

Disease Identification Guide
for Almonds and Pistachios

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Commitment to the Almond and Pistachio Industries

We are focused on a healthy tree:

- **Help provide whole-season protection for tree health with a comprehensive portfolio of leading fungicides, insecticides, and herbicides to deliver maximum yields and quality**

We are your valued partner:

- **Invest and support the almond and pistachio industries**
- **Help growers protect their investment**



Syngenta's Commitment to Helping Growers Manage Disease Resistance

Syngenta provides products with a wide range of chemistries and different modes of action, so almond and pistachio growers have a diverse arsenal to combat a broad range of diseases. Syngenta's deep portfolio combined with in-field expertise gives growers both the tools and the knowledge to manage hard-to-control diseases. With trusted brands and ongoing research investment, Syngenta is committed to protecting the tools we have and developing new disease management tools for the future.





Seasonal Calendar

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Seasonal Calendar for Almonds



DISEASES	Dormant	Pink Bud	Full Bloom	Petal Fall	Two Weeks Post Petal Fall	Five Weeks Post Petal Fall	Spring Sprays	Hull Split	Harvest
Alternaria leaf spot						** 			
Anthracnose									
Brown rot blossom blight									
Green fruit rot (jacket rot)		***							
Leaf blight									

** Quadris Top and Abound are not recommended for strobilurin-resistant alternaria

*** Suppression only



Seasonal Calendar for Almonds *continued*











DISEASES	Dormant	Pink Bud	Full Bloom	Petal Fall	Two Weeks Post Petal Fall	Five Weeks Post Petal Fall	Spring Sprays	Hull Split	Harvest
Leaf Rust						Quadris Top ® Inspire Super ®			
Phytophthora crown, collar and root rot		Ridomil Gold ®							
Scab	Bravo WeatherStik ® + dormant oil*			Quadris Top ®	Quadris Top ® Bravo WeatherStik ® Inspire Super ®				
Shot hole			Quadris Top ®		Quadris Top ® Inspire Super ®				
Rhizopus hull rot**							Quadris Top ®		

* Syngenta supports a recommendation of FIFRA Section 2(ee) application of Bravo Weather Stik for tank-mixture with agricultural oil on almonds at the recommended rates in California.

** Syngenta supports a recommendation of FIFRA Section 2(ee) application of Quadris Top for the control of rhizopus hull rot in almonds.

Seasonal Calendar

Seasonal Calendar for Pistachios

DISEASES	Dormant	April	May	June	July	August
Alternaria late blight				  		
Botryosphaeria panicle and shoot blight			 			
Botrytis blossom and shoot blight		 				
Septoria leaf and fruit blight						



Treatments

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Treatments

TM

For Proven Wet Weather Performance Choose Bravo Weather Stik

Bravo Weather Stik[®] fungicide, with its patented Super Weather Stik formulation, adheres tightly to the leaf surface for persistent coverage you can count on, even in heavy rains. During dormancy use Bravo Weather Stik to protect against scab, or use it later in the season to manage Alternaria leaf spot and anthracnose. Whatever the target, the broad-spectrum activity, residual control and tank-mix flexibility make Bravo Weather Stik the obvious choice for almond growers.



Bravo Weather Stik Recommendations for Almonds*

Target Diseases	Use Rate	Remarks
Blossom blight/brown rot (<i>Monilinia</i> spp.)	4 pt/A (3 lb a.i./A)	Application: Use water volumes of 20-300 gal/A. For blossom blight, begin applications at popcorn (pink bud) and follow with an application at full bloom. If weather is still conducive for disease development, another application may be made at petal fall.
Anthracnose (<i>Colletotrichum acutatum</i>)	1.33 pt/100 gal** (1 lb a.i./100 gal**)	For control of shot hole, make an application in the autumn at leaf fall. In the spring, make the first application at bud break, followed by an application at shuck split to control nut infections and scab.
Scab (<i>Venturia carpophila</i>)		For dormant application from December 1 through December 31. Apply Bravo Weather Stik at the rate of 4 pt/A (64 fl oz/100 gal/A - concentrate application) in a tank mixture with 4 gal agricultural oil per acre. For dilute applications, use 1.33 pt product and 1 gal oil/100 gal (maximum of 300 gal/A).
Shot hole (<i>Wilsonomyces carpophilus</i>)		For control of anthracnose on almonds, apply 4 pt/A (3 lb a.i./A) or 1.33 pt/100 gal application mix (1 lb a.i./A). Use a water volume of 20-300 gal/A. Apply by ground or air.
		Specific Use Restrictions: <ul style="list-style-type: none"> Do not apply within 150 days of harvest. Do not apply more than 25 pt/A of Bravo Weather Stik (18.75 lb a.i.) during each growing season (leaf fall through shuck split).
		<i>*Please consult the Bravo Weather Stik label for complete use instructions.</i>
		<i>**Volumetric rates to be used only with full dilute spray specified on the Bravo Weather Stik label for tree and orchard crops.</i>

