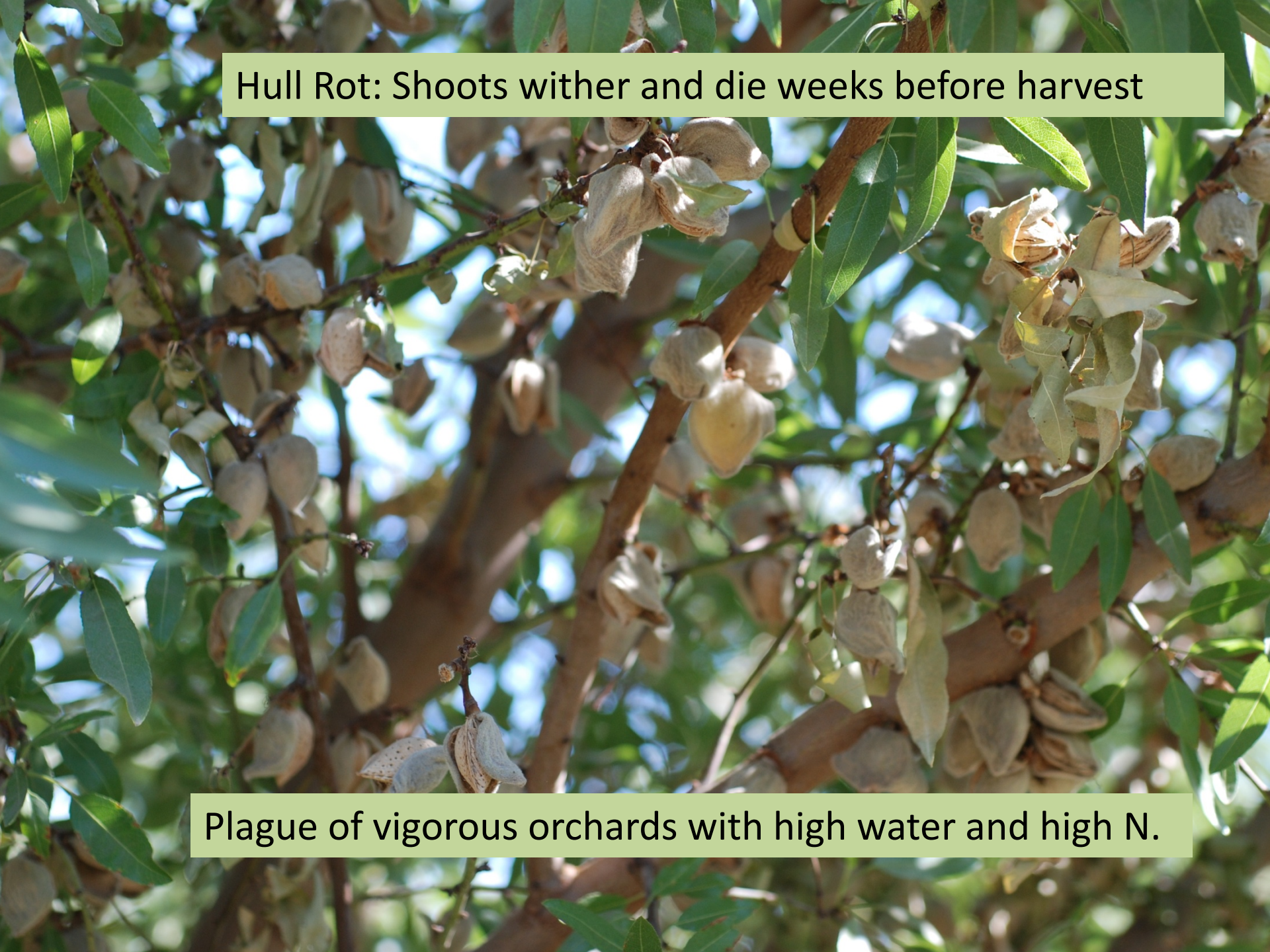
Almond Disease Management: Hull Rot and Scab

E. Fichtner: Farm Advisor, Tulare County


Hull Rot: Shoots wither and die weeks before harvest
Plague of vigorous orchards with high water and high N.

