Replant + Disease Management

Gabriele Ludwig, Moderator

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Replant + Disease Management

Presenters:

Jim Adaskaveg, Plant Pathology, UC Riverside

David Doll, UCCE Merced County

John Leahy, EPA, Pesticide Re-evaluation Division

Cooperators:
D. Thompson,
H. Förster, T. Gradziel,
J. Connell, R. Duncan,
J. Edstrom, B. Holtz,
B. Krueger, and
R. Buchner

Epidemiology and Management of Foliar Diseases in California

J. E. Adaskaveg, University of California

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Currently Registered and New Fungicides for Almond Production in California

Development of New Fungicides for Managing Almond Diseases

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Single – fungicides- Inorganics and Conventional Synthetics

Inorganics
Copper, Sulfur
M1
1960s

Dithiocarbamates
Ziram, (Maneb)
M2
1940s

Phthalimides
Captan
M3
1950s

Isophthalonitriles
Bravo, Echo, Equus
M4
1960s

Guanidines
Syllit
M6
1960s

Benzimidazoles
Topsin-M, T-Methyl
1
1970s

Sterol inhibitors (DMIs)
Rally, Laredo, Orbit, Indar, Quash, Inspire
3
1970s – 1980s

SDHIs
Luna Privilege Xemium?
7
1960s

Anilinopyrimidines
Vangard, Scala
9
1990s

Dicarboximides
Rovral, Iprodione, Nevado
2
1980s

QoIs
Abound, Gem
11
1990s

Hydroxyanilides
Elevate
17
1990s

Polyoxins
Ph-D
19
1960s

New in 2010 and beyond:
Ph-D, Inspire, Quash, Luna Privilege (fluopyram), Xemium (fluxapyroxad)

Multi-site mode of action | Single-site mode of action | Reduced risk fungicides

Development of New Fungicides for Managing Almond Diseases

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Conventional Synthetic Fungicides – Pre-mixtures

- Pristine — 7+11 — 2000s
- Luna Sensation BAS703? — 7+11 — 2010s
- Inspire XT — 3+3 — 2010s
- Inspire Super — 3+9 — 2010s
- Adament — 3+11 — 2000s
- Quilt Xcel — 3+11 — 2010s
- Quadris Top — 3+11 — 2010s
- New

3 SBIs | 7 SDHIs | 9 Anilinopyrimidines | 11 QoIs

Natural Products

Regalia, Cerebrocide, Ph-D organic, Actinovate — 2000s

Natural products and a biocontrol that already are or potentially will be OMRI approved were evaluated for organic farming of almonds.

Management of Springtime Foliar Diseases of Almond

Blossom Blight and Shot Hole

Management of Brown Rot Blossom Blight and Shot Hole*

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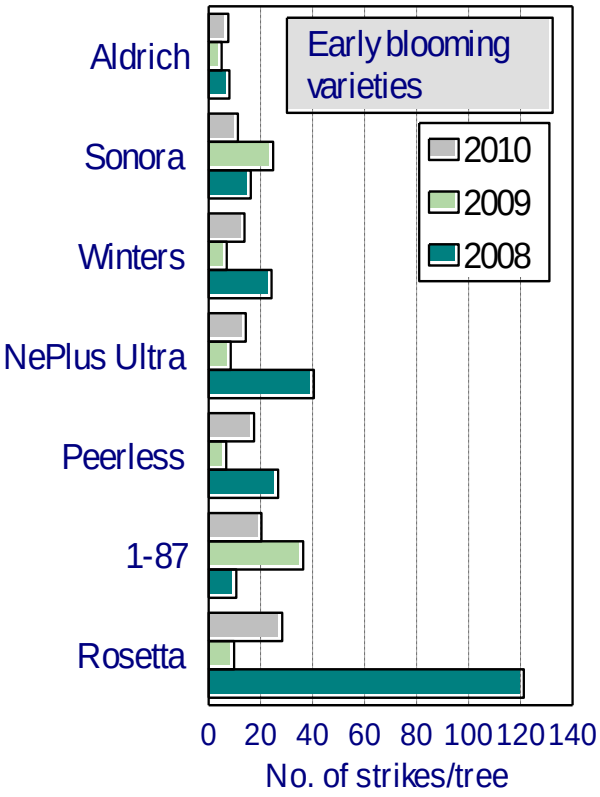
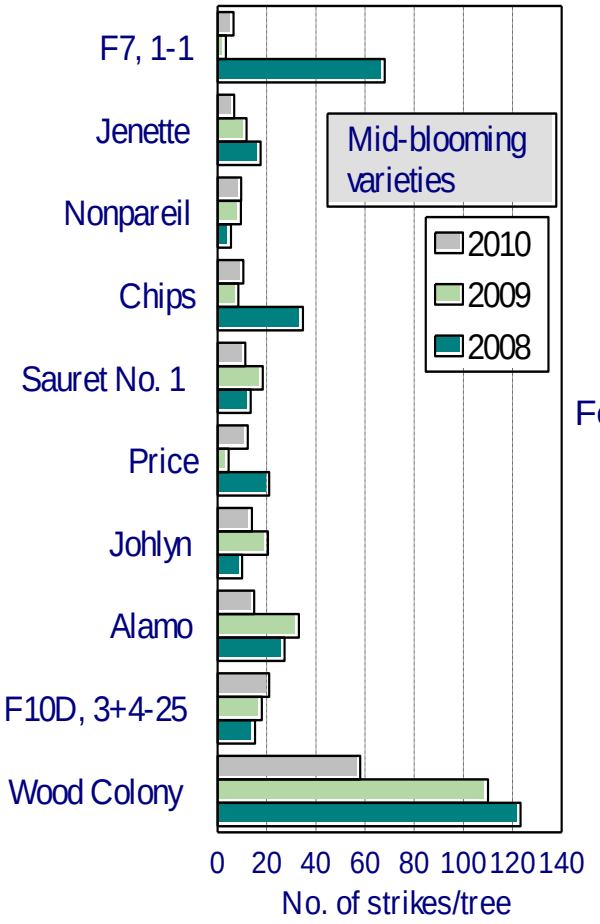
- **Most effective new fungicides:**
  - **<u>Brown rot</u>:**
    - Single Fungicides: Quash (2.5 and 3.5 equally effective)
    - Pre-mixtures: Adament, Luna Sensation, as well as Inspire Super, Inspire XT, and Quilt Xcel (when used at high label rates)
- **<u>Shot hole</u>: Bravo, Quadris Top, Quilt Xcel, Syllit, (Abound, Rovral)**
- **Natural products/biocontrols: Actinovate, Regalia, and Cerebrocide showed some activity, but were not as effective as most fungicides. Actinovate was the most consistent.**

