

# Epidemiology and Control of Almond Scab and Alternaria Leaf Spot

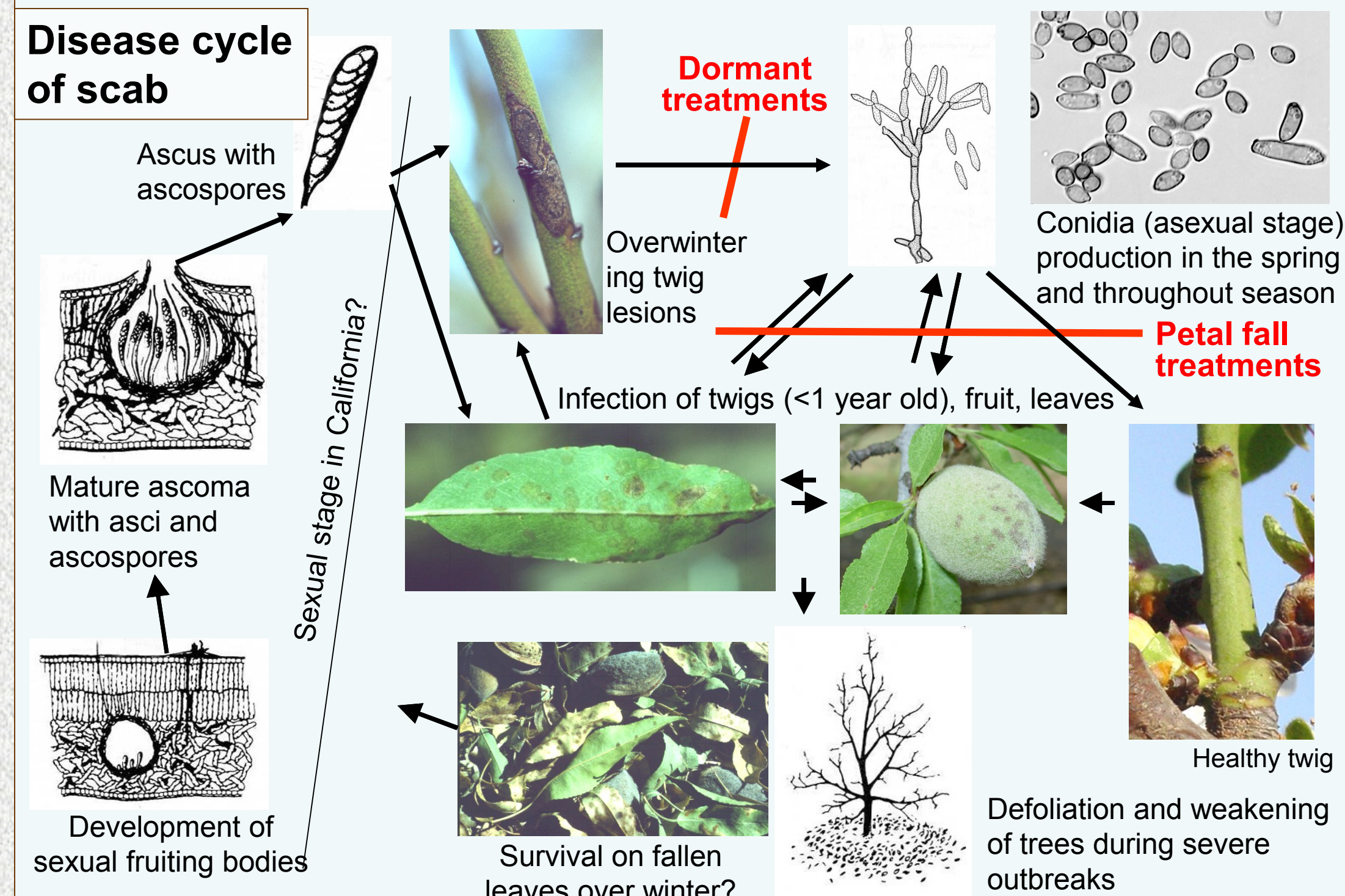
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## Almond Scab (*Fusicladium carpophilum*)



Leaf and fruit symptoms.



## Alternaria Leaf Spot of almond (*Alternaria* spp.)



Early tree defoliation and new leaf development eventually weakens the tree. Infections mostly occur on leaves but twig infections have occasionally been found.



## Scab, Alternaria leaf spot, and hull rot have increased with changes in almond production

Changing practice	Effects
High-density planting	Less air circulation, increase in shading and orchard humidity
Higher nitrogen fertilization	Rapid growth, plant tissues more susceptible
Increase in irrigation duration	Increase in orchard humidity
Planting in areas less suitable for almond production	Environments may be more favorable for disease. Increased stress on trees

Conditions that weaken trees and plant pathogens

## Field trials on scab management in 2014

### 1. Dormant applications with chlorothalonil to reduce inoculum in the spring

cv. Carmel, Butte Co.  
Application: Jan 2014, Evaluation: April 23.