Hull Rot Culprits

Monolinia *Rhizopus*

- Both respond well to cultural control
- *Rhizopus* responsive to fungicides

Fungi Responsible for Hull Rot

Rhizopus stolonifer

- More common in southern SJV
- Black spores, inside hull
- Only infects after hull split

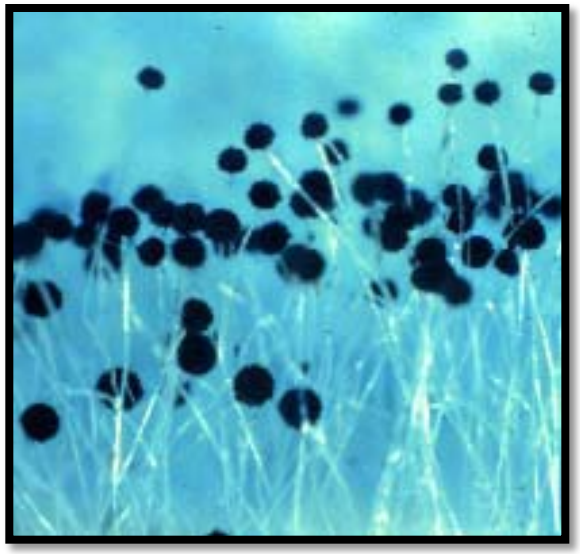
Monilinia fructicola

- More common in Sac Valley
- Tan spores, inside or outside hull
- Only infects after hull split

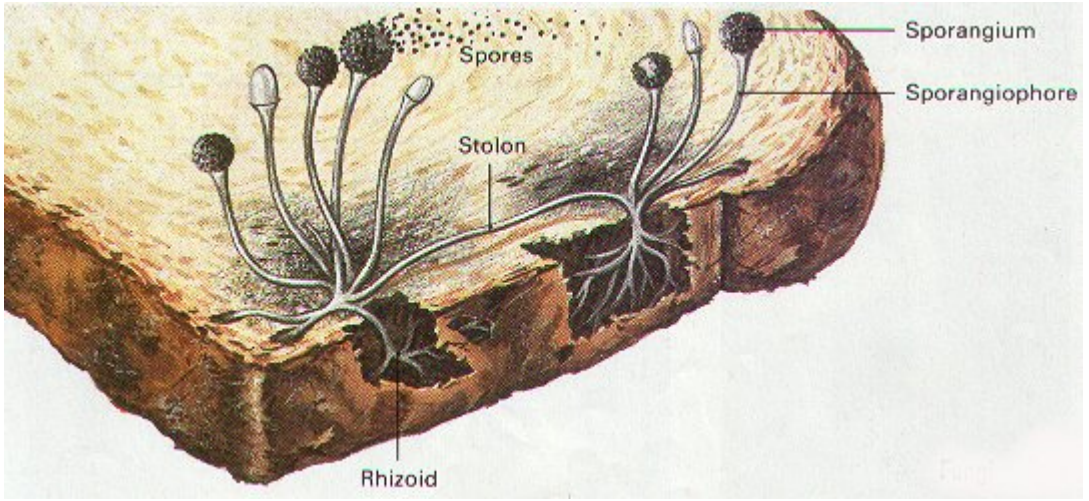
Different pathogens-similar effects

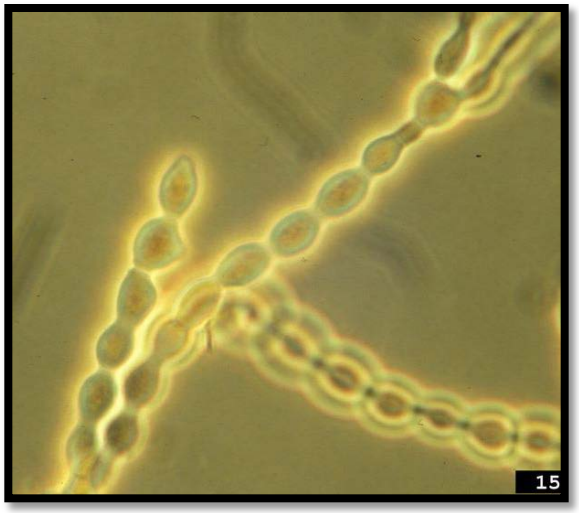
Monilinia may also infect flowers!