Bravo Weather Stik

Get Top of the Class Almond Disease Control with Inspire Super Fungicide

Inspire Super[®] fungicide offers disease control that is second to none for almonds and pistachios. It utilizes the unique active ingredient difenoconazole with translaminar activity and Vangard[®] WG fungicide with systemic activity to deliver long-lasting control of damaging diseases. For top-notch almonds and pistachios, growers can trust Inspire Super.



Inspire Super Recommendations for Almonds*

Target Diseases	Use Rate	Remarks
Blossom blight (<i>Monilinia</i> spp.)	16-20 fl oz of product/A	For blossom blight, apply 16-20 fl oz/A during the bloom period. The minimum retreatment interval is 14 days. Make no more than two sequential applications before alternating to another fungicide with a different mode of action. If disease pressure is high, use the highest rate.
Alternaria leaf spot (<i>A. alternata</i>)		For Alternaria leaf spot and scab, begin applications prior to disease onset when conditions are conducive for disease. If monitoring or history indicates the presence of Alternaria, apply 20 fl oz/A of Inspire Super in the late spring (mid-April to beginning of May) and then repeat the treatment two to three weeks later. Make no more than two sequential applications before alternating to another fungicide with a different mode of action. The minimum retreatment interval is 14 days. If disease pressure is high, use the shortest interval and the highest rate.
Green fruit rot (<i>Botrytis cinerea</i>)		
Scab (<i>Cladosporium carpophilum</i>)		
Anthracnose (<i>Colletotrichum acutatum</i>)		For all other diseases, use 16-20 fl oz/A. Begin applications prior to disease onset when conditions are conducive for disease. Apply Inspire Super on a 14-21 day schedule making no more than two sequential applications before alternating to another fungicide with a different mode of action. The minimum retreatment interval is 14 days. If disease pressure is high, use the shortest interval and highest rate.
Leaf blight (<i>Seimatosporium lichenicola</i>)		
Leaf rust (<i>Tranzschelia discolor</i>)		
Shot hole (<i>Wilsonomyces carpophilus</i>)		<p>Application: For best results, sufficient water volume must be used to provide thorough coverage. Use a minimum of 50 gal/A for ground applications. Use a minimum of 10 gal/A of water for aerial applications. Use ground application for best results.</p> <p>Specific Use Restrictions:</p> <ul style="list-style-type: none"> • Make no more than two applications by air. • 60-day PHI