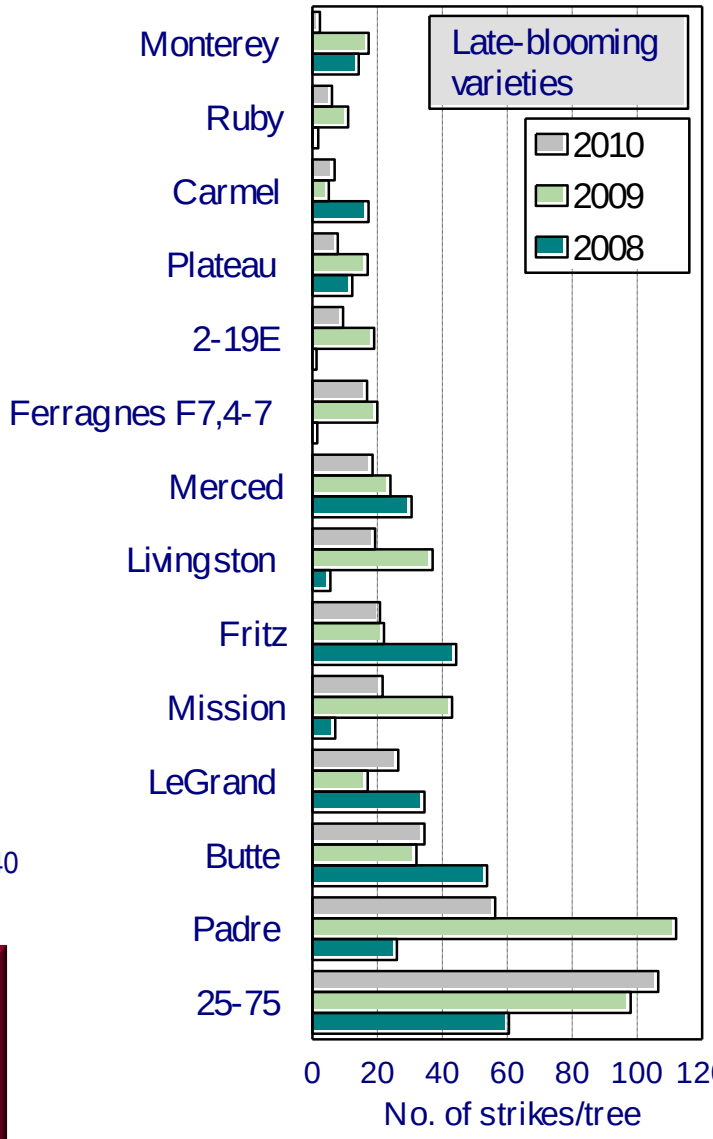
See poster for details

Natural Host Resistance Against Brown Rot Blossom Blight

Natural Host Susceptibility of Almond Cultivars Against Blossom Blight







The relative susceptibility against blossom blight was mostly consistent among almond varieties over three years.

Management of Late-spring/Summer Foliar Diseases of Almond

Rust, Scab, Alternaria Leaf Spot, Jull Rot

Management of Almond Leaf Rust

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	Treatment	4-29	5-18	6-15	
	Control	---	---	---	a
Single treatments	Ph-D 11.2DF 6.2 oz	---	@	@	b
	Tilt 3.6EC 8 fl oz	---	@	@	bcde
	Quash 50WG 3.5 oz	---	@	@	bcdef
	Inspire EC 7 fl oz	---	@	@	bcd
	Abound 2F 12.5 fl oz	---	@	@	ef
	Gem 500SC 3 fl oz	---	@	@	bc
	Bravo 96 fl oz	---	@	@	f
Pre-mixtures	Adament 50WG 6 oz	---	@	@	f
	Quadris Top 20 fl oz	---	@	@	f
	Quilt Excel 14 fl oz	---	@	@	cdef
	Pristine 38WG 14.5 oz	---	@	@	def
Rotations	Manzate Pro-Stick 76.8 oz	@	---	---	f
	Ph-D 11.2 DF 6.2 oz	---	@	---	
	Adament 50WG 6 oz	---	---	@	
	Bravo 96 fl oz	@	---	---	f
	Quilt Excel 14 oz	---	@	---	
	Quadris Top 20 oz	---	---	@	
	Ph-D 11.2DF 6.2 oz	@	---	---	bcdef
	Quash 50WG 3.5 oz	---	@	---	
	Ph-D 6.2 oz + Quash 2.5 oz	---	---	@	

0 20 40 60 80 100

Incidence (%)

cv. Carmel, Colusa Co.

*See poster for details

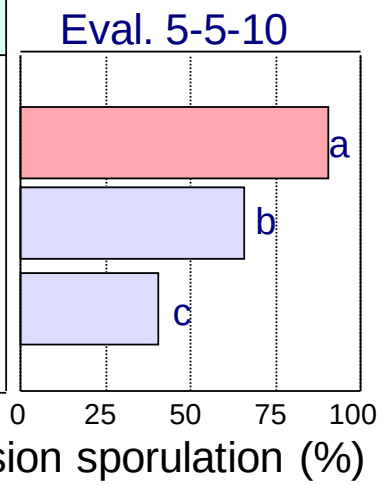
Most effective new fungicides:

- **Materials that included a QoI compound (e.g., Abound, Adament, Quadris Top, Quilt Excel, Pristine) were among the most effective fungicides**
- **The DMIs (Quash, Tilt, Inspire) and Ph-D also significantly reduced the incidence of disease**
- **Chlorothalonil (e.g., Bravo) was also highly effective, but this fungicide is currently only registered for use up to150 days of harvest (changes pending)**

Management of Scab

1. Dormant applications to reduce inoculum in the spring

2010 Treatments	Jan.
Control	---
Kocide 3000 5 lb - Cohere	@
Kocide 3000 5 lb - Oil 4 gal	@

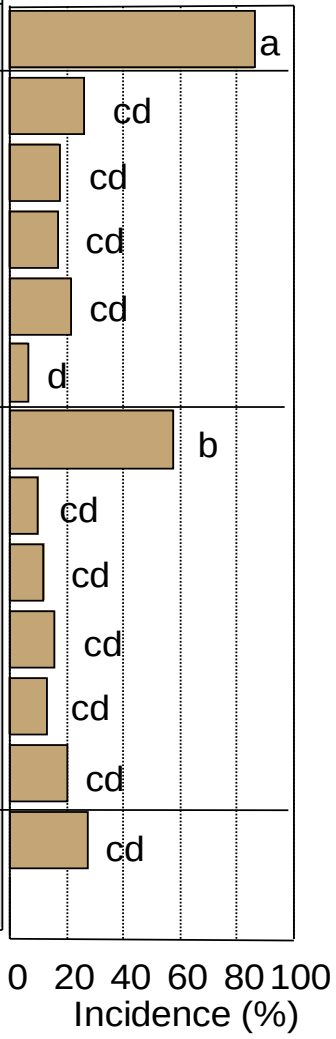


- **Dormant treatments with copper-oil are most effective in reducing primary inoculum in spring**
- **These treatments are not effective on final disease levels, but they should be included into any scab program because the risk for selection for fungicide resistance is reduced when less inoculum is exposed to in-season fungicides**

Management of Scab

2. In-season applications

	Treatment	3-wk PF	5-wk PF
	Control	---	---
Single	Syllit 4FL 2 pt	@	@
	Syllit 4FL 3 pt	@	@
	Dithane 75DF 6 lb	@	@
	Ph-D 11.2DF 6.2 oz	@	@
	Quash 50WG 3.5 oz	@	@
Pre-mix and mixes	Adament 50WG 6 oz	@	@
	Luna Sensation 500SC 5 fl oz	@	@
	Inspire Super 12 fl oz	@	@
	Quadris Top 14 fl oz	@	@
	Quilt Xcel 20 fl oz	@	@
	Ph-D 11.2DF 6.2 oz + Captan 80WP 3 lb	@	@
Rota-tion	Pristine 38WG 14.5 oz	@	---
	Indar 2F 6 fl oz + Dithane F45 192 fl oz	---	@



cv. Peerless, Butte Co.