Hull Rot Pathogens



***Rhizopus* spores**





***Monilinia* spores**

Cultivars vary in susceptibility

HIGHEST SUSCEPTIBILITY

Kapareil
Nonpareil
Butte
Winters

(200-900 strikes/tree)

HIGH SUSCEPTIBILITY

Johyn
Price
Jenette
Sonora

(100-200 strikes/tree)

MEDIUM SUSCEPTIBILITY

Aldrich
Wood
Colony
Padre
Livingston

(1-100 strikes/tree)

LOW SUSCEPTIBILITY

Fritz
Carmel
Monterey

(0 strikes/tree)

Some varieties are susceptible, but infection results in minimal damage to host

TOLERANCE

Info courtesy of B. Holz

Infection and Symptoms

Tree Damage

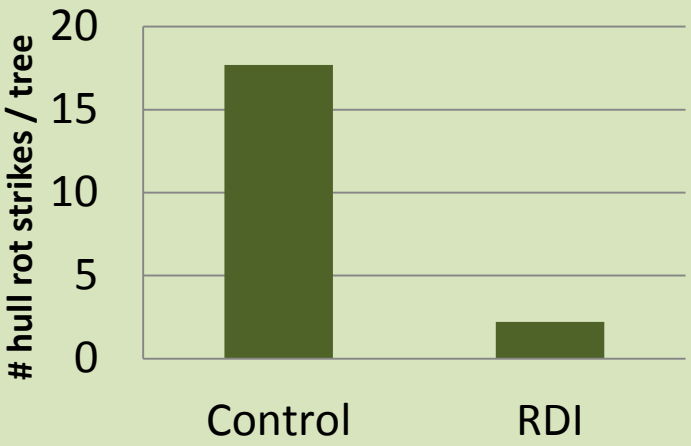
- Death of fruiting wood
  - Reduced return bloom/yield
- Infected fruit remain on tree
  - NOW overwintering site

Hull Rot Management

Cultural Control

1) Regulated deficit irrigation
   - Prior to hull split: $^{-}7$- $^{-}9$ bar
   - Early hull split: $^{-}14$- $^{-}18$ bar (mild-moderate stress)
   - Soon after harvest: $^{-}7$- $^{-}9$ bar

RDI: Experimental data demonstrated ~90% reduction in strikes.



- Visit www.ipm.ucdavis.edu

(B. Holz. 2007 The Pomology Post)

Slight H_2O stress during hull split:

Reduce Hull Rot

Achieve more uniform hull split

Shorten length of hull split

Improves nut removal/shakability

May reduce NOW

Excess water and nitrogen delay maturation

Ideal foliar N: 2.2-2.5%

Info courtesy of B. Holz

Unsplit

Initial separation stage

Deep V, unsplit

Hull split: < 3/8 inch

Initial drying stage

Completely dry stage

Fungicides

- Sterol inhibitor and Quinone outside inhibitor (strobilurins) fungicides effective for Rhizopus
- Single application at hull split, w/ NOW treatment
- May reduce incidence 60-70%.
- Integrate w/ RDI practices

UC IPM; J. Adaskaveg

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
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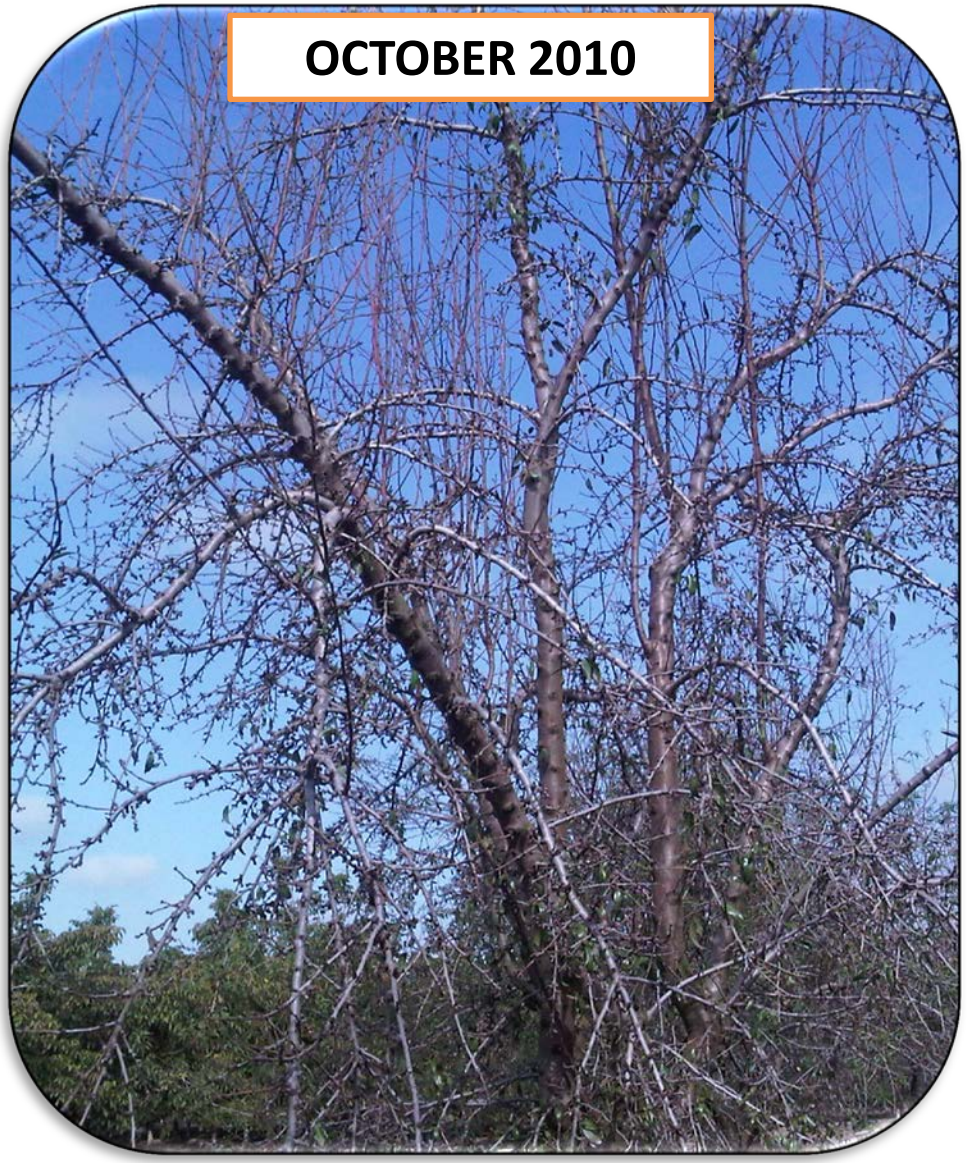
Statewide IPM Program
www.ipm.ucdavis.edu

Almond Scab

(***Cladosporium carpophilum***)

Scab: Symptom Development



Yellow flecks
Late Spring/Early Summer

Gray spots
Late Summer

By the time symptoms develop, it may be too late to spray.

Gray lesions
Nut infections

Defoliation

Survival in twig lesions

Primary Inoculum

- Twig infections

Disease Development

- Presence of inoculum
- Prolonged wet springs
- Sprinkler-irrigation
- Dense plantings

2010 Tulare County: low, cool, moist areas of orchards

Scab Management

Dormant sprays target primary inoculum

- Dormant / delayed dormant: Cu/oil
- Chlorothalonil + oil (until bud swell)…
  Will kill green tissues.

J. Adeskaveg

Shot hole sprays (petal fall) may control scab

Scab Management

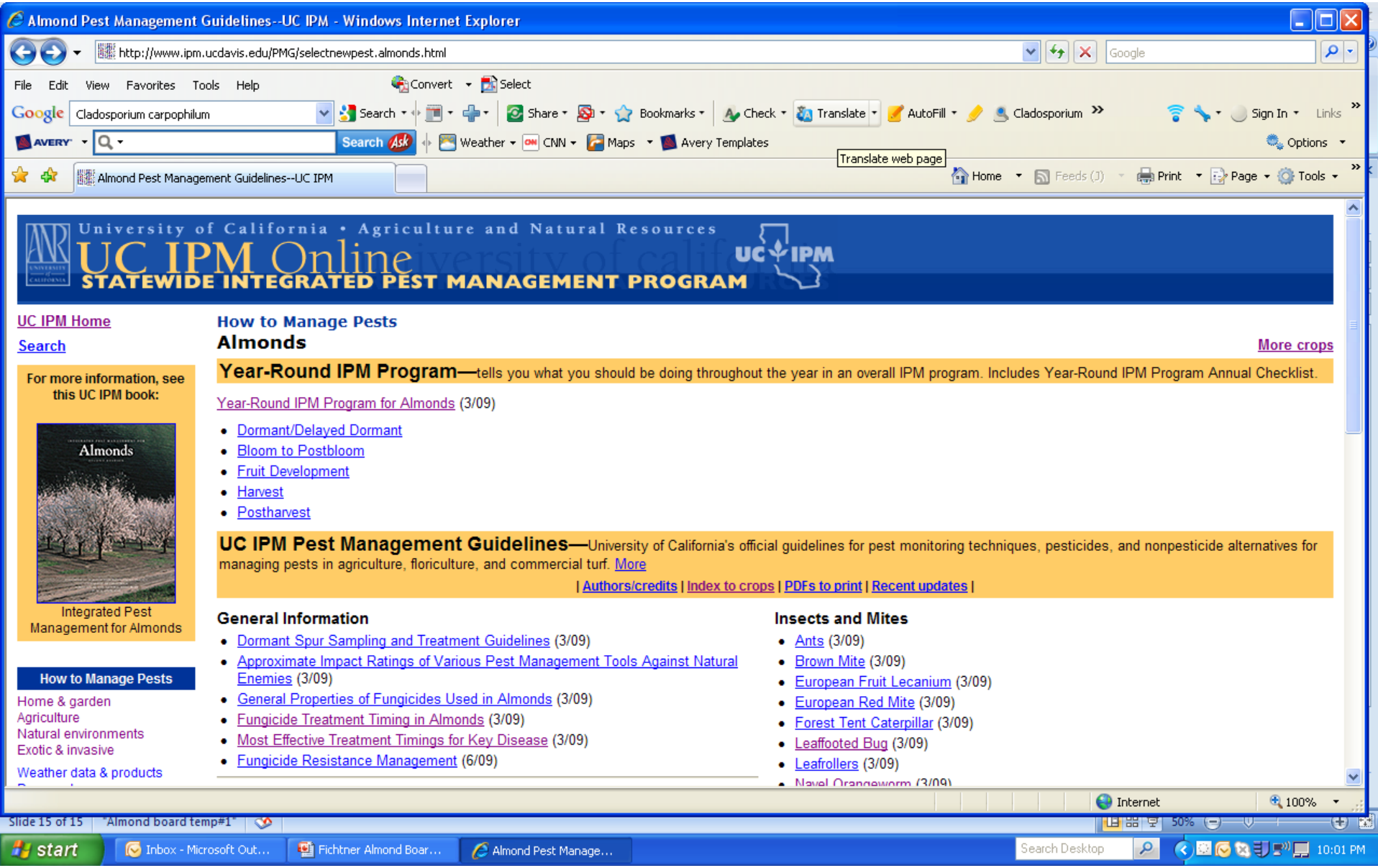
Spring-time sprays (2-5 weeks after petal fall)

- Protect leaves, fruit, young twigs
- If rains persist, applications may extend into May

Prevent Fungicide Resistance:
use single-site fungicides preventatively, not after disease development.

Cladosporium carpophilum
Resistance to strobilurin fungicides in northern SJV and Sacramento Valley

For More Information



Summer Time Almond Diseases- Alternaria and Rust

Gurreet Brar, UCCE (Fresno & Madera)

Alternaria leaf spot

Alternaria alternata

- Brown spots on leaves,
- Turn black as the spores produced
- Develops most rapidly in June and July
- Trees can be almost completely defoliated
- Most severe where dews form, humidity is high, and air is stagnant.

Alternaria leaf spot

Alternaria alternata

- Most severe on exposed leaves.
- Trees trained to an open and spreading canopy
- East-west rows more severe disease than north-south
- Most susceptible- Carmel, Monterey, Winters, and Butte.

Photo: Gary Woods

Alternaria leaf spot

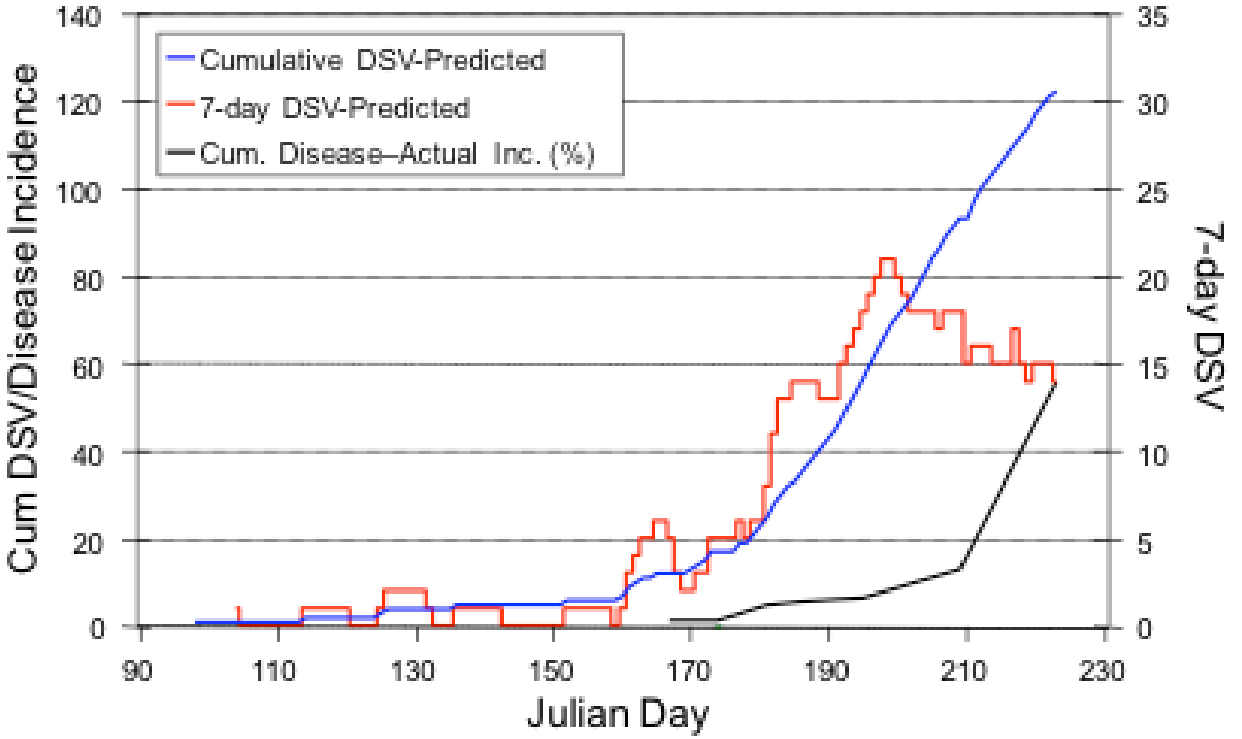
Monitoring

- Monitor for signs of the disease in April through June.
- If monitoring indicates presence of Alternaria, begin late-spring treatments about mid-April.
- In orchards with a history of the disease, treat in mid- to late April and 2 to 3 weeks later.

DSV (Disease Severity Value) Model

- Index values are assigned for average temp. & leaf wetness duration.
- Apply fungicide if accumulated index values over a 7–day period reach a value of 10 or higher.

Mean temperatures (C) during wetness	Leaf wetness duration (hours)				
15-17	0-6	7-15	16-20	21	---
17.1-20	0-3	4-8	9-15	16-22	23+
20.1-25	0-2	3-5	6-12	13-20	21+
25.1-29	0-3	4-8	9-15	16-20	23+
DSV	0	1	2	3	4



Fungicides for Alternaria

Quash	(3)	High	DMI
Pristine	(11/7)	Medium	Strobilurin/Boscalid
Luna Sensation	(11)	Medium	Strobilurin
Luna Experience	(3/7)	Medium	DMI/Boscalid
Inspire Super	(3/9)	High	DMI
Quadris Top	(11/3)	Medium	Strobilurin
Abound	(11)	High	Strobilurin
Rovral*	(2)	Low	Dicarboximide

*Do not use later than 5 weeks after petal fall.

Almond Rust

Tranzchelia discolor

- Rust occurs sporadically throughout almond-growing areas in California.