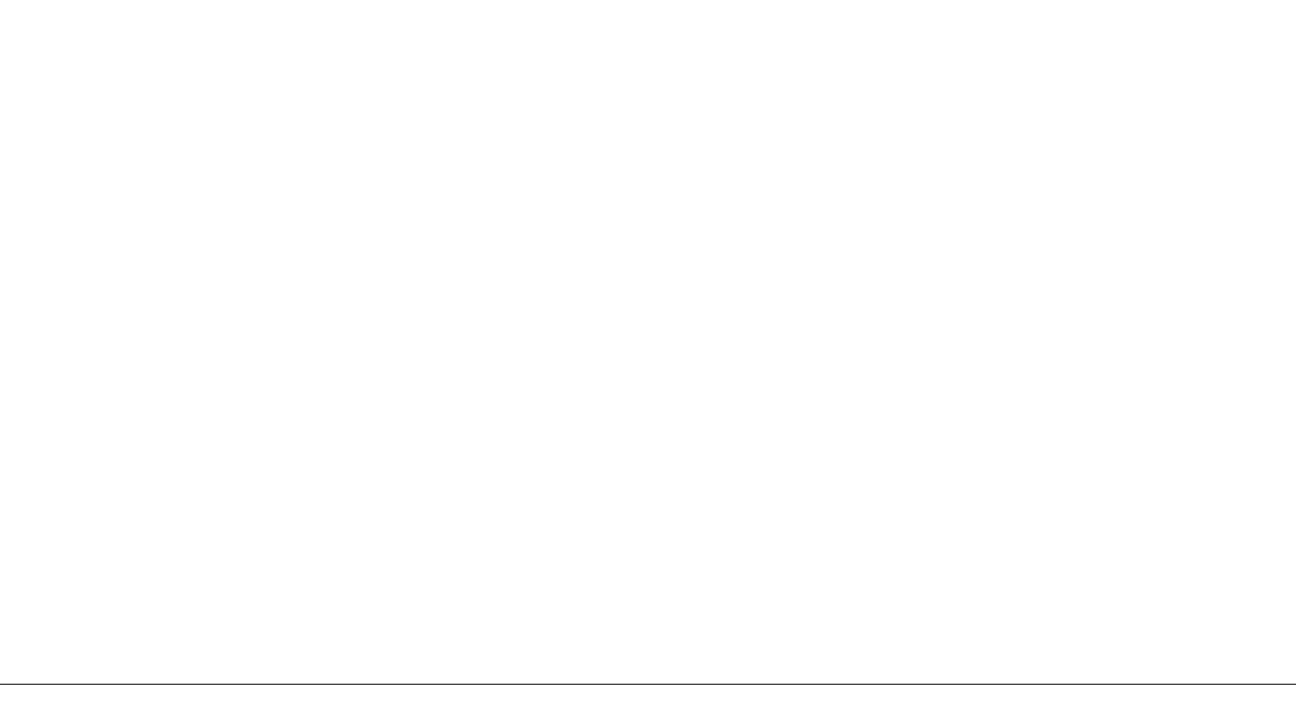
*Please consult the Inspire Super label for complete use instructions.

Inspire Super

Inspire Super Recommendations for Pistachios*

Target Diseases	Use Rate	Remarks
<p>Alternaria late blight (<i>Alternaria</i> spp.)</p> <p>Botrytis (<i>Botrytis</i> spp.)</p> <p>Panicle and shoot blight (<i>Botryosphaeria dothidea</i>)</p>	16-20 fl oz of product/A	<p>Begin applications prior to disease onset when conditions are conducive for disease. Apply Inspire Super on a 14-21 day schedule making no more than two sequential applications before alternating to another fungicide with a different mode of action. If disease pressure is high, use the shortest interval and the highest rate.</p> <p>Application: Application may be made by ground or air. For best results, sufficient water volume must be used to provide thorough coverage. Use a minimum of 50 gal/A for ground applications. Use a minimum of 10 gal/A of water for aerial application. Use ground application for best results.</p> <p>Specific Use Restrictions:</p> <ul style="list-style-type: none"> • Do not apply within 14 days of harvest.

**Please consult the Inspire Super label for complete use instructions.*



Optimized to Deliver Peak Performance Across a Broad Spectrum of Almond and Pistachio Diseases

Quadris Top[®] fungicide exhibits preventive, systemic and curative activity, and offers foliar disease control whenever it's needed. It protects almonds and pistachios from a broad spectrum of profit-robbing diseases. It helps protect almonds from Alternaria leaf spot, anthracnose, blossom blight, leaf blight, leaf rust, scab and shot hole. On pistachios, it helps combat Alternaria late blight, panicle and shoot blight, and Septoria leaf spot.



Quadris Top Recommendations for Almonds*

Target Diseases	Use Rate	Remarks
Alternaria leaf spot (<i>A. alternata</i>)	12-14 fl oz of product/A	For blossom blight, begin applications at early bloom and continue through petal fall. Make no more than two sequential applications before alternating to another fungicide with a different mode of action.
Anthracnose (<i>Colletotrichum acutatum</i>)		For all other diseases, begin applications prior to disease onset when conditions are conducive for disease. Apply Quadris on a 14-21 day schedule making no more than two sequential applications before alternating to another fungicide with a non-QoI (Group 11) mode of action.
Blossom blight (<i>Monilinia</i> spp.)		If monitoring or history indicates the presence of Alternaria, apply 14 fl oz/A of Quadris Top in the late spring (mid-April to beginning of May) and then repeat treatment two to three weeks later.
Leaf blight (<i>Seimatosporium lichenicola</i>)		If disease pressure is high, use the shortest interval and highest rate.
Leaf rust (<i>Tranzschelia discolor</i>)		
Scab (<i>Venturia carpophila</i>)		
Shot hole (<i>Wilsonomyces carpophilus</i>)		