- **Programs that start at onset of twig sporulation are more effective than those starting later in the spring**

Management of Scab

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New fungicides registered or planned for scab:

- Single-site MOA fungicides: Ph-D, Quash, Inspire, Syllit (pending)
- Pre-mixtures: Inspire Super, Quilt Xcel, Luna Sensation (pending)

Fungicide programs:

- A highly effective three-spray program should include dormant applications with copper-oil and two after-petal-fall (around twig infection sporulation) applications with chlorothalonil, possibly mancozeb (see below), captan, or ziram (all are multi-site fungicides that have a low potential of resistance development)
- Because maneb has been voluntarily canceled (2008/2009), mancozeb (e.g., Dithane) fungicides are being tested and are planned for future registrations
- Single-site fungicides should not be applied once disease is developing

Cultural practices: IPM and the Disease Triangle

Management of Alternaria Leaf Spot – Field Efficacy Trials

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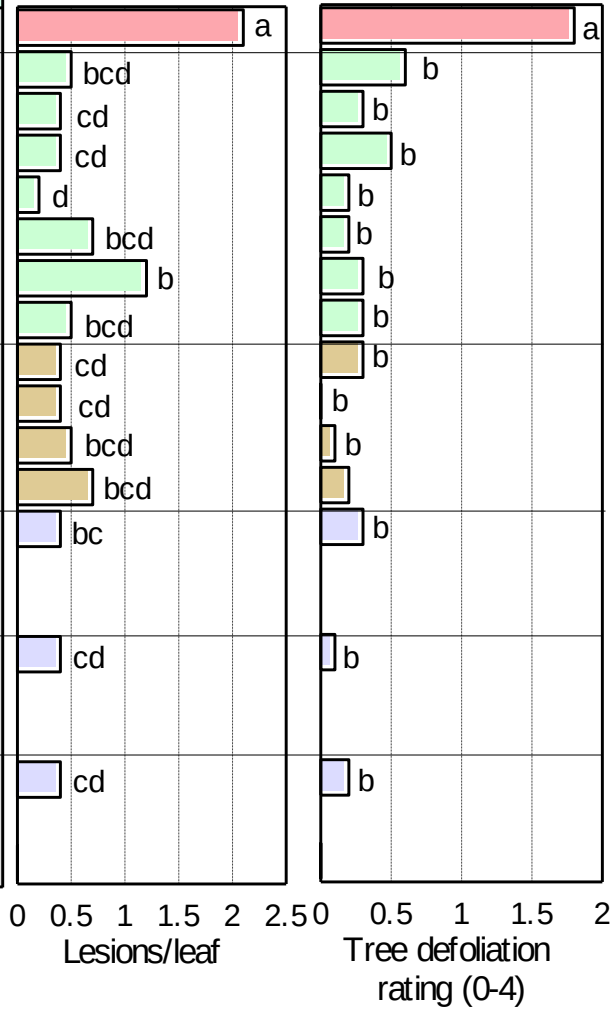
	Treatments	4-29	5-18	6-15
	Control	---	---	---
Single fungicides	Ph-D 11.2DF 6.2 oz	---	@	@
	Tilt 3.6EC 8 fl oz	---	@	@
	Quash 50WG 3.5 oz	---	@	@
	Inspire EC 7 fl oz	---	@	@
	Abound 2F 12.5 oz	---	@	@
	Gem 500SC 3 fl oz	---	@	@
	Bravo 96 fl oz	---	@	@
Pre-mixtures	Adament 50WG 6 oz	---	@	@
	Quadris Top 20 fl oz	---	@	@
	Quilt Xcel 14 fl oz	---	@	@
	Pristine 38WG 14.5 oz	---	@	@
Rotations	Manzate Pro-Stick 76.8 oz	@	---	---
	Ph-D 11.2DF 6.2 oz	---	@	---
	Adament 50WG 6 oz	---	---	@
	Bravo 96 fl oz	@	---	---
	Quilt Xcel 14 fl oz	---	@	---
	Quadris Top 20 fl oz	---	---	@
	Ph-D 11.2DF 6.2 oz	@	---	---
	Quash 50WG 3.5 oz	---	@	---
	Ph-D 6.2 oz + Quash 2.5 oz	---	---	@

cv. Carmel - Colusa Co.



Fungicide Efficacy Trials – Alternaria Leaf Spot

Tree defoliation evaluated in August

Control

Ph-D + Inspire Super

or Ph-D + Quash

Management of Alternaria Leaf Spot

Most effective treatments:

- Mixtures of the Group 19 Ph-D (polyoxin-D) and the Group 3 fungicides (i.e., Inspire, Quash)

Other new fungicides with good activity:

- Luna Sensation, Adament, Quadris Top, Quilt Excel. These all have a QoI component and thus, will exacerbate QoI resistance

Fungicide resistance:

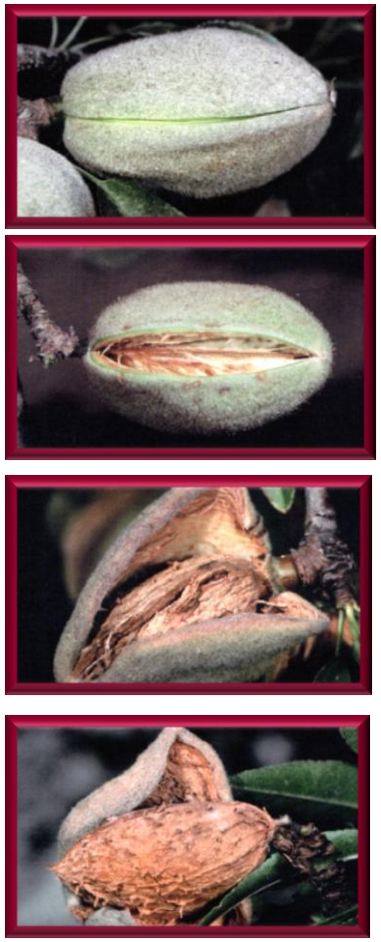
- Resistance against QoIs is common: whereas against SDHIs only at several locations at high levels
- Cross resistance within QoIs (Abound, Gem, etc.) and within SDHIs (boscalid, fluopyram, etc.)

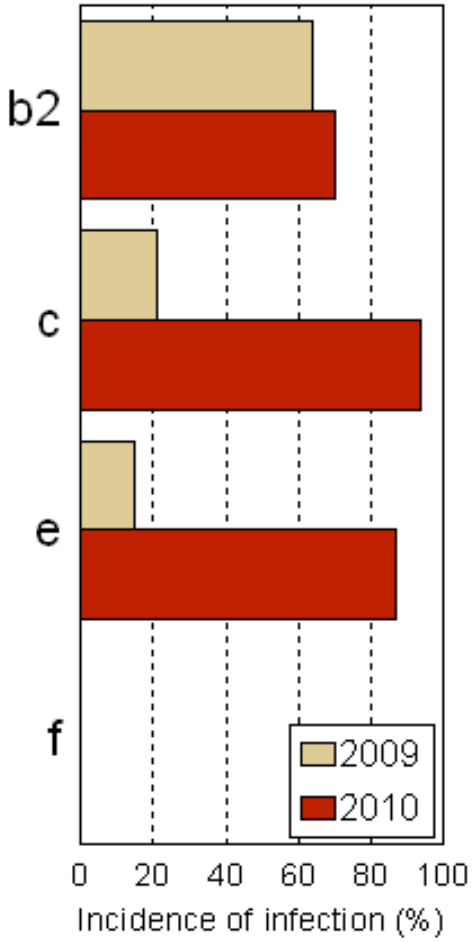
Management of Alternaria Leaf Spot

Overview:

- Programs should start with petal fall applications that include Rovral and Bravo (performance is variable and depends on the occurrence of favorable conditions). Proposed label changes with Bravo are ongoing efforts.
- Late-spring/early-summer applications (based on the DSV model) with other materials
- New materials (e.g., Quash, Inspire, Ph-D, Quadris Top, Quilt Xcel, Luna Sensation) will have to be strictly used in rotations and mixtures for resistance management
- Other components of an integrated approach in disease management are highly critical for management of Alternaria leaf spot

Management of Hull Rot - Laboratory Studies





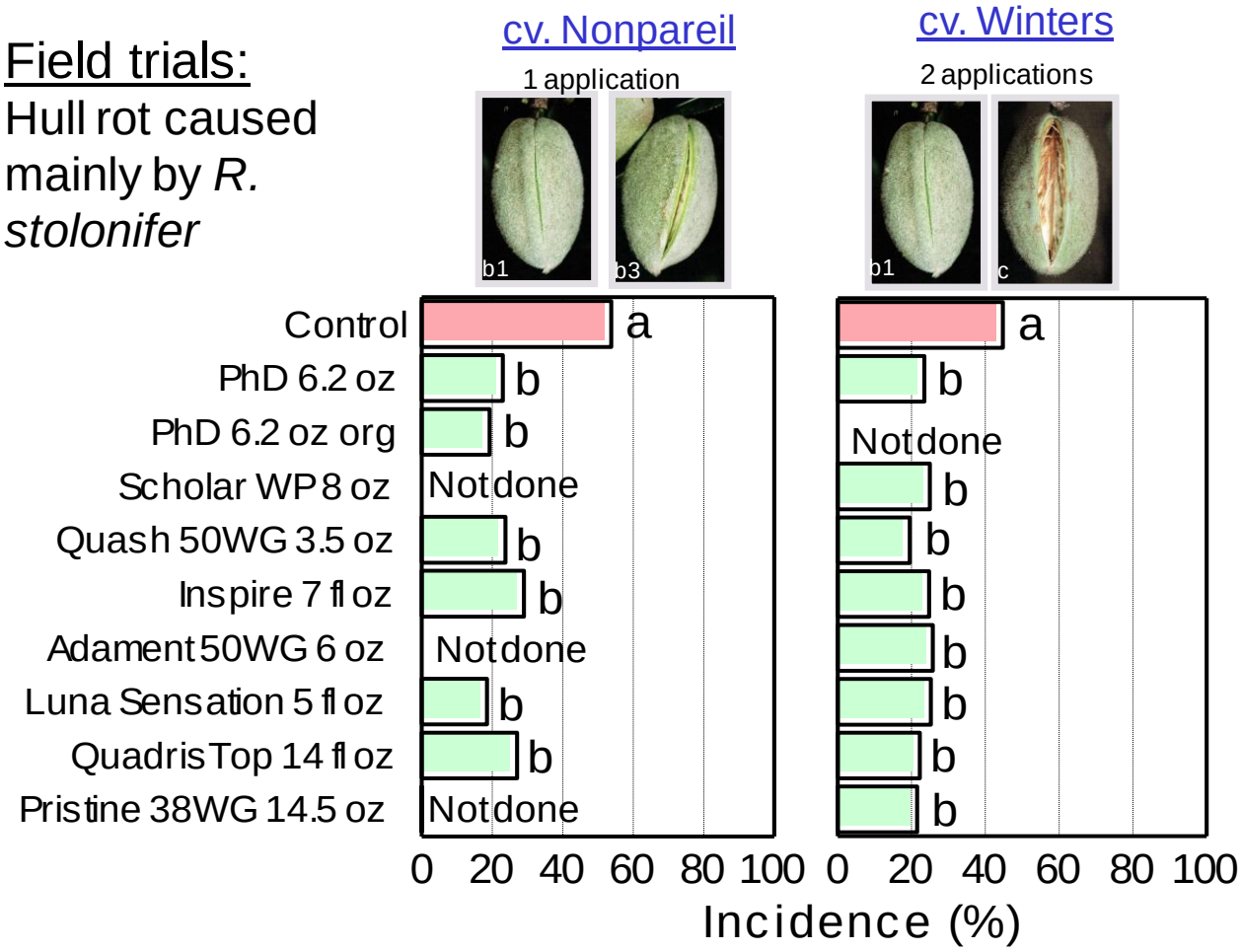
- Hull is highly susceptible to infection during early to mid split stages of nut development
- Most susceptible at hull split stages: b2 through e
- Infection likely due to conducive environments, but apparently not due to moisture content of the hull (laboratory studies)
- This information is important for the timing of fungicide applications

Hull split stages based on the UC-IPM Manual for Almonds.

Management of Hull Rot – Field Studies

Field trials:

Hull rot caused mainly by *R. stolonifer*



Application cv. Nonpareil: 8-13-10, Evaluation on 9-9-10
Applications cv. Winters: 8-31, 9-10-10, Evaluation on 10-1-10

Management of Hull Rot

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- High incidence of hull rot in 2010 due to early fall rains
- All fungicide treatments were similarly effective in reducing hull rot
- No differences in application timings, possibly because of the long hull split duration within an orchard where a similar number of nuts were in a susceptible stage at each fungicide timing
- Trials are also planned at locations where *Monilinia* spp. are the causal pathogens

Management of Hull Rot

- In 2010, PGRs were evaluated: ethephon increased rate of split (with some defoliation based on rate), gibberelin delayed hull split. Fungicide efficacy was not affected by PGR treatments
- For the most effective integrated management of hull rot, hull split should be induced simultaneously with proper water management (i.e., deficit irrigation). A fungicide could then be applied most effectively during the stages when susceptibility is high

On-line Resources on Fungicides

Statewide IPM Program
www.ipm.ucdavis.edu

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EFFICACY AND TIMING OF FUNGICIDES, BACTERICIDES, AND BIOLOGICALS FOR DECIDUOUS TREE FRUIT, NUT, STRAWBERRY, AND VINE CROPS 2011

ALMOND
APPLE AND PEAR
APRICOT
CHERRY
GRAPE
KIWIFRUIT
PEACH
PISTACHIO
PLUM
PRUNE
STRAWBERRY
WALNUT

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UC Kearney Agricultural Center
www.uckac.edu/plantpath

Statewide IPM Program
www.ipm.ucdavis.edu

Thank you

Present and Future Replant Considerations and Strategies

David Doll, UCCE Merced County

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Replant Considerations – Development of Control Strategies

Field trial locations & start dates:

Madera County, San Joaquin Valley:

- 2003, Agriland, almond after almond (sandy loam) (fr. CSREES)
- 2006, Paramount, almond after almond (sandy loam)
- 2007, Agriland, almond after almond (sandy loam)
- 2009, Poythress, almond after almond (loam)

Fresno County, San Joaquin Valley :

- 2007, USDA-ARS Parlier, peach after plum (sandy loam)
- 2007, USDA-ARS Parlier, almond after peach (sandy loam)
- 2008, Berberian, Reedley, peach after peach (sandy loam)
- 2008, KAC, Parlier, almond after peach (sandy loam)
- 2008, USDA-ARS, Parlier, peach after peach (sandy loam)
- 2010, USDA-ARS, Parlier, almond and peach rootstocks x Tel C35 fum

Colusa County, Sacramento Valley:

- 2007, almond after almond, Nickels Estate (loam)

Merced County, San Joaquin Valley :

- 2009, Frago, almond after almond (sand)
- 2010, Littlejohn, almond after almond (sand)

Replant Considerations – Development of Control Strategies

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1. Current control strategies for mitigating soilborne pathogens and nematodes upon replanting.

2. Future approaches in developing treatments for replant problems using reduced or no soil fumigants.

The Replant Problems

- **Abiotic factors** (physical, chemical conditions related to previous production)
- **Aggressive pathogens, pests** (*Phytophthora*, *Armillaria*, *Verticillium*, Ten-Lined June Beetle) –localized, not managed completely by fumigation
- **Plant-parasitic nematodes** (ring, lesion, root knot), approx. 35% of almond and fresh stone fruit acreage, 60% of cling peach acreage infested (McKenry)
- **Replant disease (RD)** Microbe-induced growth suppression; incidence nearly universal in *Prunus* after *Prunus,* but severity varies greatly

Healthy tree RD-affected tree

Symptoms of replant disease on almond

Abiotic Factors

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Learn from the old orchard!

Aerial image through Google Earth, walking the field

Determine areas of variability and address

- Soil Modification – ripping, backhoeing, slip-plowing
- Irrigation system – High volume/low volume
- Rootstocks – Determine options for salinity, boron, alkalinity, high water table, etc.

Aggressive Pathogens

- Can affect any soil type; consider history of old orchard
- Fumigation is not able to completely eradicate, but reduce population
- Fumigants that include methyl bromide
- Provide conditions that favor a thorough fumigation
- Cultural Practices and Resistant Rootstocks for Phytopthora and Armillaria– Marianna 2624, Ishtara, Krymsk-86

Plant-Parasitic Nematodes - Symptoms

Ring Nematode - Bacterial Canker Complex

Rootknot Nematode – Galls on roots

Lesion Nematode – root damage

Plant-Parasitic Nematodes - Sampling

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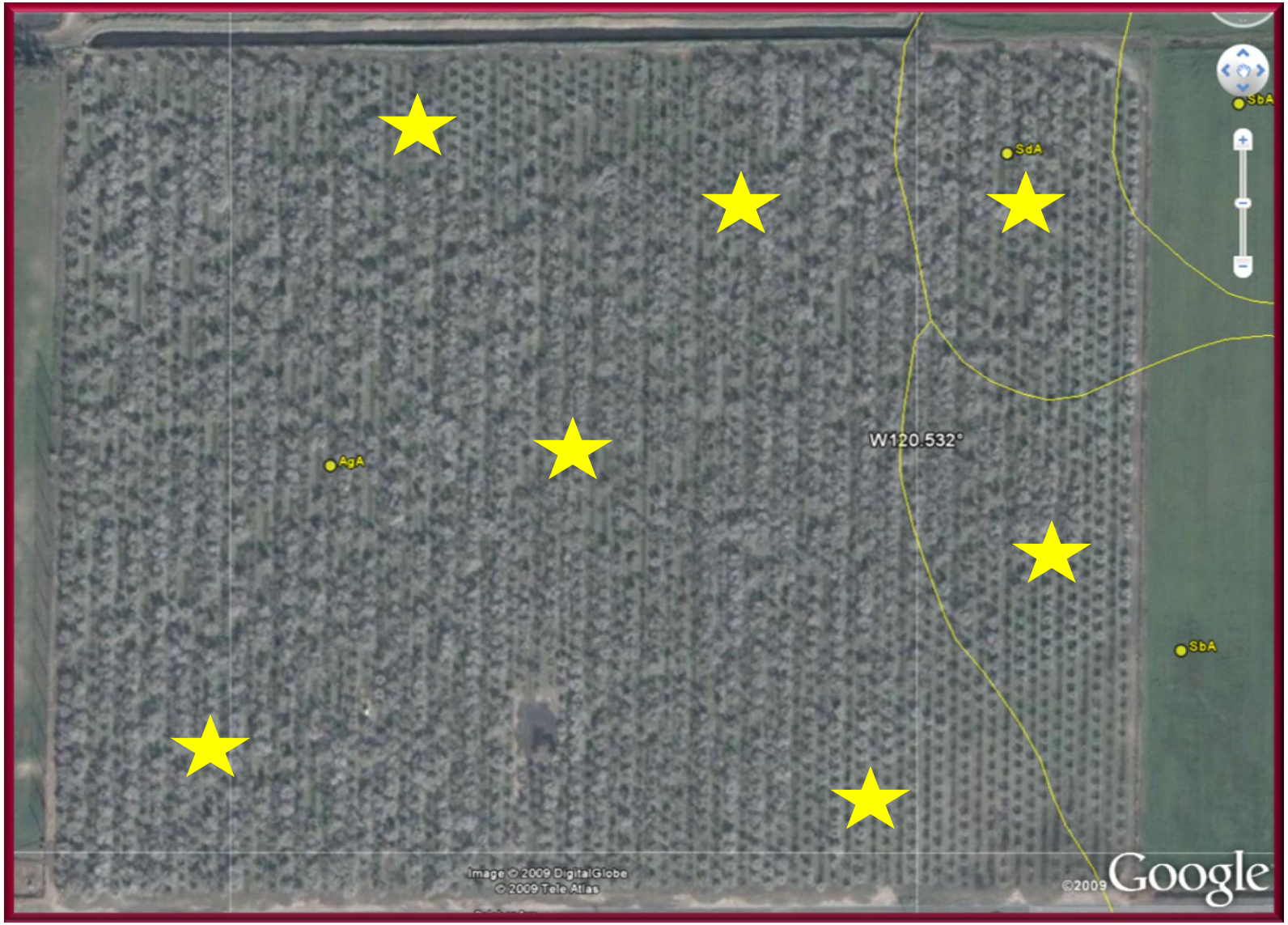

Plant-Parasitic Nematodes - Sampling

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Interpreting Results:

Main Question:

Are they there, or not?