- It often is serious on young orchards where bloom sprays have not been applied.

Almond Rust
Tranzchelia discolor

- Small, yellow spots on the upper surface of leaves.
- On the lower surface rusty red spots when the rust-colored spores erupt through the surface.

Rust Management

- In orchards with a history of rust, apply fungicides in late spring and summer to control leaf infections.
- 5 weeks after petal fall and forward
- 2-3 applications may be needed in orchards that have had severe rust problems.
- To be effective, fungicide must be applied before rust symptoms are visible.
- Micronized sulfur works well on rust, apply when not using oil
- To prevent the rust inoculum from increasing in late fall, apply zinc sulfate (20-40 lb/acre) in late October to early November to hasten leaf fall. Otherwise, the inoculum may build up, overwinter on the trees, and infect leaves the following spring.

Fungicides for Rust

timing: 5 weeks after petal fall on

• Pristine (11/7)	medium	Strobilurin/Boscalid
• Flint / Gem (11)	high risk	Strobilurin
• Abound (11)	high risk	Strobilurin
• Maneb (M3)	low risk	Carbamate
• Sulfur	low risk	Inorganic
• Rovral (2)	low risk	Dicarboximide

Almond: Treatment timings

Disease	Dormant	Bloom			Spring[1]		Summer	
		Pink bud	Full bloom	Petal fall	2 weeks	5 weeks	May	June
Alternaria	----	----	----	----	----	++	+++	+++
Anthracnose	----	++	+++	+++	+++	+++	+++	++
Brown rot	----	++	+++	+	----	----	----	----
Green fruit rot	----	----	+++	----	----	----	----	----
Hull rot	----	----	----	----	----	----	----	+++
Leaf blight	----	----	+++	++	+	----	----	----
Scab	++	---	---	++	+++	+++	+	---
Shot hole	5	+	++	+++	+++	++	----	----
Rust	----	----	----	----	----	+++	+++	+

Source: UC IPM

UC Resources

- UC IPM website:
  - http://www.ipm.ucdavis.edu/
- Almond Doctor Blog
  - http://thealmonddoctor.com/
- Fungicide Resistance Action Committee (FRAC)
  - http://www.frac.info/

Thank you.