Quadris Top Recommendations for Almonds* *continued*

Target Diseases	Use Rate	Remarks
Rhizopus hull rot (<i>Rhizopus stolonifer</i>)	14 fl oz of product /A at 1% hull split and repeat no later than 40% hull split if conditions remain favorable for development of disease (hull drying likely to extend beyond 4 weeks)	<p>Apply Quadris Top by ground at 1% Hull Split in a minimum of 100 gal/A. Thorough coverage of the almond hull is essential for disease control.</p> <p>Applications can be made with standard Navel Orangeworm applications.</p> <p>If hull drying is likely to extend beyond 4 weeks then a subsequent application of Quadris Top may be applied before 40% hull split but not inside of the 28 day pre harvest interval.</p> <p>Application: By ground or by air but for best disease control, ground applications are strongly recommended. Good coverage is essential for effective disease control. For ground applications a minimum of 100 gal/A. Apply as a foliar spray in sufficient water to obtain thorough coverage of foliage.</p> <p>Specific Use Restrictions:</p> <ul style="list-style-type: none"> • Do not apply more than 14 fl oz/A per spray • Do not apply more than 2 consecutive Quadris Top sprays • Do not exceed 56 fl oz/A of Quadris Top per acre per year. • 28-day PHI • 12 hour REI

**Please consult the Quadris Top label for complete use instructions.*



Quadris Top Recommendations for Pistachios*

Target Diseases	Use Rate	Remarks
<p>Alternaria late blight (<i>Alternaria</i> spp.)</p> <p>Panicle and shoot blight (<i>Botryosphaeria dothidea</i>)</p> <p>Septoria leaf spot (<i>S. pistaciarum</i>)</p>	12-14 fl oz of product/A	<p>Begin applications prior to disease onset when conditions are conducive for disease. Apply Quadris Top on a 14-21 day schedule making no more than two sequential applications before alternating to another fungicide with a non-Qol (Group 11) mode of action. If disease pressure is high, use the shortest interval.</p> <p>Application: For best results, sufficient water must be used to provide thorough coverage. Quadris Top can be applied by either ground or aerial application. A minimum of 15 gal/A for ground applications is recommended. For aerial applications, a minimum of 10 gal/A of water is recommended.</p> <p>Specific Use Restrictions:</p> <ul style="list-style-type: none"> • Do not use with an adjuvant • Do not apply more than 56 fl oz/A of Quadris Top per crop • Do not apply more than 0.46 lb a.i./A per crop of difenoconazole-containing products • Do not apply more than 1.5 lb a.i./A per crop of azoxystrobin-containing products • 14-day PHI

*Please consult the Quadris Top label for complete use instructions.

Providing Effective Root Protection in a Proven Formulation

Ridomil Gold® SL fungicide offers long-lasting disease protection against several species of *Phytophthora* that can infect the roots and crown of the tree, and it effectively controls crown, collar rot and root rot caused by *Phytophthora* species. The hyperactive systemic activity of Ridomil Gold SL protects the plant from the inside out and results in higher yields and quality at harvest. From planting to year-to-year tree maintenance, Ridomil Gold SL helps keep roots healthier and trees more productive.



Ridomil Gold SL Recommendations for Almonds*

Target Diseases	Use Rate	Remarks
Crown rot	2 qt/A	<p>Application: Soil spray (broadcast or band): Apply under the tree canopy to cover the root zone two weeks after planting (new plantings) or in the spring before growth begins (established plantings). Additional application may be made at two- to three-month intervals, depending on the disease pressure. Make up to three applications per year. Apply before symptoms appear. Ridomil Gold SL will not revitalize trees showing moderate to severe symptoms. For intense plantings (two to three times the normal planting rate), apply on a per area basis (1,000 sq ft).</p> <p>Specific Use Restrictions:</p> <ul style="list-style-type: none"> • Do not exceed the equivalent of 6 lb a.i./A per crop of soil-applied mefenoxam-containing products. • In California, do not apply to newly planted trees within 45 days of planting. On some varieties, chlorosis may occur on leaf margins.
Collar rot	(2 lb a.i./A)	
Root rot (<i>Phytophthora</i> spp.)	or 1.5 fl oz/ 1,000 sq ft	

*Please consult the Ridomil Gold SL label for complete use instructions.

Outstanding Early-Season Disease Control for Almond and Pistachio Orchards

Vangard® WG offers almond and pistachio growers the very best in early-disease protection. Active against a wide range of fungal diseases, Vangard WG helps fight brown rot, jacket rot, and shot hole in almonds and Botrytis and Alternaria in pistachios. The powerful activity of Vangard also protects the delicate flowers from Monilinia infection, and the residual activity on the tree suppresses other diseases.



Vanguard WG Recommendations for Almonds*

Target Diseases	Use Rate	Remarks
Brown rot blossom blight (<i>Monilinia</i> spp.)	5-10 oz of product/A	Application: Apply Vanguard WG at 5-10 percent bloom. Additional applications at 50-100 percent bloom and petal fall may be necessary.
Suppression Only:		When used for control of brown rot blossom blight, Vanguard WG will provide suppression of shot hole.
Green fruit rot (jacket rot) (<i>Botrytis cinerea</i>)		For suppression of green fruit rot, apply at full bloom.
Shot hole (<i>Wilsonomyces carpophilus</i>)		For broad-spectrum disease control in tank mixture, apply Vanguard WG at a minimum rate of 5 oz in tank mixtures with other fungicides registered for use on almonds.
		Disease suppression for almond diseases refers to erratic control from fair to good, or consistent control at a level below that obtained with products registered for control.
		Specific Use Restrictions: <ul style="list-style-type: none"> • Do not apply more than 30 oz/A of Vanguard WG per plot of land per year • Make no more than two applications by air • 60-day PHI
		<i>*Please consult the Vanguard WG label for complete use instructions.</i>

Vangard WG Recommendations for Pistachios*

Target Diseases	Use Rate	Remarks
Botrytis (<i>Botrytis</i> spp.)	5.5-7 oz of product/A	Make the first application during early bloom and repeat applications at 14-day intervals if conditions remain favorable for disease development.
Alternaria (<i>Alternaria alternate</i>)		<p>Application: Application may be by ground. Good coverage is essential for good disease control. Use a minimum of 20 gal/A spray volume by air.</p> <p>Specific Use Restrictions:</p> <ul style="list-style-type: none"> • Make no more than two applications by air. • Do not apply more than 28 oz/A of Vangard WG (1.3 lb a.i./A of cyprodinil) per plot of land per year. • 7-day PHI

**Please consult the Vangard WG label for complete use instructions.*



Disease Identification
Almonds

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Almond Diseases

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Alternaria Leaf Spot

Alternaria Leaf Spot – *Alternaria alternata*

Symptoms

Infections appear as brown, circular lesions that coalesce into large, irregular necrotic zones on leaves.



Courtesy: Malcolm Media

Lesions often become black in the center where numerous spores are produced.

Disease Cycle

Symptoms of these leaf lesions are typically found in late summer. However, outbreaks can occur earlier and become severe enough to cause debilitating defoliation (especially in the southern San Joaquin Valley).

Conditions for Development

Warm temperatures, dew and humidity are ideal conditions for *Alternaria* leaf spot development. This disease is consistently worse in areas of little or no air movement and where dew remains for many hours each day in late spring through summer.

Anthracnose

Anthracnose – *Colletotrichum acutatum*

Symptoms

Leaf infections are yellow, irregular lesions that begin at the leaf margin or tip and advance toward the middle of the leaf.



Courtesy: J. Adaskaveg

Infected nuts show round, orange colored, sunken lesions on the hull. Profuse gumming occurs as the infection progresses into the kernel.



Courtesy: J. Adaskaveg

Symptoms of anthracnose on almonds include blossom blight and fruit infections, often with spur and limb dieback. Infected flowers look similar to brown rot strikes.

The shoots or branches that bear infected nuts often die.



Courtesy: J. Adaskaveg

Disease Cycle

The anthracnose fungus overwinters in dead wood or in mummified fruit that remains attached to the tree. Orange lesions on the infected nuts may appear as early as three weeks after petal fall or later in the season if conditions are favorable. The shoots or branches that bear infected nuts often die. