2017 THE ALMOND CONFERENCE

COMMON ERRORS IN ORCHARD SET UP

Room 308-309 | December 5 2017

california almonds® Almond Board of California

growing ADVANTAGE® The Almond Conference

CEUs – New Process

Certified Crop Advisor (CCA)

- <u>Sign in and out of each session you attend.</u>
- Pickup verification sheet at conclusion of each session.
- *Repeat this process for each session, and each day you with to receive credits.*

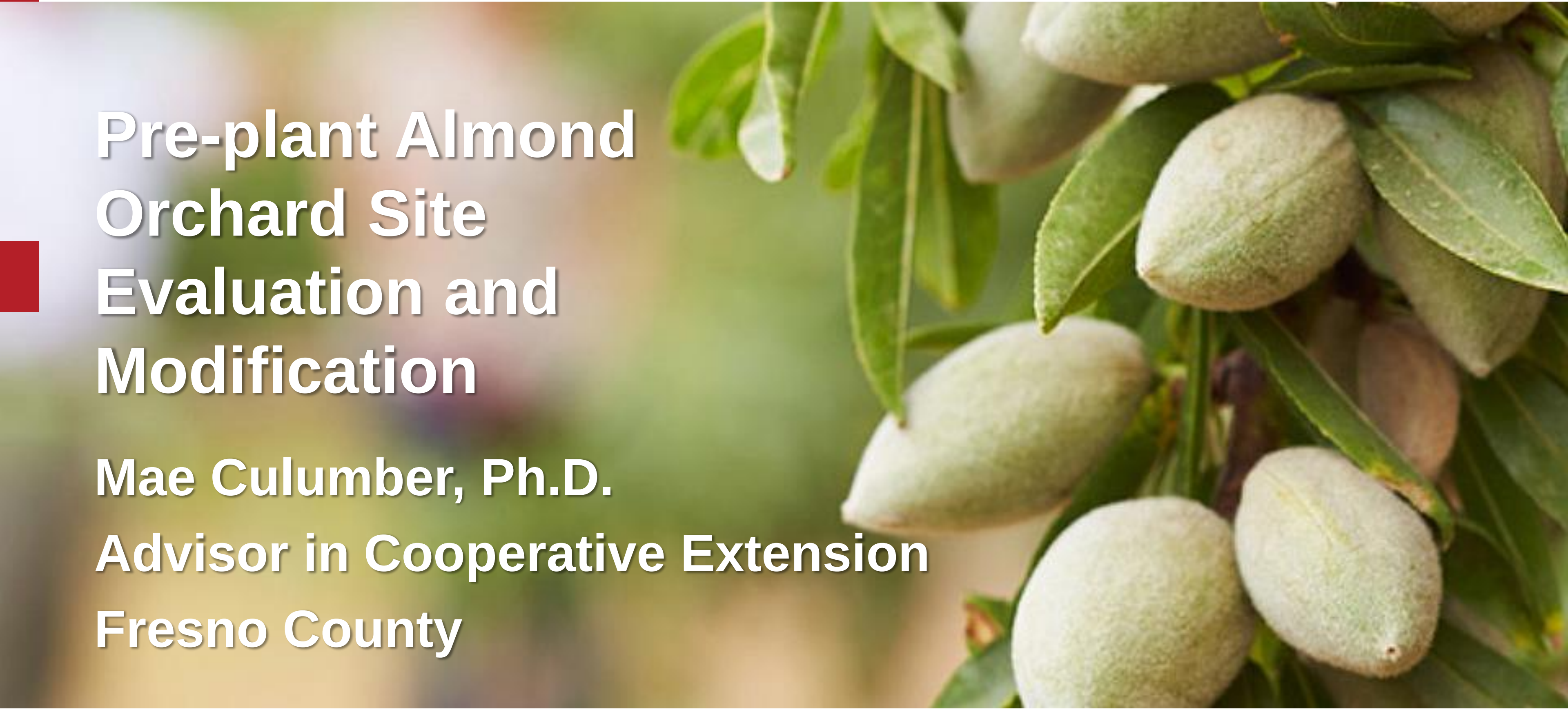
Pest Control Advisor (PCA), Qualified Applicator (QA), Private Applicator (PA)

- Pickup scantron at the start of the day at first session you attend; complete form.
- <u>Sign in and out of each session you attend.</u>
- Pickup verification sheet at conclusion of each session.
- Turn in your scantron at the end of the day at the last session you attend.

Sign in sheets and verification sheets are located at the back of each session room.

AGENDA

- **Spencer Cooper**, Almond Board of California, moderator
- **Mae Culumber**, UCCE-Merced County
- **Franklin Gaudi**, Irrigation Training & Research Center
- **Roger Duncan**, UC Cooperative Extension, Stanislaus County



Pre-plant Almond Orchard Site Evaluation and Modification

Mae Culumber, Ph.D.

Advisor in Cooperative Extension

Fresno County

Site Evaluation: Soil Surveys

- Soil type and distribution
- Drainage
- Flood potential
- Soil salinity levels (Na^+, Cl^-, and B)

UCDAVIS
CALIFORNIA SOIL RESOURCE LAB

HOME | SOILWEB APPS | PEOPLE | PROJECTS | SOFTWARE | LINKS | BLOG

HOME » SOILWEB APPS

SoilWeb Apps

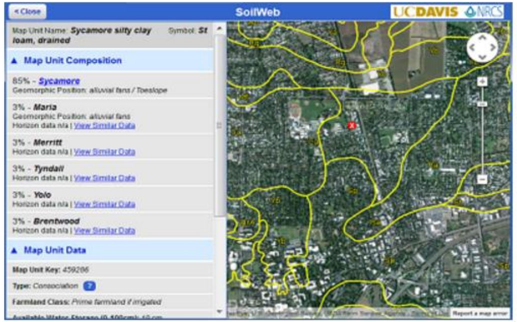
SoilWeb products can be used to access USDA-NCSS detailed soil survey data (SSURGO) for most of the United States. Please choose an interface to SoilWeb:

Soil Properties App

This app allows users to explore a variety of soil properties in map form.

SoilWeb

Explore soil survey areas using an interactive Google map. View detailed information about map units and their components. This app runs in your web browser and is compatible with desktop computers, tablets, and smartphones.

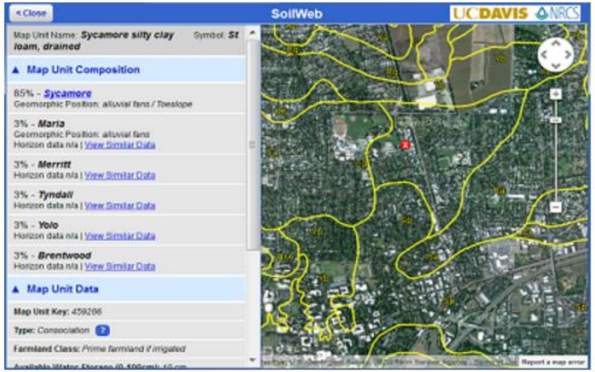


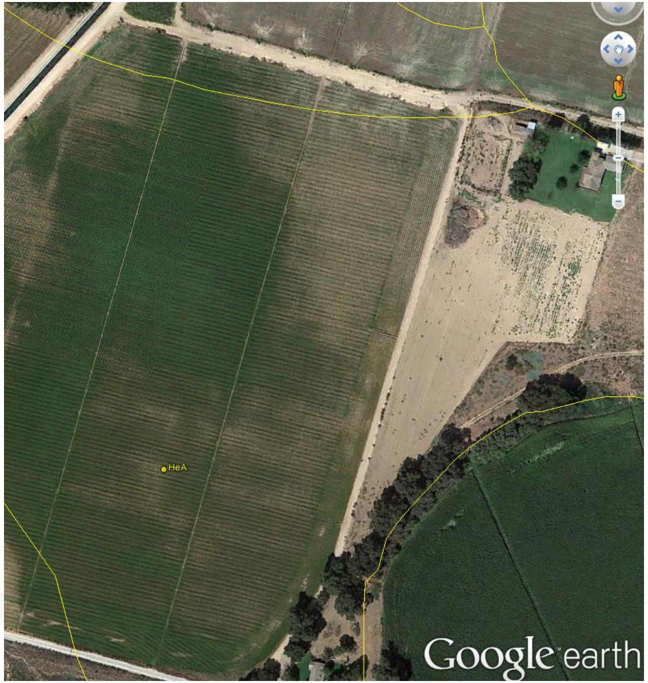
https://casoilresource.lawr.ucdavis.edu/soilweb-apps/

Site Evaluation: Soil Differences

SoilWeb

Explore soil survey areas using an interactive Google map. View detailed information about map units and their components. This app runs in your web browser and is compatible with desktop computers, tablets, and smartphones.





Soil Map: NRCS, Google Earth, etc.

Check with a Backhoe

Start with soil survey

- Dig holes (5’-6’ deep) where maps show differences
- Look for:
  - stratified and compacted layers
  - pull soil samples for analysis and nematodes

Soil Sampling

Soil Analysis

- Objective: Determine suitability for planting
- Sample equal depths down to 5 feet (12” or 18” increments)
- Within CA, labs generally analyze soil-water extract for water soluble salinity, which generally is sufficient

Plant Parasitic Nematodes

- Objective: Determine the presence of plant parasitic nematodes
- Assists in rootstock selection and fumigation requirements
- Sample the top profile of the soil, usually between 6”-12” from multiple sites

Interpreting a Soil Sample – Typical Soil Profile

Depth	pH	EC (dS/m)	Ca (meq/l)	Mg (meq/l)	Na (meq/l)	Cl (meq/l)	SAR	B (mg/l)	Sat %
0-12”	6.64	1.10	4.16	3.51	3.91	1.91	2.00	0.30	47.07
13-24”	6.74	1.11	3.99	3.51	4.27	2.09	2.21	0.45	48.68
25-36”	7.04	1.01	4.02	3.66	3.17	2.61	1.62	0.80	50.08
37-48”	6.99	1.18	5.10	4.84	2.47	3.36	1.11	0.30	53.28
49-60”	7.49	1.38	2.95	3.54	2.42	1.95	1.34	0.69	56.77
AVG	6.98	1.16					1.66	0.508	

Interpreting a Soil Sample

Electrical Conductivity (EC):

–Measure of total salts recorded in deci-Seimens per meter (dS/m)

–Ideally <1.5 for average rootzone, too high reduces growth and production due to osmotic effects

Saturation Percentage:

–Measure of soil-water content at saturation

–Helps characterize soil texture

SP%	Soil Type
<20%	Sandy Soils
20-35%	Sandy loam to loam
>35%	Silt or clay loam, clay

Soil Amendments

Soil pH

- Acidic Soils: Lime can raise pH, cheap source of calcium
- Alkaline Soils: Acid, sulfur (slow process)
- Often materials are applied heavily prior to modification to move to deeper depths

Salinity

- Reclaiming ground is challenging and requires a lot of water
- Use calcium containing products to displace Na^+
- Acidify the soil if dealing with alkaline situations

Interpreting a Soil Sample - Nematodes

	Plant Parasitic Nematodes						*Soil Ecology	
Extraction Method SF	Root Knot	Stubby Root	Dagger Xiphenema americanum	Dagger Xiph. index	Ring	Pin	BF + FF	MI
	109	5	9		1,067	85	73	0.06
	188		15	3	1,041	134	129	0.10

<u>Plant Parasitic Nematodes:</u>

- – Ring, Lesion, and Rootknot nematodes are of primary concern
- –Should be considered when determining soil fumigation needs
- –If not listed, the nematode is not found

Water Sampling

- Water should be sampled to determine suitability for almonds
  - –Well and surface water
- Water sampling should occur at various times of the year
  - –Wells should run 30 minutes prior to sampling
  - –Install an EC meter, and resubmit when salinity changes by 20%

Well Water Analysis: Interpretation

Salinity Impacts:

- EC_w > 1.5 dS/m – growth can be impacted
- SAR > 3
- Chlorides > 5 meq/L
- Boron > 0.5 ppm

Infiltration Issues:

- SAR/ EC_w < 5.0
- Ca:Mg <2.0
- Total salts
- pH: indicates if bicarbonate and carbonate ions

Soil Modification

Ripper

Soil Modification - Generalizations

	Ripping	Slip Plow	Backhoe
Strength	Shattering Hardpan	Mixing Layers	Mixing Layers
Cons	Doesn’t Mix Layers – tend to reform	Expensive to break hardpans, settling, pulls up “bad stuff”	Expensive, settling
Areas of Use	Hardpan within the first 4 feet	Extensive fine and coarse layering, heavier soils	Area of layering, compaction, lighter soils

Site Evaluation and Modification

Concluding thoughts:

- Start early
- Best money spent in evaluating sites will prevent costly mistakes
- Soil salinity can reduce yields and kill trees, only sampling will reveal levels
- Any attempts to modify deeper soils should occur prior to planting

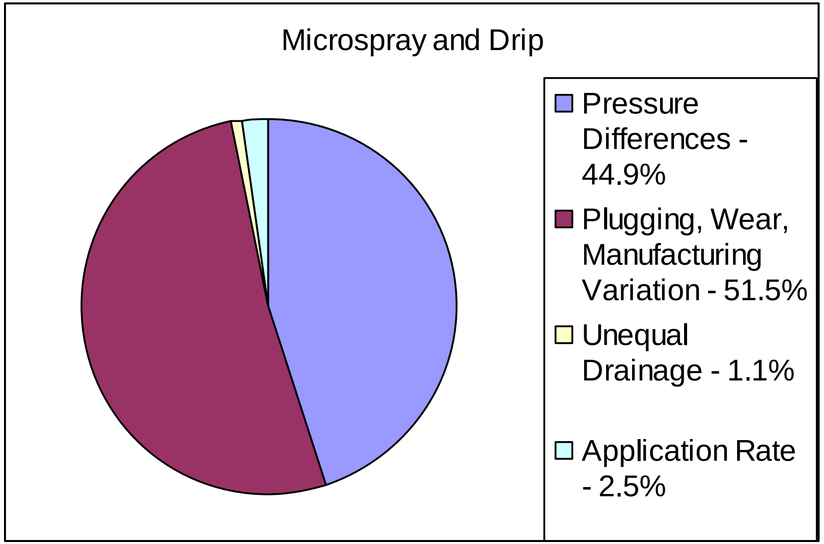
Thank you!

COMMON ERRORS IN IRRIGATION DESIGN AND CONSTRUCTION

Dr. Franklin Gaudi
Irrigation Training & Research Center (ITRC)
at Cal Poly

DRIP EVALUATIONS IDENTIFY PROBLEMS

- Student teams Evaluate fields each year
  - over 20 years worth of data
  - Major problem: Plugging and Pressure



ERROR #1 – HOSE SCREEN WASHERS AT THE HEAD OF EACH HOSE

- THEY PLUG UP AND REDUCE THE PRESSURE TO THE ENTIRE HOSE

- Solution
  - BEST TO REMOVE THEM AND REPLACE WITH REGULAR HOSE SCREEN WASHERS

ERROR #2 – LACK OF FLUSHING AT THE HOSE ENDS

- THIS PLUGS THE EMITTERS AND AFFECTS THE FLOW RATES TO THE TREES

- SOLUTION
  - BEST TO FLUSH AS OFTEN AS POSSIBLE

ERROR #3 – FERTILIZER INJECTION DOWNSTREAM OF FILTERS

- The fertilizers may bond with other nutrients in the water and precipitate out, which plugs the emitters

- Solution
  - Best to inject upstream of the filters
    - Except for strong acids and pesticides

ERROR #4 – DUAL LINE DRIP HOSES INSTALLED TO CLOSE TOGETHER

- This reduces the wetted area,

  which is the purpose of two drip lines

- Solution
  - keep the lines about 5-6 feet apart

ERROR #5 – RUN TIMES OFTEN MISS THE MARK

- IRRIGATING BLOCKS FOR 48-72 HOURS WITH DRIP CAN BE PROBLEMATIC, COMPARED TO MICRO

- SOLUTION
  - BECAUSE THE WETTED AREA IS TYPICALLY SMALLER, IT IS BEST TO ROTATE MORE FREQUENTLY BETWEEN BLOCKS WITH A SHORTER DURATION

ERROR #6 – UNDERSIZED EQUIPMENT

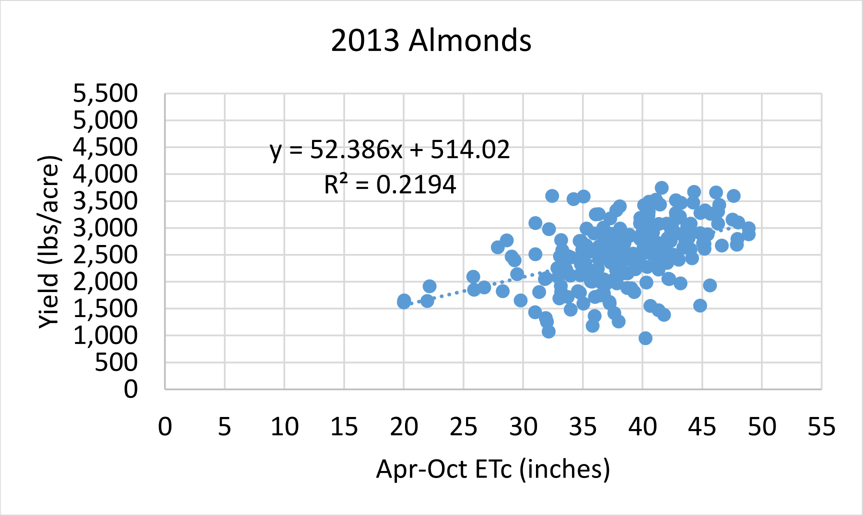
- OFTEN THE PUMPS ARE SIZED TO PROVIDE ADEQUATE FLOW AND PRESSURE, BUT ONLY WHEN NEW
- THE MAINLINES ARE GOING TO BE IN THE GROUND FOR 15-20 YEARS, SO CONSIDER THE ECONOMICS EARLY ON
- SOLUTION
  - INCREASE THE SIZE OF THE PUMP/MOTOR AND ADD A VDF
  - INCREASE PIPE SIZE

california almonds
Almond Board of California

ERROR #7 – NOT LEVELING THE PLAYING FIELD

- VARIATIONS IN NUTRIENTS AND SOIL TYPES CAN HAVE BIG IMPACTS ON YIELD

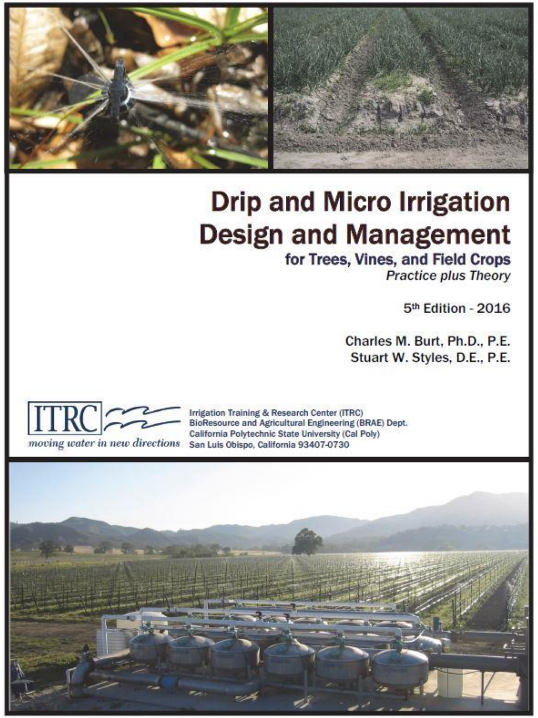
- SOLUTION
  - MAP THE SOILS AND NUTRIENTS IN THE FIELD AND DIFFERENT DEPTHS PRIOR TO PLANTING



GET A RESOURCE

- ITRC WROTE THE BOOK ON DRIP AND MICRO IRRIGATION

- GET IT AT: WWW.ITRC.ORG



Thank you!

Common Errors in Orchard Setup
- Rootstock Consideration

Roger Duncan
UC Cooperative Extension
Stanislaus County

University *of* California
Agriculture and Natural Resources

Goal: Orchard that will quickly and uniformly fill in the space and capture maximum sunlight for as long as possible

The best offense is a great defense

Think of the rootstock as your insurance policy

- Protect yourself from nonuniformity & early orchard decline

Lime induced chlorosis
on Nemaguard

Much greener trees
on Hansen P/A hybrid

Severe zinc deficiency in old corral on Nemaguard

Defoliation and tree decline from excessive chloride – Carmel on Lovell Rootstock

Chloride toxicity on Padre: Lovell Rootstock

Boron toxicity on Carmel: Lovell Rootstock

Bacterial Canker

Nemaguard

Nickels Rootstock

Hansen Rootstock

What is the best rootstock?

Rootstock choice should be site specific and based on the physical, chemical, and biological conditions in your field

There are now many commercial rootstocks from which to choose

- Peach
- Peach hybrids
- Peach x Almond hybrids
- (Peach x almond) x (Peach x almond)
- Plum
- Peach x Plum
- Almond x Plum
- Complex hybrids (peach, almond, plum, apricot)

Rootstock Influences Many Things

- Nematode tolerance
- Soil-borne disease tolerance
- Soil chemistry tolerance
- Replant disease
- Vigor
- Nutrition
- Bloom time
- Date of maturity
- Drought tolerance

Rootstock Vigor

- Peach / Almond hybrids (Hansen, Bright's, Nickels, Titan, etc.), Empyrean 1

- Interspecifics (Viking, Atlas)
- Peach (Nemaguard, Lovell)

- Plum (Marianna 26-24)

Most Vigorous

(wide spacing)

Least Vigorous

(close spacing)

Specific Challenges…

- Alkaline / salty soil or water
  - P/A hybrid (not if heavy, wet soil or if ring nematodes)
    - Hansen, Bright's 5, Cornerstone, Titan, BB106, F x A
  - Viking
  - Empyrean 1
  - Rootpac R (heavy soil, no ring nemas)

Almond Rootstock Sensitivity to Toxic Salt Ions.

Keyes, CA July, 2014

	Levels of Toxic Ions in July-Sampled Leaves			
	Nonpareil		Carmel	
	% Sodium	% Chloride	% Sodium	% Chloride
Nemaguard	**0.88** a	0.27 bc	**1.19** a	0.26 a
Guardian	**0.66** ab	0.21 cd	**0.69** bcd	0.27 a
Lovell	**0.58** bc	0.28 bc	**0.75** bc	0.25 a
Atlas	**0.57** bc	0.16 de	**0.86** b	0.22 ab
Krymsk 86	**0.55** bc	**0.32** b		
Cadaman	**0.31** cd	0.23 c	**0.47** cde	0.24 ab
Penta	0.24 d	**0.50** a		
Viking	0.21 d	0.12 ef	**0.43** de	0.18 bc
Nickels	0.18 d	0.12 ef	**0.35** ef	0.15 cd
Paramount	0.11 d	0.08 f	0.07 f	0.07 e
Empyrean 1	0.11 d	0.07 f		
Hansen	0.11 d	0.09 ef	0.10 f	0.10 de
Empyrean 101	0.10 d	0.12 ef		
Cornerstone	0.06 d	0.07 f		
Julior			**0.37** ef	0.11 de
Critical Level	**0.25**	**0.3**	**0.25**	**0.3**

Rootstock Effect on Chloride Accumulation in Leaf Tissue

Cl critical level = 0.3%

	% Cl
Krymsk 86	0.89 a*
Lovell	0.72 b
Nemaguard	0.57 c
PAC9908-02	0.45 d
Atlas	0.42 de
Cadaman	0.38 def
Empyrean 1	0.33 ef
HBOK 50	0.31 ef
Viking	0.30 f
F x A	0.19 g
BB 106	0.19 g
Brights 5	0.18 g
GF 677	0.18 g
Rootpac R	0.17 g
HM2	0.16 g
Hansen	0.15 g

*P ≤ 0.05

University of California
Agriculture and Natural Resources

Rootstock Effect on Boron Accumulation in Hull Tissue

B critical level = 300 ppm

	B (ppm)
Lovell	180 a*
Cadaman	170 ab
Atlas	158 ab
HBOK 50	158 ab
Nemaguard	153 bc
Krymsk 86	152 bc
Empyrean 1	133 cd
Rootpac R	132 cd
Hansen	126 de
GF 677	120 de
HM2	116 de
Viking	109 e
PAC9908-02	108 e
Brights 5	106 e
F x A	104 e
BB 106	102 e

*$P \leq 0.05$

University of California Agriculture and Natural Resources

Specific Challenges…

- Phytophthora
  - Marianna 26-24
  - Krymsk 86
  - Marianna 40
  - Rootpac R

Specific Challenges…

- Poor drainage / heavy soil
  - Marianna 26-24
  - Krymsk 86
  - Marianna 40?
  - Rootpac R?

Specific Challenges…

- Anchorage / high wind
  - Krymsk 86
  - Viking
  - Hansen

Specific Challenges…

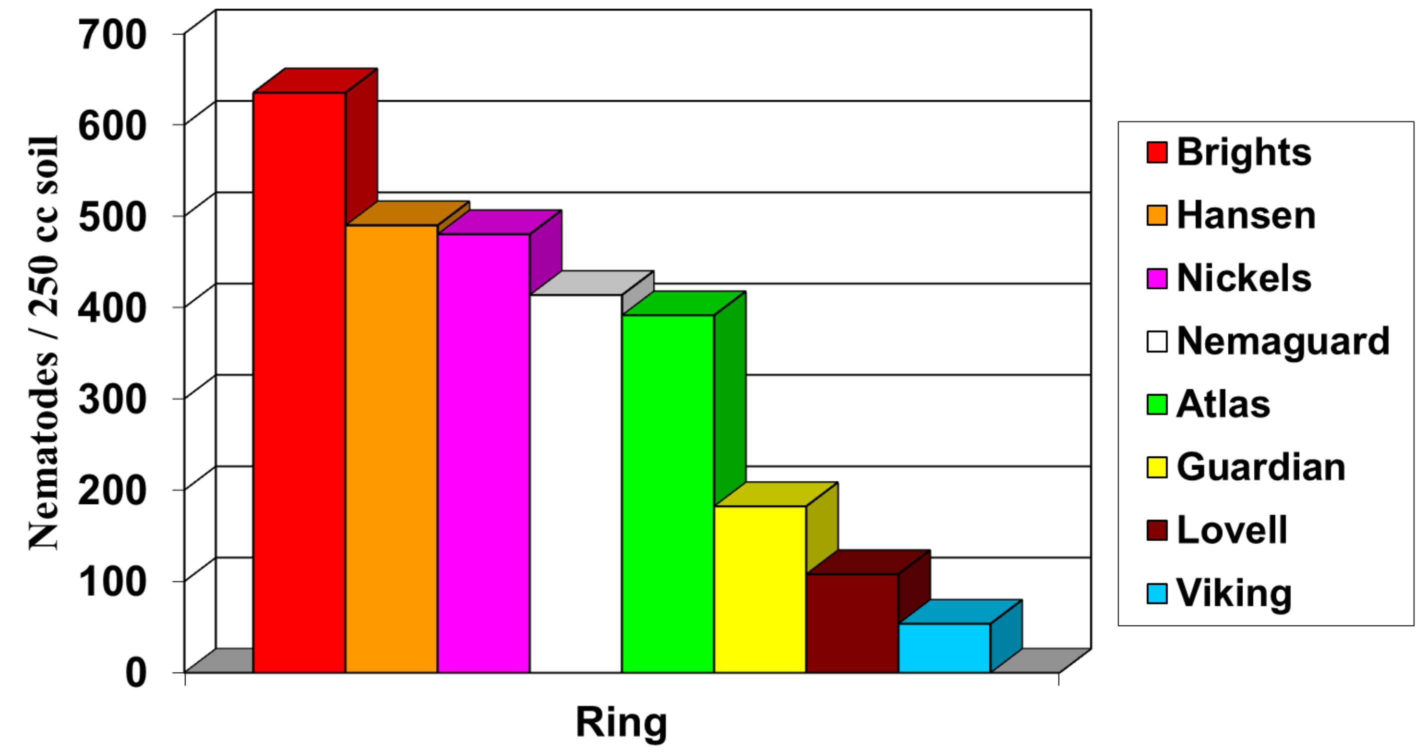
- Armillaria (Oak Root Fungus)
  - Marianna 26-24
  - Krymsk 86

Specific Challenges…

- Bacterial Canker / Ring Nematodes
  - Viking
  - Guardian
  - Lovell

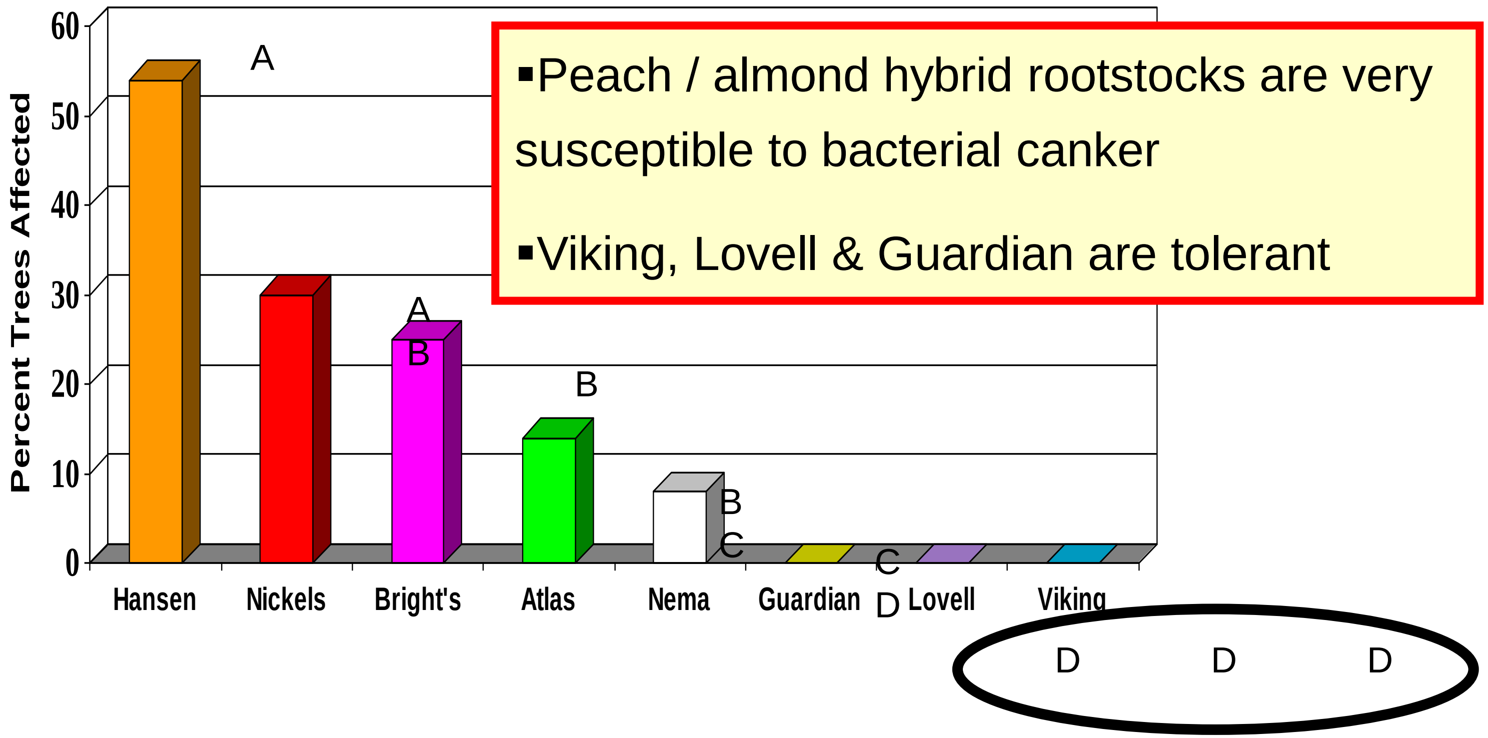
Soil Numbers of Ring Nematodes as Influenced by Almond Rootstock

Escalon, CA.



A Comparison of Almond Rootstocks for Incidence of Bacterial Canker

Escalon, CA (8th leaf)



- Peach / almond hybrid rootstocks are very susceptible to bacterial canker
- Viking, Lovell & Guardian are tolerant

Specific Challenges…

- High Water Table

  Often double whammy due to salt build up
  - Rootpac R?
  - Viking, Empyrean 1, P/A hybrid??
  - Krymsk 86 very susceptible to salt injury
  - Corn & oats??

Think about what specific challenges your ground may have and select the appropriate rootstock.

Thank you for your attention

Thank you!

What's Next

Tuesday, December 5 at 3:00 p.m.

- How to Manage a Young Orchard – Room 308-309
- Come See What's Happening in D.C.! – Room 306-307
- Research Update: Soil Health, Aerial Almond Mapping and Almond Lifecycle Assessment – Room 312-313
- Technology in the Food Safety World: Tools Such as Whole Genome Sequencing – Friend or Foe? – Room 314

Research Poster Sessions

Wednesday, December 6
3:00 p.m. – 5:00 p.m.

Featured topics:
- Irrigation, nutrient management
- Breeding
- Soils, if related to organic matter input
- Sustainability, irrigation improvement continuum, life cycle assessment, dust
- Food quality and safety

Thursday, December 7
1:30 p.m. – 2:30 p.m.

Featured topics:
- Insect and disease management
- Fumigation and alternatives
- Biomass (including biochar-related efforts)
- Pollination
- Almond Leadership Program

2017 Research Update Book

- Pickup your copy at the ABC Booth in Hall A+B
- Includes a one-page summary of every current ABC-funded research project