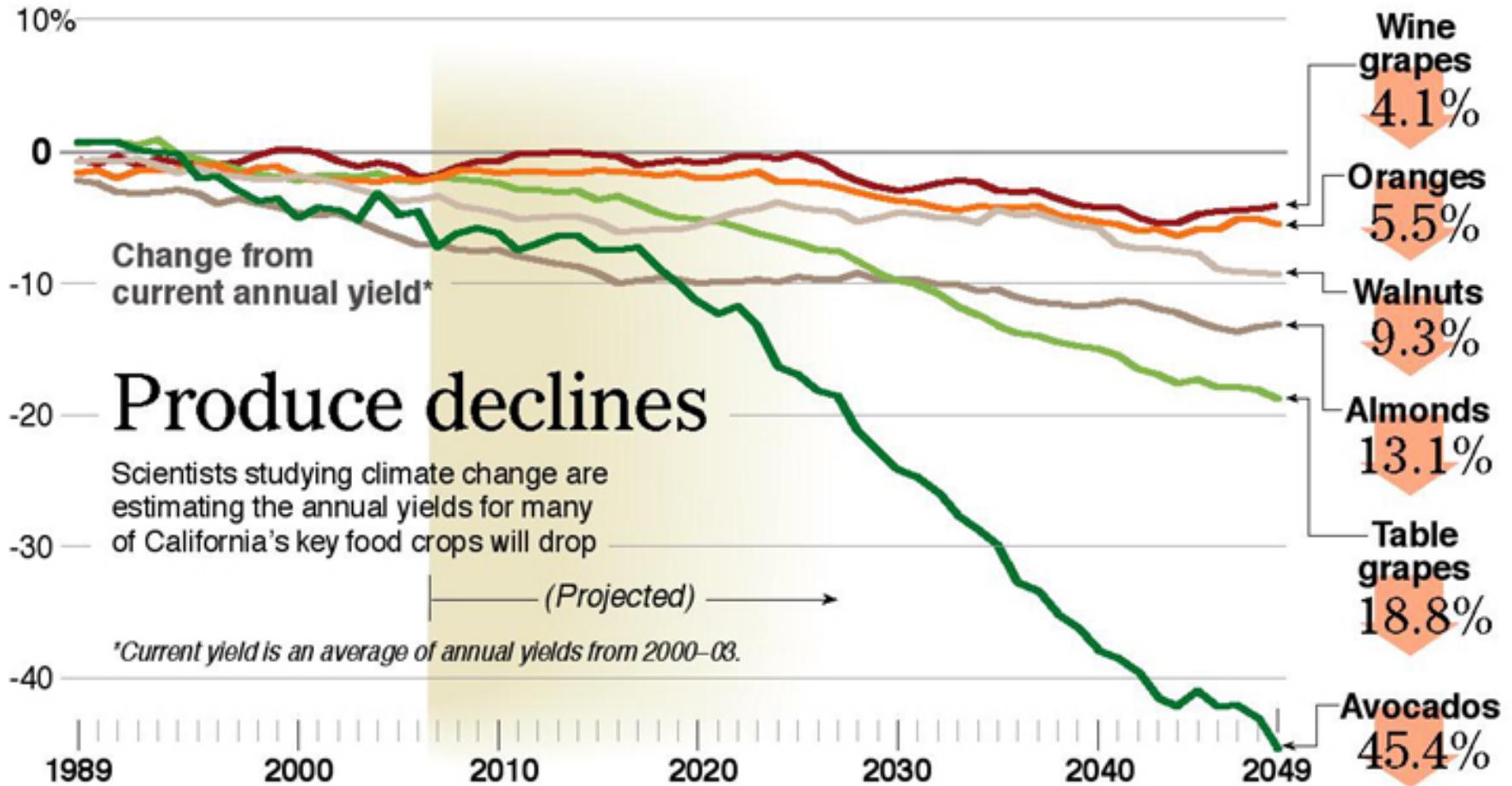
In response to California grower interest in finding new export opportunities, CAC intensified efforts to open the Chinese market this year. Earlier this year Ken Melban visited Washington, D.C., and met with APHIS Deputy Administrator Osama El-Lissy, along with personnel in charge

Produce Prices Pop

Projected maximum price increases for fresh fruits and vegetables most affected by the California drought



INCREASES IN CALIFORNIA TEMPERATURES WILL CAUSE DECREASES

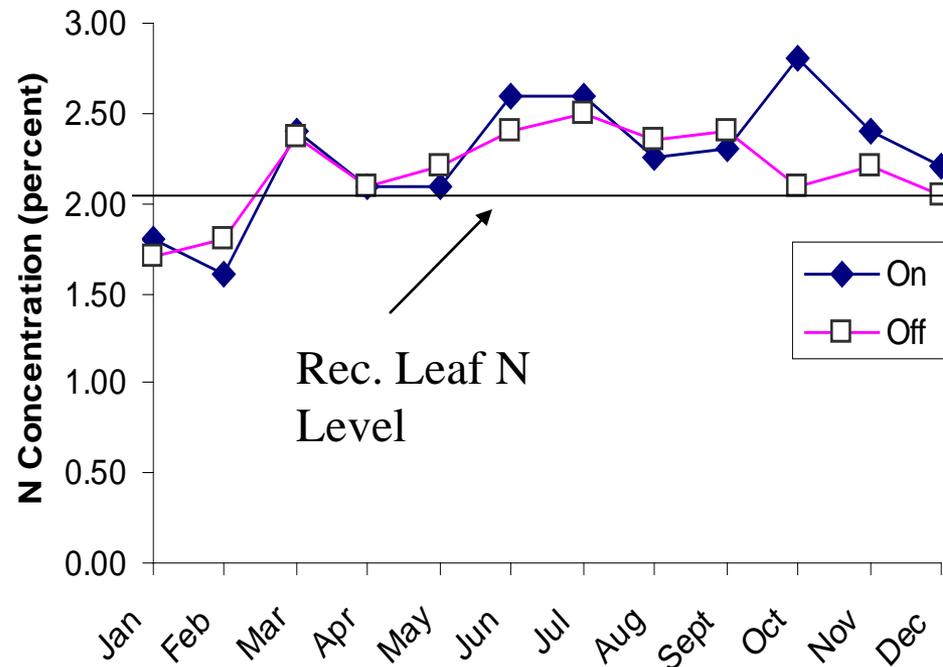


Source: David Lobell of Lawrence Livermore Laboratory

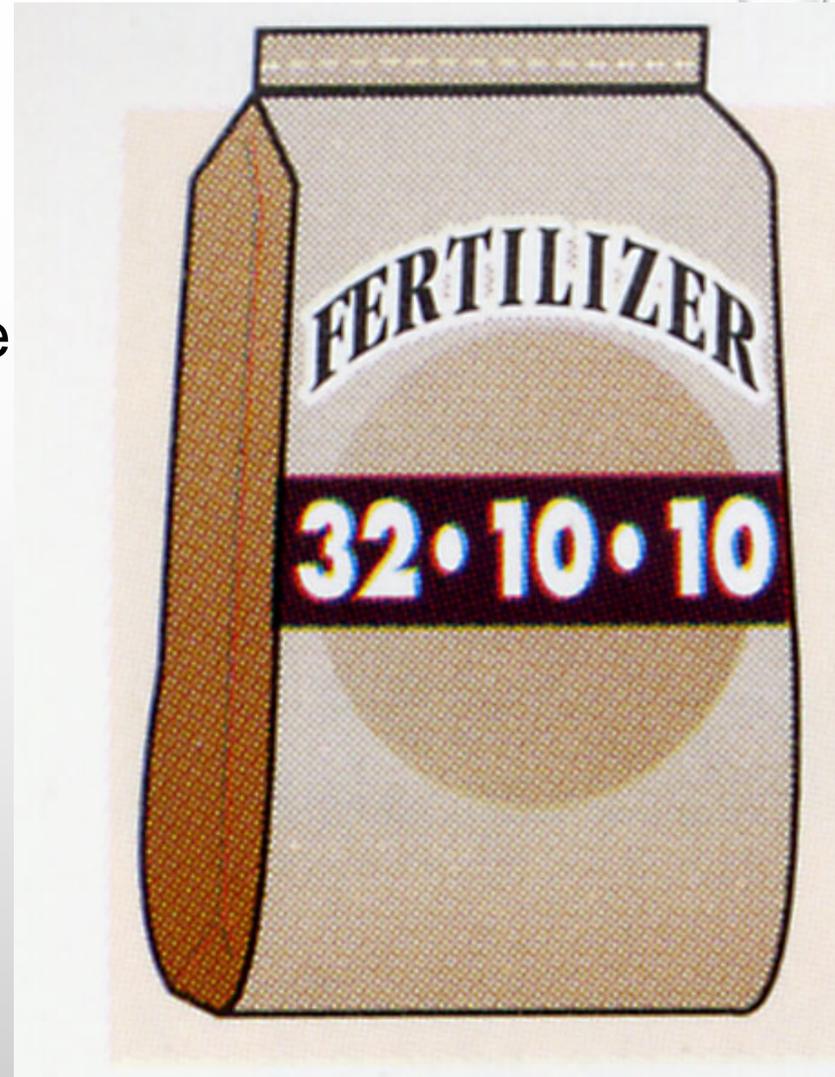
TIMES

PROBLEM

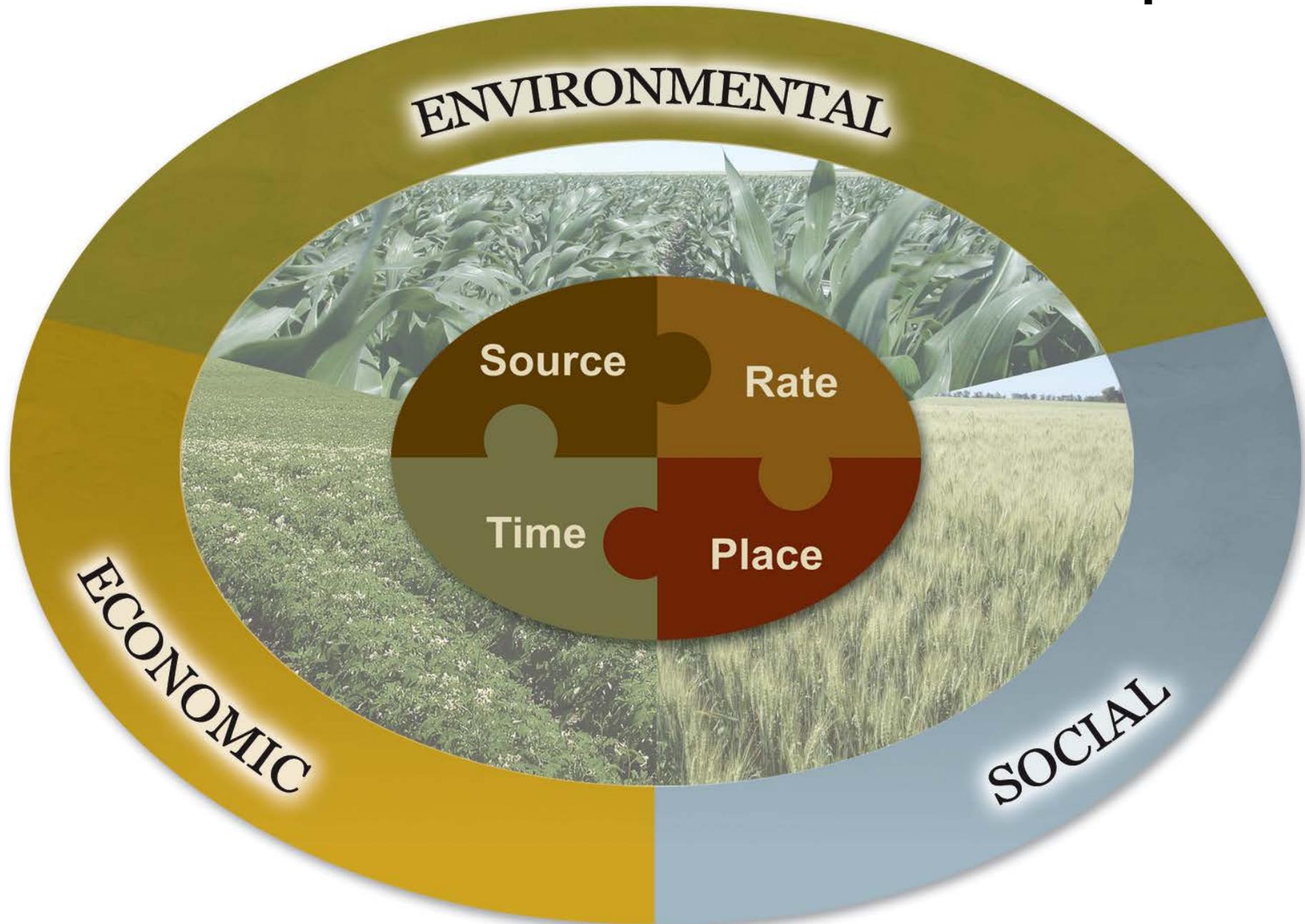
- Common practice apply N (~125 to 200 lbs/a) into small applications between late January to early November.
- Little effort placed on coordinating N application with phenology of tree
- Leaf N values of little use



“Nitrogen is applied routinely in quantities much greater than those required for the growth of the avocado” (Lahav, 1995)



4 Rs of Nutrient Stewardship



FERTILIZER DECISIONS

WHAT?



HOW
MUCH?

HOW?

WHY?

WHAT
TIME?

WHEN?

WHERE?

Managing nutrients by managing for spatial and temporal variability is critical to efficiency

Almond Nitrogen Model

Field Name:
 Address:

***** Yield History And Crop Load *****

Please type in your almond yields for the past 3 years below

Last year's yield: lb/acre Year: ▼
 2 years ago yield: lb/acre Crop load: ▼
 3 years ago yield: lb/acre

lb/acre

Override "Estimate Yield" (if you want to use other yield to estimate the fertilizer requirement, please enter new yield in box about and check mark override)

*** Fertilizer Application ***

Fertilizer application method: ▼

***** Available N from Field *****

Soil type of Orchard: ▼
 Acre feet of well water applied per year: feet/acre
 Water Nitrate -N (NO₃-N) concentration* ppm (mg/liter)
*if you don't know your water NO₃-N level enter 0
 Last July leaf total N level ** % of dry weight
** if you don't know leaf N level enter 2.3

***** Organic N *****

Manure: Last year: ▼ tons/acre
 Two year prior: ▼ tons/acre

Compost: Amount (tons/acre)
 % N in compost ▼

Legume cover crop: ▼ ▼

***** Potassium Application *****

Potassium fertilizer type: ▼
 Last July leaf total K level** % of dry weight
**if you don't know leaf K level enter 2.5

Please allow pop up on browser. IE 10 users may need to enable compatibility mode.

***** Almond N K Model Result *****

2010 projected yield: **2644 lb/ac**

Total Fertilizer Nitrogen Required (lb/ac)

Months Fertilizer Should Be Applied

Application method	Mar-April	May-June	June-July	Total Nitrogen
Fertigation via low volume irrigation	40	54	40	134

Note: This Table provides an estimate of Fertilizer Nitrogen Demand, this is not equivalent to the quantity of actual fertilizer demand. To convert these recommendations to lbs of fertilizer required use the following formula: Lbs of N Fertilizer required = Fertilizer N demand (from Table) multiplied by (100/%N concentration in the fertilizer.)

The application method in red is the selected method

Nitrogen Balance

Tree N Demand -----	180 lb/ac
External N Supply and Adjustments -----	84 lb/ac
Leaf Tissue Adjustment -----	50 lb/ac
Irrigation Water -----	34 lb/ac
Soil -----	0 lb/ac
Manure -----	0 lb/ac
Compost -----	0 lb/ac
Cover crop -----	0 lb/ac
Adjusted Orchard N Demand -----	96 lb/ac
(Tree Demand Less External N Supply)	

K recommendation

Potassium requirement is 207 lb/ac

Potassium Chloride (Muriate) requirement is 340 lb/ac

NutMan: Decision Support Using Predicted Yields, Real-time Field Data, Automated Analyses, and Information Delivered to

Growers

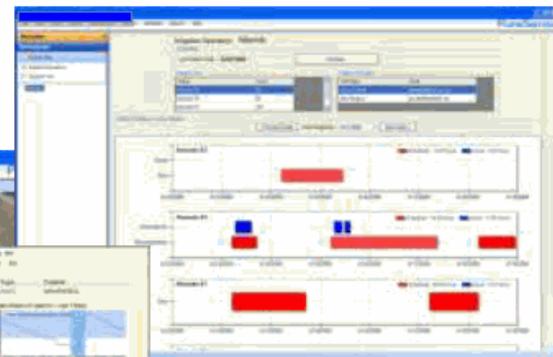
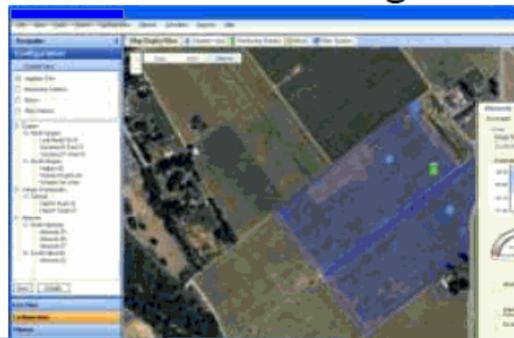
Models and Prediction

Automated Monitoring



Real-time Field Monitoring Stations Deliver Data Wirelessly So Growers Know Field Conditions On Demand

Remote Sensing



Growers can Use their Office or Field Computers, Even Their Phones, to Access their Information

Remote Sensing



Provide Block Specific Decision Support in Easy to Use Format.



CROPMANAGE

Help and User Instructions for Irrigation and N management tool

© Rectangular Strip



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CropManage Overview: A web application for managing water and nitrogen fertilizer in lettuce

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Author: Michael D Cahn

October 15, 2012

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- 2013 Irrigation and Nutrient Meeting
- CropManage privacy policy: how we keep your data private and secure
- CropManage Overview: A web application for managing water and nitrogen fertilizer in lettuce

Cool season vegetable production requires significant inputs of water and nitrogen (N) fertilizer to maximize yield and quality. Proposed changes in water quality regulations on the Central Coast and higher fertilizer prices in recent years have prompted grower interest in increasing efficiency of nitrogen fertilizer use in lettuce. By improving water management and matching nitrogen applications to the uptake pattern of the crop, growers could potentially reduce fertilizer use and

Archives



OPTIMIZING FERTILIZATION OF AVOCADO TREES

ENSURING NUTRIENTS ARE PRESENT IN AN AVAILABLE FORM AT THE APPROPRIATE TIME, AND IN THE CORRECT AMOUNT.

- DETERMINE TREE NUTRIENT DEMAND.
 - GROWTH AND CROPPING
- REPLACE WHAT IS REMOVED BY THE CROP.
- TIME APPLICATIONS TO MATCH UPTAKE.
- CONSIDER ALL INPUTS.

RESULT: ECONOMICAL AND ENVIRONMENTALLY SENSIBLE FERTILIZATION.

NITROGEN FERTILIZATION

1. HOW MUCH ?

NUTRIENT BUDGETS

2. WHEN ?

^{15}N STUDIES



NUTRIENT BUDGET APPROACH

REPLACE NUTRIENTS REMOVED FROM ORCHARD IN THE CROP

- DETERMINE TOTAL ANNUAL NUTRIENT DEMAND (YIELD, GROWTH, STORAGE)
 - HOW ALTERNATE BEARING INFLUENCE DEMAND?
- DETERMINE PATTERNS OF DEMAND
 - WHEN DOES DEMAND OCCUR & WHEN ARE NUTRIENTS AVAILABLE IN THE SOIL?



N Removal

Crop	N Removed (lbs/ac)
Almond	140
Pistachio	130
Avocado	50
Apple	30
Pine	7

AVOCADO N REMOVAL (LB/A) FOR 11,000 LBS FRESH FRUIT

<u>COUNTRY</u>	<u>N REMOVAL IN FRUIT</u>
CALIFORNIA *	50
AUSTRALIA *	43
ISRAEL	12
VENEZUELA	28
CUBA	61

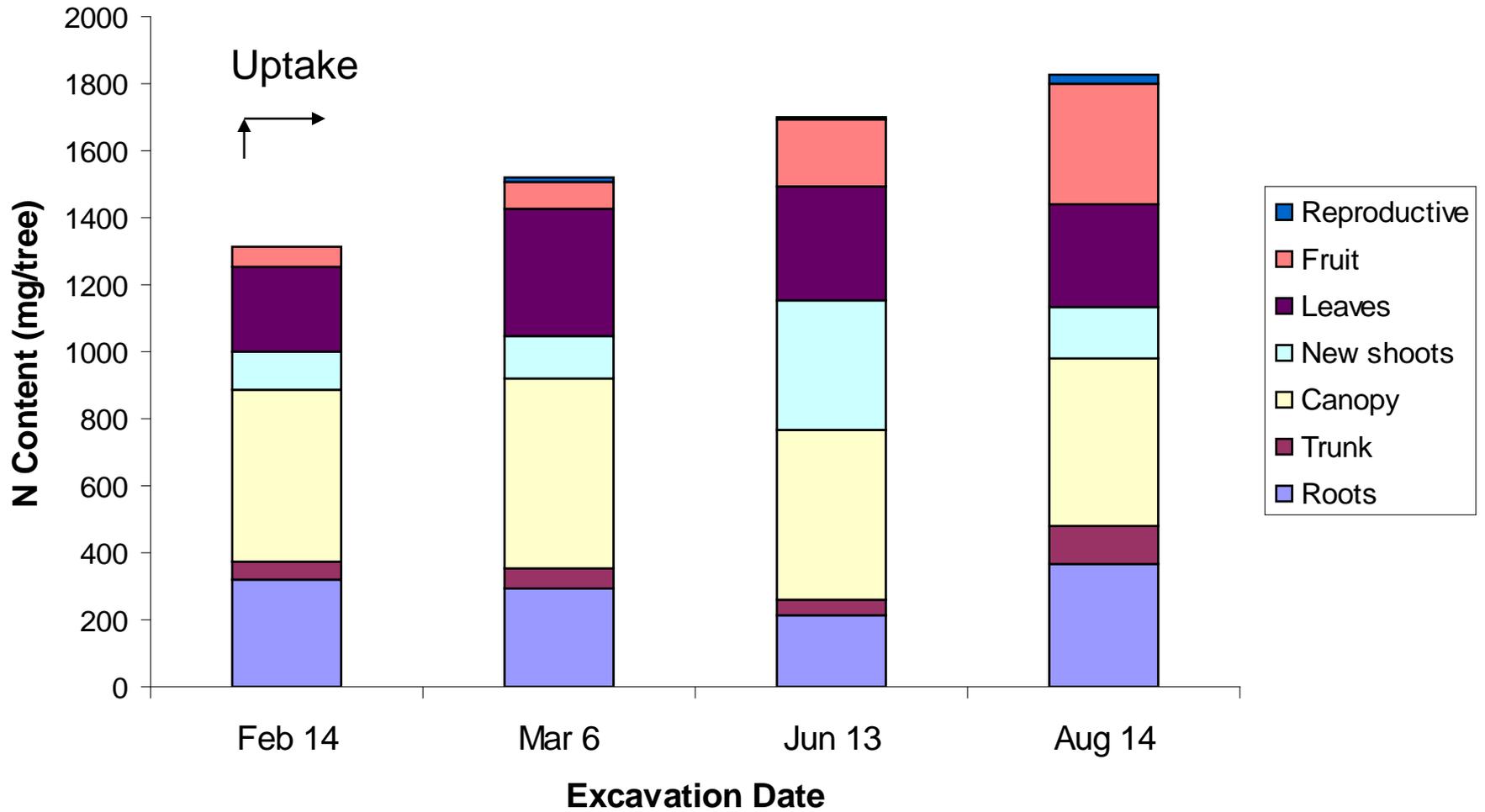
* HASS VARIETY

DETERMINING TREE NUTRIENT DEMAND

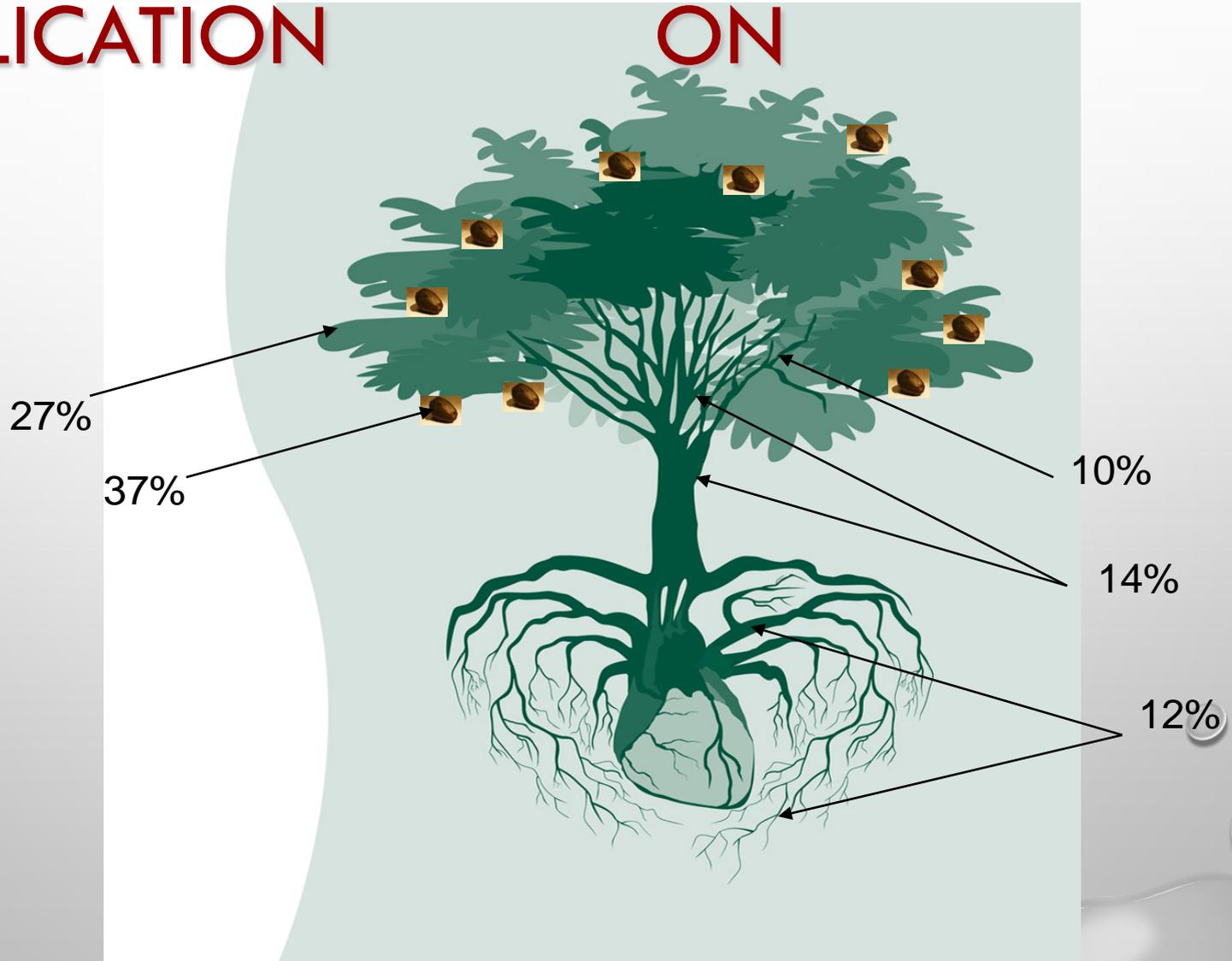
- EXPERIMENTAL METHODS
 - SEQUENTIAL TREE HARVEST,
PARTITIONING AND NUTRIENT
ANALYSIS
 - ^{15}N LABELING



WHOLE TREE N CONTENTS BY ORGAN IN AVOCADO



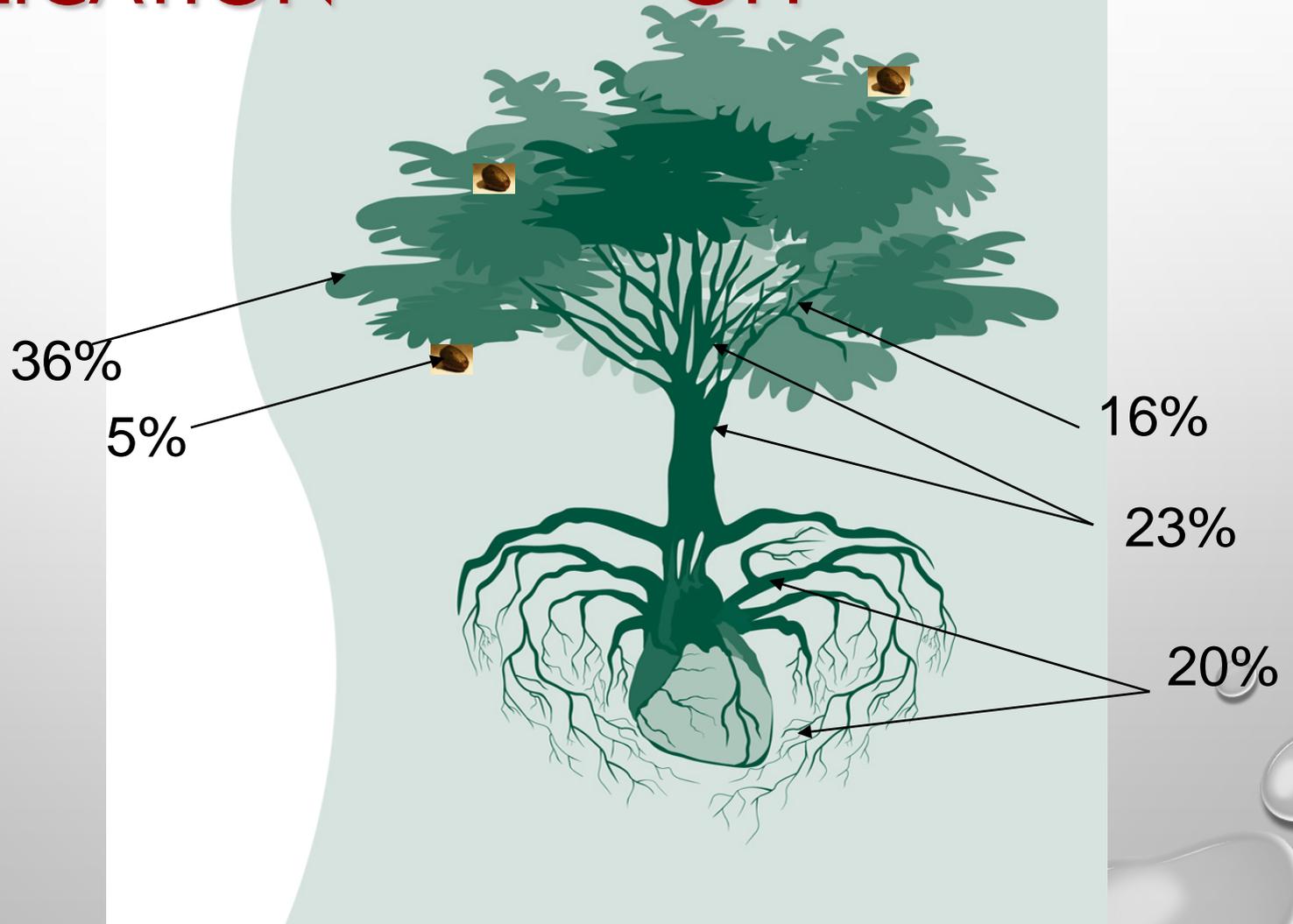
^{15}N DISTRIBUTION FOLLOWING AUG. APPLICATION



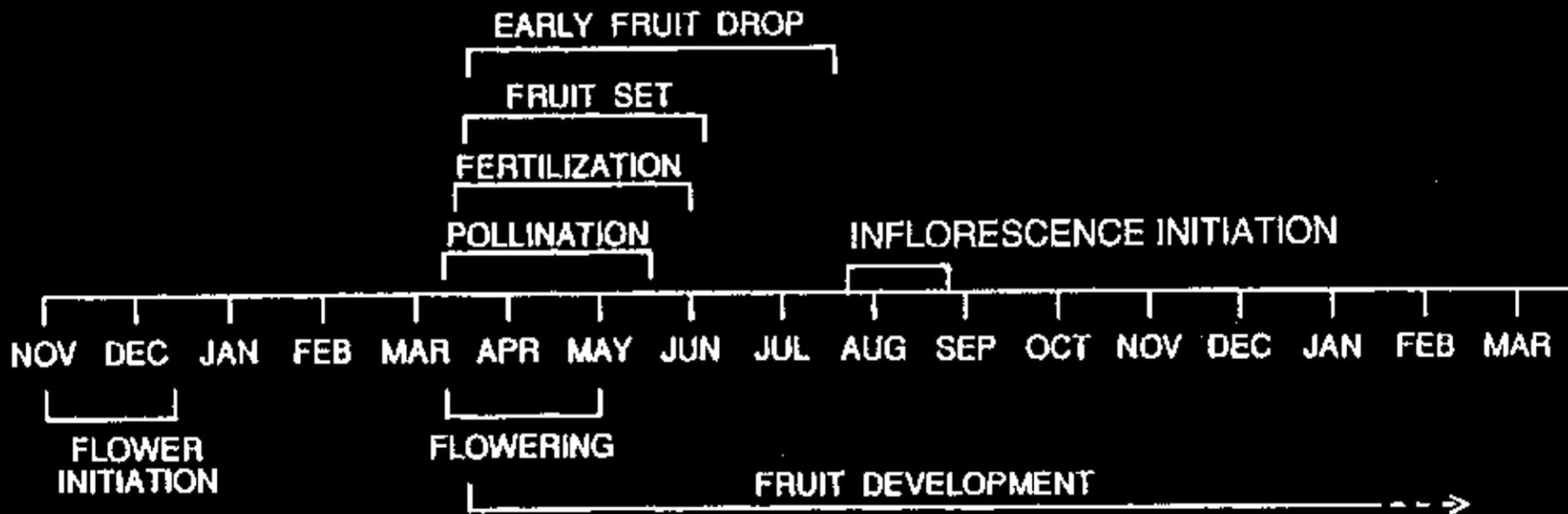
^{15}N DISTRIBUTION FOLLOWING AUG.

APPLICATION

OFF



PHENOLOGY OF THE 'HASS' AVOCADO IN CALIFORNIA



HOW IS N FERTILIZER RATE DETERMINED?

FERTILIZER N =

- N REMOVAL IN THE MATURE CROP + YOUNG CROP – SOIL MINERALIZATION – PLANT RESIDUE N

2 CROPS ON THE TREE



Flowering – winter spring

Fruit Maturing – winter spring



MODEL INPUT

Avocado Nitrogen And Potassium Model

Field Name: Crop Year:

Area: Full Bloom Date:

*** Crops Information ***

Estimate 2014 Yield : lb/acre
2013 Crop still on trees: at 2014 Full Bloom
Estimate 2013 Yield : lb/acre
2013 Crop Harvest : 2014

*** Orchard Information ***

Orchard Tree Age* :
Distance between trees : ft
Distance between rows : ft
Canopy diameter : ft

*** Fertilizer Application ***

Soil type of Orchard :
Fertilizer application method :

*** Available N from Field ***

Acre feet of well water applied per year feet/acre. ** 3.6 feet/acre recommended for SouthCoast area 7 years old orchard.

** 0 % over recommended water usage. **Low** leaching risk. Get water usage recommendations

Water Nitrate - Nitrogen (NO₃-N) concentration* ppm (mg/liter).

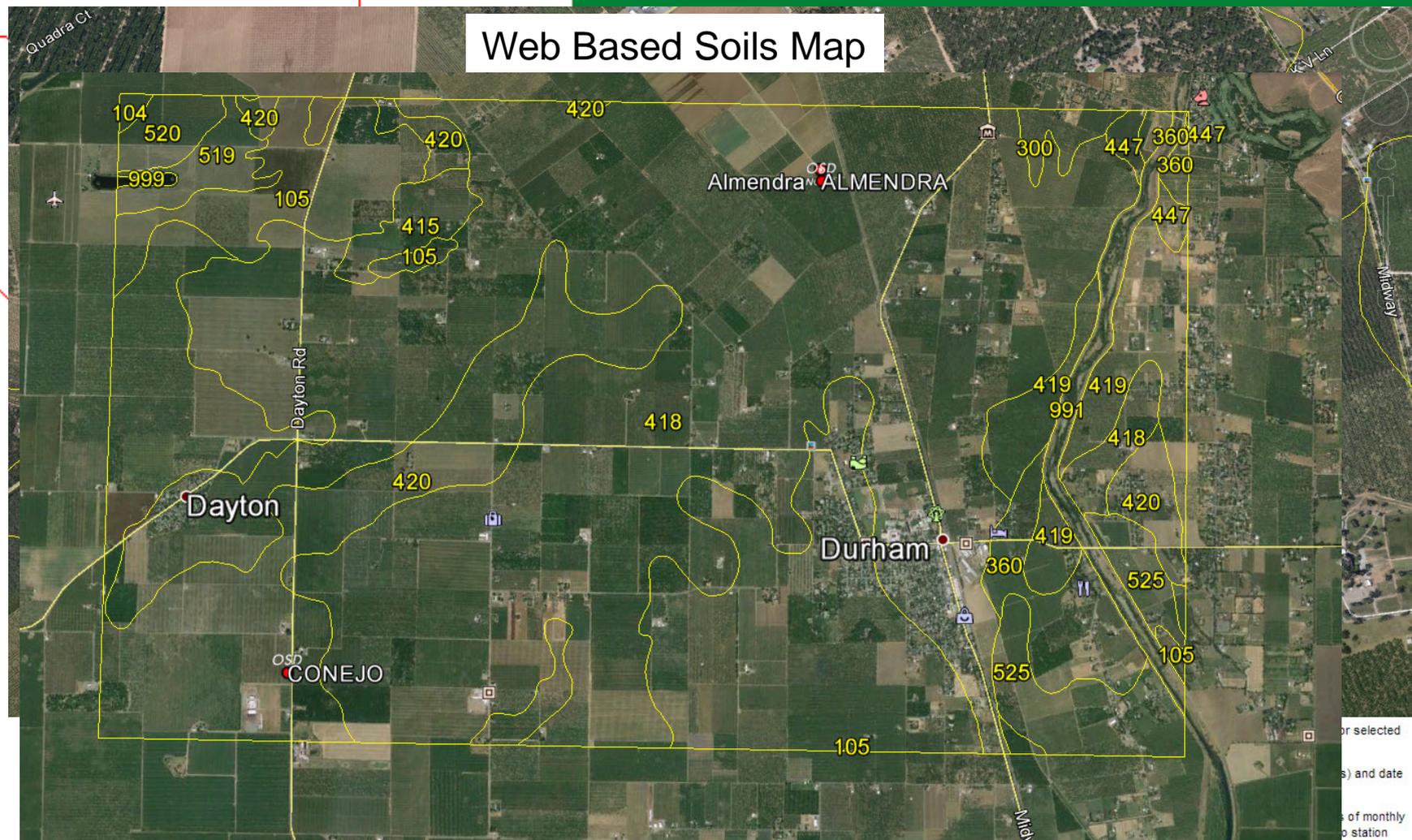
**If you don't know your water NO₃-N level enter 0. To convert nitrate concentration to nitrate nitrogen concentration multiple by 0.23.

Last Sept. leaf total N level ** % of dry weight. **If you don't know leaf N level enter 2.2

CA WEATHER STATIONS

California Irrigation Management Information System

Web Based Soils Map



depending on how long the station has been active.

INTERFACE WITH WATERIGHT

Welcome to Wateright



Seasonal Irrigation Scheduling Programs

Point to your state to continue...



- Home
- References
- Research Publications
- FAQs
- Advisories
- Related Web Sites
- Site Map

News & Events

- Water Sources: Wells & Surface Water
- Irrigation System Spring Cleaning and Maintenance
- Wateright - Web Based Irrigation Scheduling
- Irrigation Water: Monitoring Tools to Make the Most Out of Every Drop

[All Events & News](#)

Center for Irrigation Technology,

California State University, Fresno
5370 North Chestnut Ave. - MS/OF 18
Fresno, CA. 93740-8021

HOW MUCH WATER TO APPLY?

Welcome to Wateright



About Us



Tutorial



Scheduling



Advisories

About Wateright

References

Research Publication

Pumping efficiency rebate and education program

IMPORTANT!

- Please refer to the notes at the bottom of this page for information on how the schedule was calculated.
- Users ABSOLUTELY need to verify the plant health and soil moisture in their fields.
- This is an AVERAGE SEASONAL schedule and should be used as INITIAL GUIDANCE ONLY.

The Irrigation Schedule starts just below the Field Data Summary.

Field Data Summary



CIMIS Stn:	San Luis Obispo #52 City of San Luis Obispo in San Luis Obispo County
Field Number	1
Description	
Crop	Avocado
Crop Season	3/1 - 10/31
Stop Irrigating	12/31
Soil	Loamy Sand
Maximum RootZone (ft)	4
Irrigation System	Microsprinkler
Irrigation Efficiency	85%
Gross Application Rate (in/hr)	0.107
Scheduling Basis	Max. Allowed Depletion
Management Allowed Depletion	50%
Allowed Depletion at Max. RtZn (in)	2.10
Runtime at Maximum RtZn (hh:mm)	23:06

Seasonal Irrigation Schedule

For Week Ending	Average Year		This Year		Kc	Averages for Week			Change This Yr vs Avg Yr	Total ETc to Date
	ETo	Rain	ETo	Rain		ETc	Root Zone	RunTime		
	In/Day	In/Wk	In/Day	In/Wk		In/Dy	Ft	HH:mm	%	In
6/14/2014	0.19	0.00	0.21	0.00	0.69	0.13	4.00	9:52	10	10.07
6/21/2014	0.19	0.00	0.21	0.00	0.69	0.12	4.00	9:22	8	10.92
6/28/2014	0.20	0.00	0.22	0.00	0.69	0.13	4.00	9:56	13	11.82
7/5/2014	0.19	0.00	0.22	0.00	0.69	0.12	4.00	9:22	14	12.67
7/12/2014	0.19	0.00	0.21	0.00	0.69	0.12	4.00	9:36	10	13.55
7/19/2014	0.19	0.00	0.18	0.00	0.69	0.12	4.00	9:15	-4	14.39
7/26/2014	0.19	0.00	0.22	0.00	0.69	0.12	4.00	9:20	18	15.24
8/2/2014	0.19	0.00	0.20	0.00	0.69	0.12	4.00	9:16	7	16.08
8/9/2014	0.19	0.00	0.18	0.00	0.69	0.12	4.00	9:12	-3	16.91
8/16/2014	0.18	0.00	0.20	0.00	0.69	0.12	4.00	9:15	8	17.75
8/23/2014	0.18	0.00	0.17	0.00	0.69	0.11	4.00	8:41	-6	18.54
8/30/2014	0.18	0.00	0.20	0.00	0.69	0.12	4.00	9:02	13	19.37
9/6/2014	0.17	0.01	0.17	0.00	0.69	0.11	4.00	8:11	0	20.11
9/13/2014	0.16	0.01	0.17	0.00	0.69	0.11	4.00	8:14	4	20.86
9/20/2014	0.16	0.00	0.16	0.00	0.69	0.10	4.00	7:46	3	21.56
9/27/2014	0.15	0.01	0.15	0.00	0.69	0.09	4.00	6:50	3	22.18
10/4/2014	0.14	0.04	0.18	0.00	0.69	0.09	4.00	7:05	33	22.83
10/11/2014	0.13	0.32	0.15	0.00	0.69	0.08	4.00	6:20	18	23.40
10/18/2014	0.12	0.18	0.17	0.00	0.69	0.07	4.00	5:40	43	23.92
10/25/2014	0.11	0.21	N/A	N/A	0.69	0.07	4.00	5:34	N/A	24.42
11/1/2014	0.11	0.17	N/A	N/A	0.60	0.06	4.00	4:40	N/A	24.85
Total RunTime = 273:20 hh:mm = 29.23 inches Gross Applied										

The column titled "Change, This Year vs. Average Year" is the percentage difference between the actual ETo for this year versus an average year. A positive number means that this year has higher ETo

MODEL INPUT CONT

*** Organic N ***

Manure:: Last year 0 tons/acre
Two year prior 0 tons/acre

Compost: Amount(tons/acre)
 % N in compost

Legume cover crop:
Other ground cover: tons/acre

*** Potassium Application ***

Potassium fertilizer type:
Last September leaf total K level** % of dry weight **if you don't know leaf K level enter 1.0

Please allow blocked content.

This program provides recommendations only and is not intended to be used as the sole source of information for making N and K fertilization decisions. Local environmental conditions can have a profound effect on fertilizer demands. The California Avocado Commission, California State University, and the University of California are not responsible for the accuracy of this model.

Area: SouthCoast

9/8/2014

Location: North Side

2015 estimated Avocado yield: 10000 lb/ac

2014 estimated Avocado yield: 0 lb/ac

MODEL OUTPUT - NITROGEN

Nitrogen Recommendation (lb/ac)

	<u>N Requirement</u>	<u>Low Volume Fertigation</u>
March - April	4.6	6.44
May - June	5.26	7.36
July - Aug	7.01	9.81
Sep - Oct	7.72	10.81
Nov - Feb	2.2	3.08
March - Harvest 2016	8.26	11.56
<hr/>		
Total	35.04	49.06

**Not all fertilizer applied is taken up by the tree; losses occur in the orchard. A factor 1.4 was multiplied by the N requirement to account for N field losses.

Yield and N Analysis

Total N required by trees	50	lb/ac
available external N	15	lb/ac
N required from fertilizer	35	lb/ac

MODEL OUTPUT

K & OTHER NUTRIENTS

	<u>K Recommendation</u>	
Total K ₂ O required by trees	75	lb/ac
available external K ₂ O	0	lb/ac
K ₂ O required from fertilizer	75	lb/ac
Potassium Chloride (Muriate) required:	123	lb/ac

<u>Breakdown of available external K</u>		
Leaf Tissue Adjustment	0	lb/ac
Manure	0	lb/ac
Compost	0	lb/ac
**Soil	0	lb/ac

**Because of the ability of some soils to fix K, the K available in the soil was not included in the above calculation. If the soil available K is known please subtract this value from the total K₂O required by the trees.

<u>Other Nutrients Removed in the Crop</u>		
Phosphorus	12.08	lbs/acre
P ₂ O ₅	27.67	lbs/acre;
Sulfur	21.73	lbs/acre
Boron	14.78	oz/acre
Calcium	6.09	lbs/acre
Magnesium	11.72	lbs/acre
Zinc	7.23	oz/acre
Manganese	4.05	oz/acre
Iron	2.15	oz/acre
Copper	2.65	oz/acre

More Avocado Information



General Information

Contains a variety of information on avocados including type of fruit, growing conditions, as well as an "ANSWERS to QUESTIONS" section for the backyard grower.

Avocado Varieties

Want to know about various types of avocados? Want to look through a database of almost 1,000 avocado variety names? Want information on species related to avocados? This is the place.

Flowering

The avocado flower is rather unique. Learn how it is unique and its effect on pollination. Watch a flowering video.

Irrigation

Irrigation information.

Phenology

This has to do with the timing of plant growth and flowering.

Rootstocks

Rootstock information

Other Links

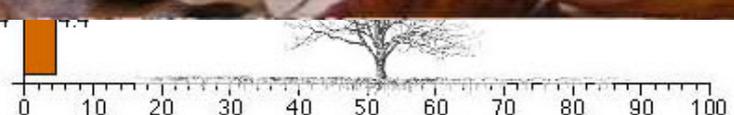
Useful links to other web sites.

MORE AVOCADO INFORMATION



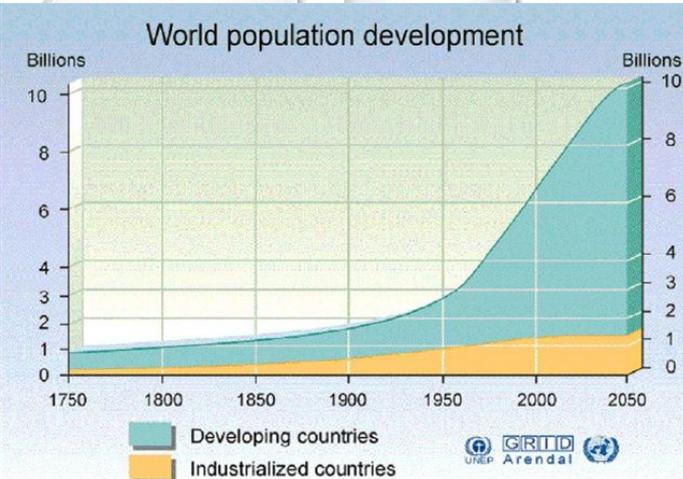
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CONCLUSIONS



- POPULATION GROWTH & CLIMATE CHANGE - MAJOR CHALLENGES FACING AGRICULTURE
- INCREASES IN WATER AND NUTRIENT USE EFFICIENCIES ARE NEEDED TO MEET DEMAND
- WEB APPLICATIONS CAN USE COMPLEX MATHEMATICAL MODELS & DATA SETS TO HELP FARMERS MAKE IMPORTANT DECISIONS
- TOOL THAT CAN ALSO BE USED BY CROP ADVISORS AND RESEARCHERS TO ASSIST GROWERS WITH FERTILIZER MANAGEMENT