If not, fumigation is not needed for nematodes.

If so – how many are present?

Plant-Parasitic Nematodes – Sampling / Treatment

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50-100 Nematodes per 1 Liter of Soil

1. Manage weeds for 1-2 years before orchard removal
2. If possible, cover crop with Piper Sudan Grass for one year
3. Plant Resistant Rootstocks
4. 6-8’ Row Strip fumigate with Telone at 33 gallon per treated acre

>100 Nematodes per 1 Liter of Soil

1. Same cultural practices as moderate populations
2. Broadcast fumigate fumigate with Telone at 33 gallon per treated acre

Plant-Parasitic Nematodes - Rootstocks

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Nematode of Concern

Recommended Rootstocks

Rootknot	Nemaguard, Atlas, Viking, Peach-almond hybrid with Nemaguard Parentage
Ring	**Avoid Peach-almond hybrids**, Viking and Lovell
Lesion	Rootstocks with high vigor such as Peach-almond hybrids

Replant Disease - Symptoms

Healthy (L) and replant disease-affected (R) almond trees, Madera County 2007

Replant Disease - Control

Cumulative yield responses, 2003 almond replant trial, Madera Co. (Fumigated Oct 2003, planted Jan 2004)

Fumigant, rate	Plot area treated	Cumulative yield (kernel pounds/acre)				
		2006	2006-07	2006-08	2006-09	2006-10
Control	None	370	2039	4680	7073	9362
Control	None	294	2106	4974	6970	9642
MB, 400 lb/a	Br. (100%)	482	2544	5647	8198	10601
MB, 400 lb/a	R. strip (38%)	424	2318	5515	7838	10197
Telone II, 340 lb/a	Br. (100%)	547	2746	5857	8736	***11849
Telone II, 340 lb/a	R. strip (38%)	483	2509	5572	7702	10501
Telone C35, 535 lb/a	Br. (100%)	***637	***3022	***6480	***9560	***12271
Telone C35, 535 lb/a	R. strip (38%)	***696	***2829	5916	8947	***11590
IM:CP (50:50), 400 lb/a	Br. (100%)	***682	***3046	***6292	***9370	***12060
IM:CP (50:50), 400 lb/a	R. strip (38%)	***632	***2873	***6182	***9499	***12399
CP 400 lb/a	Br. (100%)	554	2745	5682	8542	11001
CP 400 lb/a	R. strip (38%)	***680	***2981	***6192	***9176	***11716

Replant Disease - Control

Fine texture soils do not tend to have as severe of replant disease problems

Fallow or cover crop for at least one year

Fumigate row strips with chloropicrin containing fumigants

Switching rootstock parentage may provide some control, but sacrifices other horticultural benefits

Replant Problems – Fumigant Selection

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Problem	Fumigant	Method
Nematode Parasitism	Telone II or Telone C35	Broadcast or Row Strip
Replant Disease	Chloropicrin or Telone C35	Row Strip or Tree Site
Aggressive Pathogens	Chloropicrin/ Methyl Bromide	Broadcast

Replant Considerations – Development of Control Strategies

1. Current control strategies for mitigating soilborne pathogens and nematodes upon replanting.

2. Future approaches in developing treatments for replant problems using reduced or no soil fumigants.

Development of spot treatments

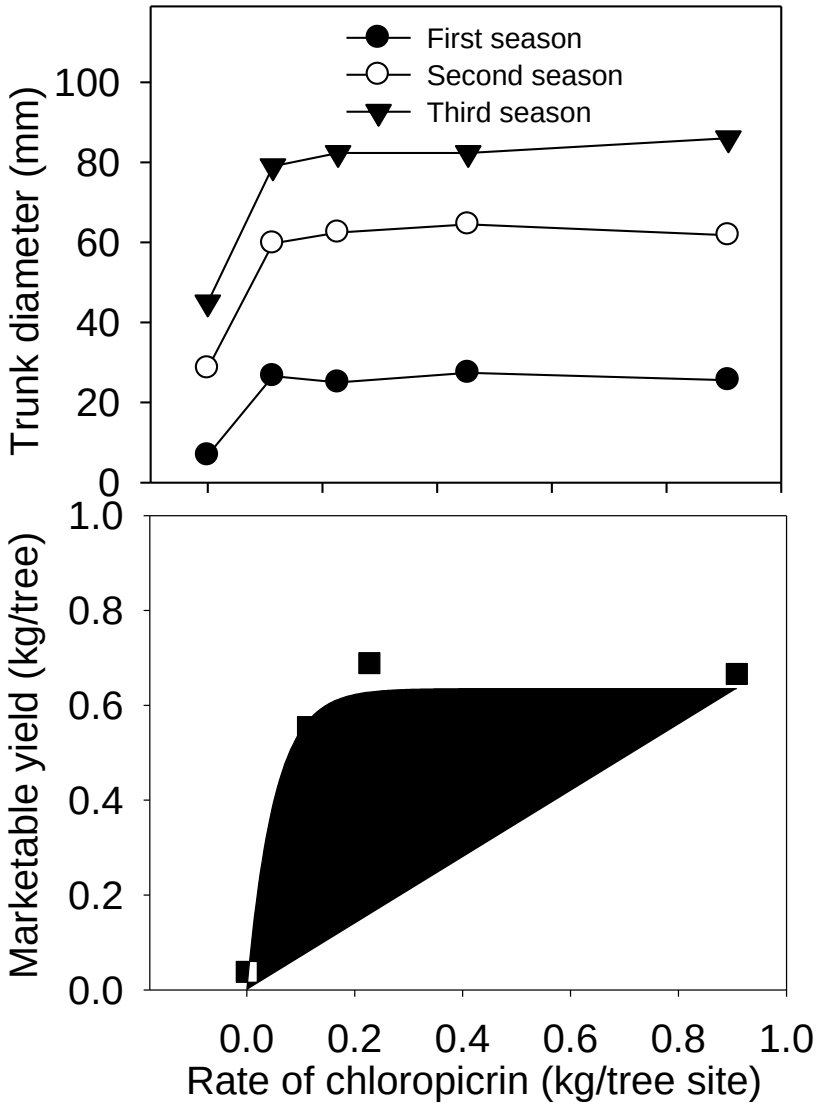
Early spot fumigation by “hand probe”

Growth in spot fumigated site

Growth in non-fumigated site

Replant Problems – Fumigant Reduction

Growth and 1st year yield response of almond to pre-plant spot fumigation treatments with chloropicrin (0.25 to 2.0 lb / tree site), Butte County



GPS-controlled shank spot fumigation-

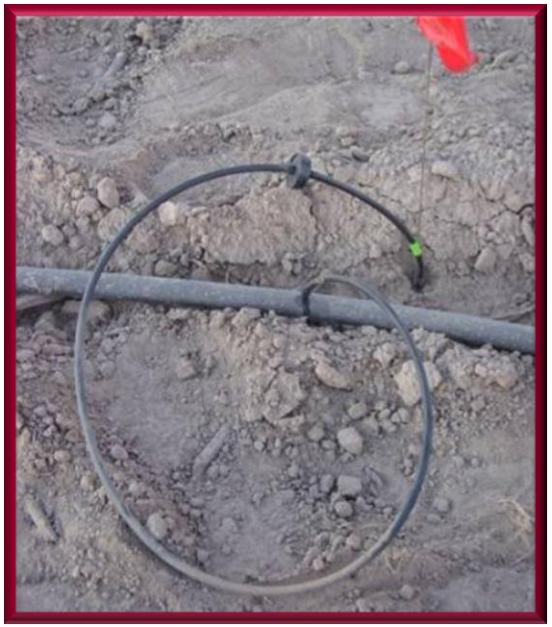
Upadhyaya et al. in collaboration with TriCal, Inc.

GPS-controlled shank spot application of fumigant in Fall 2006 (L) and Fall 2009 (R)

Replant Problems – Fumigant Reduction

Drip spot fumigation

- Effective, but commercial feasibility limited by low-flow risk of CP damage to irrigation system PVC
- Strip drip fumigation, improved emulsification are possible solutions
- Key is to use available crop irrigation system
- Spot fungicide concept be tested



Replant Problems – Fumigant Reduction

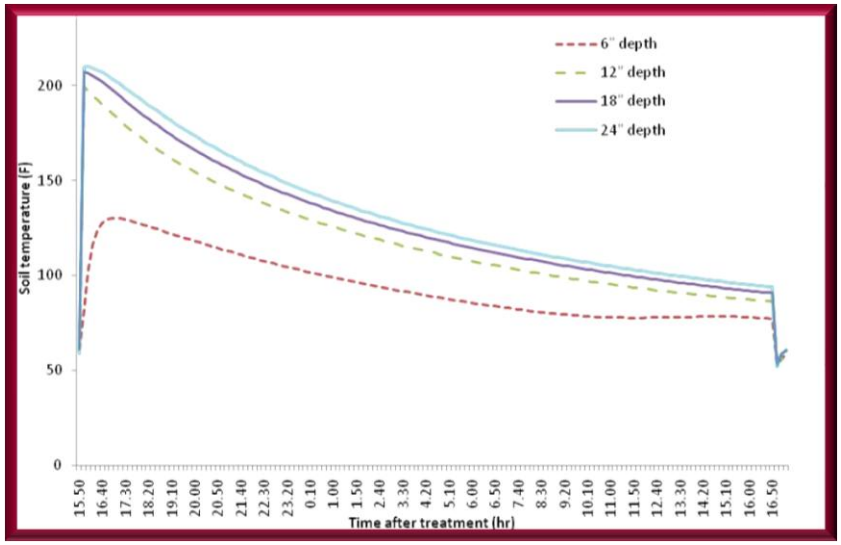
2008, USDA-ARS, Parlier, peach after peach (sandy loam)

Fumigant	Fumigant per treated acre (lbs)	Fumigant per orchard acre (lbs)	Mkt. fruit yield (lb/ac) 2010
Control	0	0	6,171
Telone C35 Row Strip – 8.3’	540	227	31,527
Telone C35 Tree Site – 5’x6’	540	81	19,911
Telone C35 Inline – 4’ diameter	540	43	19,094

Replant Problems – Fumigant Replacement

Soil Steaming

- Collaborative project, Hanson, Fennimore, Browne, Doll, Almond Board of CA
- Augers built by Weimer, Fennimore- 2.5’ & 3.0’ diameter
- Tree and spot responses pending
- Not without potential environmental impacts



Replant Problems – Fumigant Replacement

Soil Augmentation

- Liquid injection auger can disperse agent or product within the soil
- Increases the likelihood of even distribution within the root zone
- Auger built by Weimer- 2.5’ diameter
- Tree and spot responses pending

Present and Future Replant Considerations and Strategies - Conclusions

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- Results indicate effectiveness of MB alternatives
- For replant disease, the most common replant problem, spot fumigation offers acceptable efficacy and fumigant rate and emissions reductions
- Other spot treatments (steam, fungicides) offer promise
- Results for fumigation and steam and treatments pending for nematode-infested sites
- Rootstock rotations to be further investigated
- Cultural contributions (soil ripping, irrigation, nutrition, safe weed management) critical to effective replant management

Present and Future Replant Considerations and Strategies - Conclusions

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Acknowledgements:

Tri-Cal Fumigation Company

Weimer Manufacturing/Atwater Irrigation

Trial Hosts: Agriland, Berberian, Frago, Littlejohn, Nickel's Estate, Paramount Farms, Poythress

Hunter Farms and Kruppa Farms for Excavation Services

Almond Board of California

Greg Browne – USDA-ARS leader for Area-Wide Methyl Bromide Alternatives Initiative

UCCE Advisors J. Connell, D. Doll, J. Edstrom, and B. Holtz

UC Specialists S. Fennimore, B. Hanson, B. Lampinen, and M. McKenry

Thank You

Soil Fumigants – EPA Update

John Leahy, EPA, Office of Pesticide Programs

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Overview – Reregistration

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Reregistration Eligibility Decisions or "REDs"

Re-licensing decisions for chemicals used as soil fumigants

- **Methyl Bromide**
- **Chloropicrin**
- **Metam Sodium/Metam Potassium**
- **Dazomet**

First comprehensive reevaluation since products first registered

Soil Fumigant Review Goals

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Protect workers and bystanders while maintaining key benefits of use

Ensure a level playing field across all soil fumigants

Make risk management decisions that are protective and that take into account likely real-world outcomes

Benefit and Risk Conclusions

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Soil fumigation brings high benefits to growers

- **Highly effective pest control tools**
- **Broad spectrum**
- **Increased revenue**

Soil fumigation poses risks to applicators, workers, and bystanders

- **Assessments based on multiple lines of evidence**
  - **Human and animal toxicity studies**
  - **Exposure based on monitoring and modeling**
  - **Incidents – effects, causes, distances observed**

Mitigation Summary

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High risks + High benefits →

Package of measures that work together to

- **Reduce potential for direct exposure to toxic concentrations**
- **Reduce likelihood of accidents and errors**
- **Foster planning and compliance**
- **Assure appropriate response to exposures that occur**

Measures and Implementation Schedule

- ■ under development
- ● adopt fully

Risk Mitigation Measure	Phase 1	Phase 2
Good agricultural practices (GAPs)	•	•
Restricted use (new measure for metam sodium/ potassium & dazomet only)	•	•
New handler protections including changes to Respiratory protection, tarp cutting/removal and worker reentry restrictions	•	•
Fumigant management plans and post application summaries	•/■	•
Buffer zone distances, credits, and posting		•
Emergency preparedness measures		•
Difficult to evacuate sites		•
Notice to state lead agencies		•
Safe handling information	•	•
First responder, community outreach and certified applicator training	■	•
Rate reductions and use site limitations	•	•

Summary of Phase 1 Measures

Key Measures

First phase of Implementation late 2010

- **Respiratory protection**
- **Tarp and entry restrictions**
- **Fumigant management plans**

Respiratory Protection

If experiencing sensory irritation, handlers must either:

1. **Stop work and leave area**
   OR
2. **Wear a respirator & resume work**

Note: air purifying respirators are required for all activities with methyl bromide products that have less than 20% chloropicrin

Tarp Perforation and Removal

Perforation

5 days after fumigant application is complete

- Exceptions for weather, flood prevention

Mechanical perforation required, except

- At the beginning of each row when a coulter blade is used on a motorized vehicle such as an ATV
- In fields that are 1 acre or less
- During flood prevention activities

Removal

- 2 hours after perforation is complete

Entry Restricted Period Scenarios

Entry Restricted Period by Scenario

If application is…	**and** tarp is…	_____ days after application is completed	workers may enter…
1. Untarped	**-**	**-**	**5 days after application is complete**
2. Tarped	**Perforated & Removed**	**within 14 days**	**after tarp is removed**
3. Tarped	**Perforated BUT Not Removed**	**within 14 days**	**48 hours after perforating tarps**
4. Tarped	**Perforated and/or Removed**	**more than 14 days**	**5 days after application is complete**

Fumigant Management Plans (FMPs)

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Purpose of the FMP:

- Ensure thorough planning
- Prevent accidents
- Identify appropriate emergency procedures
- Demonstrate compliance with label

FMP must be prepared and . . .

Certified Applicator supervising the application must verify (sign and date) that it is accurate before fumigation begins.

Fumigant Management Plans (FMPs)

Major elements of a Phase 1 FMP:

- On-site applicator information
- General site information
- General application info
- Measurements taken to comply with GAPs
- Soil conditions, weather conditions
- Worker protections (tasks, PPE requirements, monitoring)
- Posting and record-keeping procedures
- Emergency response plans and procedures

Post Application Summary

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Post Application Summary

- Deviations from FMP (e.g., date of application, tarps used, procedures, changes in personnel, etc.)
- Summary of actual weather
- Actual date of tarp activities and sign removal
- Description of problems, complaints, incidents
- Air monitoring results

Must complete within 30 days of application and kept with FMP for 2 years.

Fumigant Management Plans

What this means in California

- DPR developed a California specific template
- County Permit + NOI + Regulations + California FMP = Label required elements

Templates and Tools

- Federal EPA templates
  - Downloadable files and web-based templates
  - www.epa.gov/oppsrrd1/reregistration/soil_fumigants

    Or internet search for . . .

    "*soil fumigant implementation*"
  - California DPR template
  - Company/grower specific templates

FMP Sample Template

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2010 SOIL FUMIGANT MANAGEMENT PLAN (METHYL BROMIDE/CHLOROPICRIN PRODUCTS)

The below text fields will expand as the text is entered. After completing each field, use *Tab key* to go to next text field or check box.

I. Certified Applicator Supervising the Fumigation

Name:	Phone number:	License and/or certificate number:	☐ Commercial applicator ☐ Private applicator
Employer name:	Employer address:		

II. General Site Information

Application block/field location (e.g., county, township-range-section quadrant), address including zip code, or global positioning system (GPS) coordinates:

III. Owner/operator of Application Block

Name:	Address:	Phone number:

IV. Recordkeeping

☐ The owner/operator of the application block has been informed that he/she as well as the certified applicator must keep a signed copy of the site-specific FMP and the post-application summary for 2 years from the date of application.

V. General Application Information

Target application date/window:	EPA Registration Number: -	Fumigant Product Name:	
Application method: ☐ Tarp bedded ☐ Tarp broadcast ☐ Deep untarp broadcast (CA only) ☐ Hot gas – outdoor ☐ Hot gas – greenhouse ☐ Hand held probes (tree hole)	Application Rate (lbs or gallons of product/treated acre):	Injection Depth (inches):	Application Block Size (acres):

VI. Emergency Response Plan

Description of evacuation routes (a diagram or drawing may be attached to the FMP):

☐ Check here if diagram or drawing is attached

Locations of telephones:

Contact information for first responders:	Local/state/federal contacts:	Other contact information for emergencies:

Emergency procedures/responsibilities in case of an incident, equipment/tarp/seal failure, complaints or elevated air concentration levels suggesting potential problems, or other emergencies:

Key Phase 2 Measures

Key Measures

Second Phase of Implementation - late 2011

- **Buffer zones**
- **Site-specific response measures (if triggered)**
- **Buffer zone monitoring or**
- **Response information for neighbors**
- **FMPs with additional elements**

Buffer Zone Calculator (sample screen)

EPA reg number: 11220-10 **Product name:** Tri-Con 50/50

Company name: Trical

Active ingredients:
methyl bromide - 50%
chloropicrin - 49.5%

Application method:

- (•) Tarped bedded
- ( ) Tarped broadcast
- ( ) Deep untarped
- ( ) Outdoor tarped hot gas
- ( ) Greenhouse tarped hot gas
- ( ) Tree hole replacement with hand held probe

Note: User must verify that the application methods selected are allowed by product label.

Soil moisture:

- (•) Soil moisture is ≥ 70% and measured with instrument or ≥75% using the USDA Feel and Appearance Method
- ( ) Soil moisture is 50 to 69% and measured with instrument or 50 to 75% using the USDA Feel and Appearance Method

<-- Return To Welcome Screen | Continue to Application Inputs

Outreach Materials

EPA materials for outreach include

- Fact sheets
- Presentations and training modules
- Tools and templates

Visit . . .

www.epa.gov/oppsrrd1/reregistration/soil_fumigants

Or internet search for . . .

"***soil fumigant implementation***"

Changes to California's Methyl Bromide Regulations

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Summary:

- **County Ag Commissioners may not use buffers smaller than specified in the "MB Field Fumigation Buffer Zone Determination" document**
- **Respirator type clarified**
- **Revised MB monthly township caps – 171,625 lbs per month**
- **Revised maximum work hours in a 24-hour period – Most reduced by 1 hour**

1,3-D Review Status with CDPR

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Summary:

- **CDPR is currently developing the risk assessment for 1,3-dichloropropene**
- **Completed risk assessment expected in 2011**
- **Based on results, CDPR may propose additional mitigation to address any risk concerns identified**

VOC Rules in California

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In San Joaquin Valley additional restrictions may apply

May affect applications taking place May 1 – October 1

County Agricultural Commissioners will be able to provide specific information

EPA Contact Information

General Contact:

- **John Leahy (703) 305-6703**

Team Leaders:

- **Steven Weiss (703) 308-8293**
- **Cathryn O'Connell (703) 308-0136**
- **Eric Olson (703) 308-8067**

E-mail: lastname.firstname@epa.gov

Thank You

Wrap-Up, Discussion and Q&A

Next Session:

Treevix Herbicide, a new Innovation in Broadleaf Weed Control in Almonds from BASF

Treevix Herbicide from BASF

Ben Duesterhaus, BASF

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