Treatment	Sporulation	Incidence (%)	Rating (0-3)
Control	a	~80	~2.5
Manzate ProStick 6 lb + Oil 3.5 gal	ab	~60	~2.0
Captan 80WDG 5 lb + Oil 3.5 gal	b	~40	~1.5
Bravo 6 pts + Oil 3.5 gal	c	~20	~1.0



- Chlorothalonil-oil was again highly effective in delaying sporulation of twig lesions into late spring – copper-oil less effective, captan-oil or mancozeb-oil have little efficacy.
- Considerations for using Bravo:
  - Effective by itself, but oil increases effectiveness.
  - Applications in mid-December similarly effective as in mid-January.

#### Guidelines:

- At locations with high disease levels, a dormant or delayed-dormant application is recommended.
- Bravo WeatherStik received a Section 2(ee) registration for dormant application between Dec. 1 and Jan. 10 (before bud swell).
- Full registration is planned through IR-4 to change PHI to 60 days and rate to 6 pts/A (pending for 2015).
- Additional benefit: Align scab treatments with Alternaria treatments

### Timing of scab and Alternaria treatments without and with the use of a scab dormant application

Disease	Dor-mant	Bloom			Spring		Summer	
		Pink bud	Full bloom	Petal fall	Two week	Five week	May	June
Scab	++	-	-	+	+++	+++	+/-	+/-
Scab Dormant Chlorothalonil+oil	++	-	-	-	-	-	-	-
Alternaria	-	-	-	-	-	-	-	-

Note: - = no application; + = application timing slightly beneficial to +++ = application timing very beneficial.

### 2. In-season applications

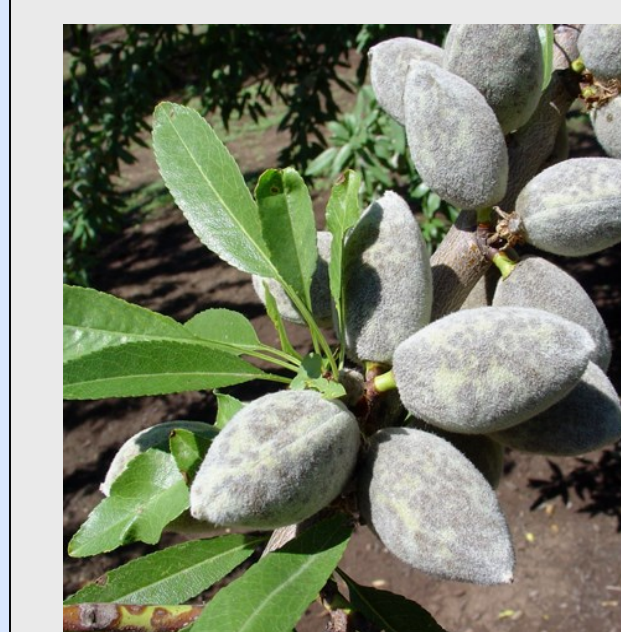
Treatment	Rate (/A) (oz/fl oz)	4/30	5/28	Disease incidence (%)	Severity rating (0-4)
Control	---	---	---	~80	~3.5
Quash	3.36	@	@	~40	~1.5
Quash + S2200	3.36 + 3.36	@	@	~30	~1.2
Quash + Protexio	3.36 + 14.4	@	@	~30	~1.2
Ph-D + Tebucon + NF-P	6.2 + 8 + 8	@	@	~30	~1.2
Syllit 65WG	32	---	@	~40	~1.5
Tebucon 45 + NF-P	8 + 8	@	---	~40	~1.5
Catamaran	64	@	---	~40	~1.5
Viathon	64	@	@	~40	~1.5
Bravo WeatherStik	64	@	---	~40	~1.5
Quadris Top + DyneAmic	14 + 16	---	@	~40	~1.5
Ph-D + NF-P	6.2 + 8	@	---	~40	~1.5
Tebucon 45 + NF-P	8 + 8	---	@	~40	~1.5

Treatment	Rate (/A) (oz/fl oz)	4/30	5/28	Disease incidence (%)	Severity rating (0-4)
Control	---	---	---	~80	~3.5
EXP-1	5.14	@	@	~40	~1.5
EXP-1 + EXP-2	3.43 + 4.57	@	@	~30	~1.2
EXP-1 + Headline	3.43 + 5.48	@	@	~30	~1.2
Isofetamid + IB18121	8.6 + 13.7	@	@	~30	~1.2
Fontelis + Tebucon 45	14 + 8	@	@	~30	~1.2
Luna Experience	6	@	@	~30	~1.2
Luna Sensation	5	@	@	~30	~1.2
Merivon	6.5	@	@	~30	~1.2

#### Most effective newer fungicides:

Single: Quash, Ph-D, Syllit, EXP-1  
Pre-mixtures: Quadris Top, Inspire Super, Luna Sensation, Merivon  
Rotations: including Catamaran/Viathon

### Summary: Management of scab with fungicides



- An effective 3-spray program includes dormant and two applications after twig infection sporulation (the first in-season scab application has to be done at initiation of twig lesion sporulation for best efficacy).
- Multi-site fungicides with low resistance potential (chlorothalonil, mancozeb, captan, ziram) should be in rotations with the newer single-site and pre-mix fungicides.
- Syllit 65WG is a new scab material and should be used at 16-32 oz/A.
- Mancozeb (Manzate/Dithane) was registered in 2013 to replace maneb.
- Single-site fungicides should not be applied once disease is developing.

## Field trials on Alternaria leaf spot management 2014

1. cv. Monterey, Colusa Co.

Treatment	Rate (/A) (oz/fl oz)	5/20	6/10	7/1^	Disease rating (0-4)
Control	---	---	---	---	~3.5
Rhyme	7	@	@	@	~1.5
EXP-1	5.14	@	@	@	~1.5
EXP-1 + Headline	3.43 + 5.48	@	@	@	~1.5
EXP-1 + EXP-2	3.43 + 4.57	@	@	@	~1.5
Isofetamid + IB18111	10.3 + 5.57	@	@	@	~1.5
Luna Experience	6	@	@	@	~1.5
Luna Sensation	5	@	@	@	~1.5
Merivon	6.5	@	@	@	~1.5
Ph-D 11.3DF + Tebucon	6.2 + 8	@	---	---	~1.5
Inspire Super*	20 + 16	---	@	---	~1.5
Ph-D	6.2 + 8	---	---	@	~1.5
Fontelis	20	---	@	---	~1.5
Ph-D	6.2	@	@	@	~1.5
Inspire Super*	20 + 16	---	@	---	~1.5
Quadris Top*	14 + 16	@	---	@	~1.5

\* Treatments used in combination with DyneAmic.

Disease pressure was low at many locations in 2014. This was likely due to reduced orchard irrigation that made orchard microclimatic conditions less favorable for development of Alternaria leaf spot.

2. cv. Monterey, Kern Co.

Treatment	Rate (/A) (oz/fl oz)	5/14	6/4	6/6	Disease incidence (%)	Severity rating (0-4)
Control	---	---	---	---	~80	~3.5
Isofetamid	17	@	@	@	~40	~1.5
EXP-1	5.14	@	@	@	~40	~1.5
EXP-1 + Headline	3.43 + 5.48	@	@	@	~40	~1.5
EXP-1 + Exp-2	3.43 + 4.57	@	@	@	~40	~1.5
Isofetamid + IB18111	10.3 + 5.57	@	@	@	~40	~1.5
Isofetamid + IB18121	10.3 + 11	@	@	@	~40	~1.5
Ph-D + Tebucon	6.2 + 8	@	@	@	~40	~1.5
Fontelis + Tebucon	14 + 8	@	@	@	~40	~1.5
Luna Experience	6	@	@	@	~40	~1.5
Luna Sensation	5	@	@	@	~40	~1.5
Merivon	6.5	@	@	@	~40	~1.5
Inspire Super	20	@	---	---	~40	~1.5
Quadris Top	14	---	@	---	~40	~1.5
Bravo Weather-Stick	64	@	---	---	~40	~1.5
Quadris Top*	14 + 16	---	@	---	~40	~1.5
Ph-D + NF-P	6	@	---	---	~40	~1.5
Tebucon	8	---	@	---	~40	~1.5
Quadris Top*	14 + 16	---	@	---	~40	~1.5
Inspire Super*	20 + 16	---	---	---	~40	~1.5
Luna Sensation	5	---	@	---	~40	~1.5
Luna Experience	6	---	---	---	~40	~1.5

\* Treatments used in combination with DyneAmic.

### Summary: Management of Alternaria leaf spot

- Late-spring/early-summer applications based on the DSV model or calendar based starting in May until late June/early July.
- Modification of the DSV model by using daily temperatures, dew periods, and precipitation was a less accurate predictor of infection periods than using leaf wetness duration and temperatures during wetness.
- Highly effective fungicides: Quash, Ph-D, Inspire Super, Quadris Top, Luna Sensation, Luna Experience, Merivon, Ph-D + Tebucon, Fontelis + Tebucon, isofetamid. EXP-1, EXP-1 + EXP2 - have to be strictly used in rotations and mixtures for resistance management.
- Other components of an integrated approach in disease management are highly critical: row orientation with prevailing winds and pruning to improve air movement, nitrogen management on replacement schedule only to reduce excess growth, improve water penetration, & shorter irrigation periods,

### The Disease Severity Value (DSV) model

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

### Integrated management of main flower, foliar, and fruit fungal diseases of almond in an annual 5- to 6-spray program

Dormant	Feb./March (bloom)	May	June	July (hull split)
Chlorothalonil -oil: Scab, (insect pests)	1-2 applications: Brown rot, shot hole, jacket rot	1 application: Alternaria, scab, rust, (mites)	1 applications: Alternaria, scab, rust, Monilinia hull rot	1 application: Rhizopus hull rot, (NOW)

Choose fungicides for each application timing that are active against all diseases present at an orchard site (see: [www.ipm.ucdavis.edu](http://www.ipm.ucdavis.edu)). Some sprays can be combined with insecticide/miticide applications.