

Epidemiology and Control of Almond Scab and Alternaria Leaf Spot

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Almond Scab (*Fusicladium carpophilum*)



Almond scab and Alternaria leaf spot are summer diseases that are found especially in locations with high humidity and poor air circulation. Early defoliation results in weakened trees and yield decline.

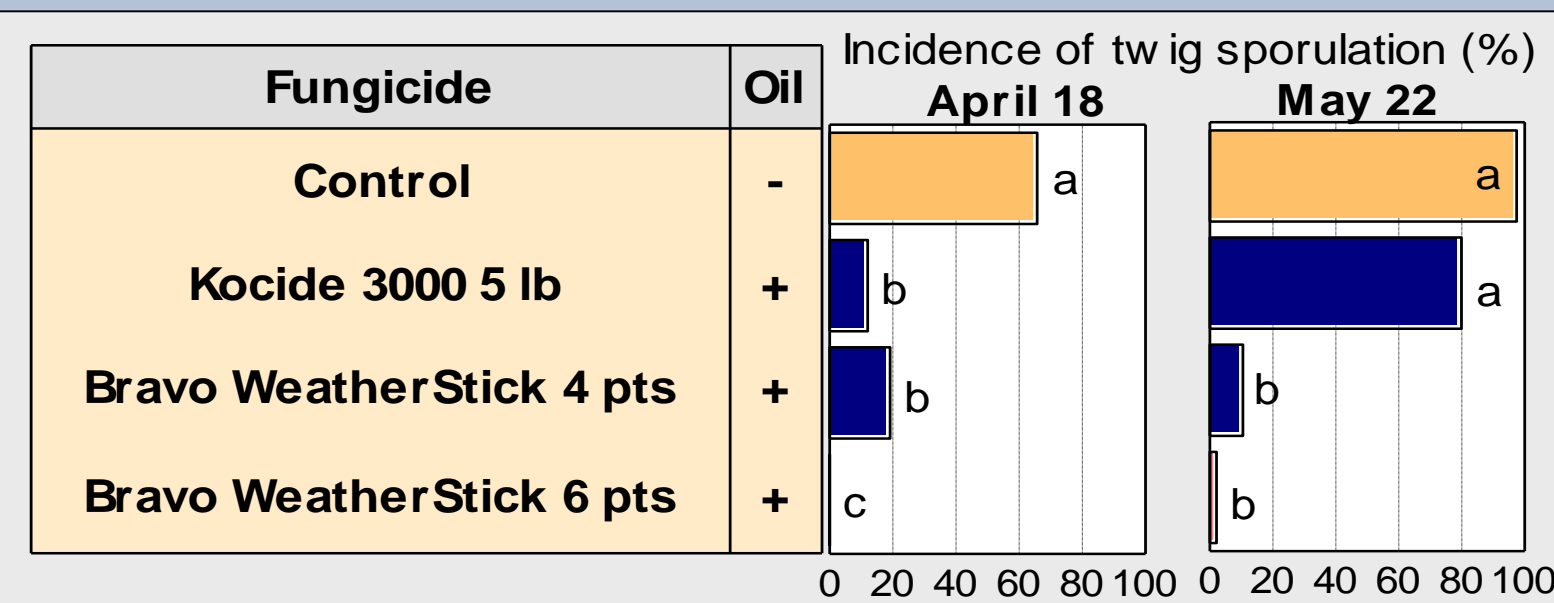
Leaf and fruit symptoms of almond scab.

Field trials on scab management in 2017

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

Due to dry weather in the spring of 2017, scab sporulation on twigs and disease incidence were low.

- In previous years we established that chlorothalonil-oil is highly effective in delaying sporulation of twig lesions into late spring.
- Copper-oil is less effective
- Chlorothalonil is effective by itself, but oil significantly increases efficacy.
- Timing: Mid-December to mid-January.



cv. Carmel, Butte Co. Application: Jan

- At locations with high disease levels, a dormant or delayed-dormant application is recommended.
- Bravo WeatherStick received a Section 2(ee) registration for dormant application between Dec. 1 and Jan. 10 (before bud swell). Full registration is planned and change PHI to 60 days and rate to 6 pts/A
- Delay in sporulation synchronize scab treatments with Alternaria treatments.

2. In-season applications 2017

Treatment	Rate(/A)	Scab incidence (%)	Scab lesions/fruit
Control	---	a	a
Ph-D*	6.2 oz	bc	b
Rhyme*	7 fl oz	cdef	b
Fontelis*	20 fl oz	bcd	b
Pyraziflumid + NIS	5.08 + 4 fl oz	bcde	b
UC-1 + Sylcoat	4 + 3.84 fl oz	bcdef	b
Ph-D + Quash*	6.2 + 3.5	def	b
Luna Experience + NIS	8 + 8 fl oz	ef	b
IL-5412	15 fl oz	bcde	b
UC-2 + Sylcoat	6 + 3.84 fl oz	cdef	b
EXP-AD	13.7 fl oz	f	b

cv. Monterey, Colusa Co.; Applications 5-4, 5-24, 6-15-17

Treatment	Rate(/A)	Scab incidence (%)	Scab lesions/fruit
Control	---	a	a
Aproach 2.08SC + NIS	8 fl oz	a	ab
Fontelis*	20 fl oz	a	ab
Ph-D + Quash*	6.2 + 2 oz	bc	cd
Aproach + Fontelis + NIS	8 + 14 fl oz	a	abc
Quash + Intuity	2 oz + 2 fl oz	bc	cd
Luna Sensation + NIS	7.8 + 8 fl oz	ab	abcd
Luna Experience + NIS	8 + 8 fl oz	a	ab
Merivon + Sylcoat	6.5 + 3.84 fl oz	ab	cd
UC-2 + Sylcoat	6 + 3.84 fl oz	c	d
IL-5413	15.5 fl oz	ab	abc
IL-5414	15.5 fl oz	ab	abcd
IL-5412	15 fl oz	a	bcd

cv. Carmel, Colusa Co., Applic. 5-4, 5-24, 6-15, 2017; pathogen QoI-resistant

Summary: Management of scab with fungicides

Effective fungicides
Single: FG 19 (Ph-D), FG 3 (Quash, Inspire, Rhyme), FG U12 (Syllit)
Pre-mixtures: FG 3/11 (Quadris Top), FG 3/9 (Inspire Super), FG 7/11 (Luna Sensation, Merivon)
New: EXP-AD, UC-2, IL5412



- An effective 3-spray program includes a dormant and two applications after twig-infection sporulation
- First in-season scab application at the beginning of twig-lesion sporulation.
- Multi-site fungicides with low resistance potential (e.g., chlorothalonil, captan, ziram) applied at petal fall to satisfy PHI requirement. Rotations of captan with single-site and pre-mix fungicides are suggested.
- Single-site fungicides should not be applied once disease is developing.**

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.

Leaf symptoms, tree defoliation, twig infection

Field trials on Alternaria leaf spot management 2017

Similar to scab, incidence and severity of Alternaria leaf spot was low at test trial locations that in previous seasons had high levels of disease. This is likely due to reduced irrigation schedules because of the state-wide drought and subsequently less favorable disease conditions.

cv. Monterey, Colusa Co.
 Applications 5-18, 6-7, 6-20-17
 NIS = non-ionic surfactant

Treatment	Rate(/A)	Disease rating (0-4)
Control	---	a
Ph-D + NIS	6.2 oz + 8 fl oz	b
Quash + Intuity + NIS	3.36 oz + 3.36 + 8 fl oz	b
Luna Sensation + NIS	7.8 fl oz	b
Luna Experience + NIS	8 fl oz	b
Quadris Top + DynAmic	14 + 14 fl oz	b
EXP-AD + NIS	11 fl oz	b
IL-5412 + NIS	15 fl oz	b
IL-5413 + NIS	12.5 fl oz	b
IL-5414 + NIS	12.5 fl oz	b

isolate No.	Cross resis. group	pyridinecarb oxamide	pyrazole-4-carboxamides			N-methoxy-(phenylethyl)-pyrazolecarbox amides	pyridinyl-ethylbenzamide	phenyl-oxo-ethyl thiophene amide	pyrazinecarb oxamide
		Boscalid	Fluxapyroxad	Penthiopyrad	Isopyrazam	Pydiflumetofen	Fluopyram	Isfetamid	Pyraziflumid
1	---	0.054	0.02	0.045	0.035	0.002	0.024	0.159	0.018
2	---	0.027	0.016	0.019	0.022	0.002	0.03	0.070	0.015
3	---	0.042	0.017	0.027	0.021	0.002	0.051	0.159	0.035
4	---	0.030	0.017	0.021	0.020	0.001	0.037	0.075	0.006
5	---	0.035	0.012	0.021	0.024	0.004	0.023	0.036	0.007
6	---	0.045	0.016	0.033	0.023	0.002	0.054	0.080	0.005
7	1	5.05	1.53	4.97	4.414	0.045	0.457	0.366	11.272
8	1	5.98	1.53	5.95	3.835	0.036	0.431	0.659	4.415
9	1	>20	1.62	>20	4.453	0.036	0.276	0.659	4.415
10	1	>20	1.52	>20	2.308	0.215	0.458	2.442	>40
11	1	>20	1.60	>20	1.702	0.026	0.215	0.250	5.129
12	1	>20	0.85	>20	2.231	0.026	0.218	0.369	2.664
13	1	>20	0.94	>20	2.198	0.023	0.211	0.190	1.286
14	2	1.67	0.206	0.379	0.181	0.022	0.023	0.039	0.581
15	2	3.20	0.139	0.427	0.132	0.007	0.019	0.021	0.172
16	2	3.50	0.123	0.734	0.265	0.014	0.034	0.041	0.546
17	2	5.46	0.164	0.576	0.241	0.025	0.037	0.052	0.300
18	2	9.349	0.107	0.185	0.121	0.014	0.020	0.034	0.268
19	---	12.87	0.34	9.2	0.712	0.034	0.082	0.419	>40
20	---	3.20	0.025	0.033	0.233	0.013	0.017	0.176	0.139
21	---	12.2	0.70	4.0	0.752	0.014	0.194	0.230	1.554
22	---	>20	0.19	0.308	0.172	0.010	0.012	0.027	0.170
23	---	>20	0.34	>20	2.836	0.048	0.302	0.626	>40

Numbers represent EC₅₀ values for inhibition of mycelial growth.

Cross-resistance in Alternaria spp. isolates from almond among fungicides in six SDHI sub-groups

- Cross-resistance groups previously identified are no longer upheld when including additional SDHI fungicides.
- Pydiflumetofen is the most active SDHI compound to date. No high resistance identified.

■ Sensitive
■ Moderately resistant
■ Highly resistant

Summary: Management of Alternaria leaf spot

- Late-spring/early-summer applications based on the DSV model by calendar starting in May until late June/early July.
- Highly effective fungicides: Quash, Ph-D, Inspire Super, Quadris Top, Luna Sensation, Luna Experience, Merivon, Ph-D + DMI, Fontelis + DMI, Aproach, UC-2, IL-54111 - have to be strictly used in rotations and/or mixtures for resistance management.
- Integrated disease management: row orientation with prevailing winds, pruning to improve air movement, nitrogen management, improve water penetration, shorter irrigation periods, dust control.

Overall Summary for Foliar Diseases

Integrated management of 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 application: Alternaria, scab, rust, Monilinia hull rot	1 application: Rhizopus hull rot, and insect pests (e.g., NOW)

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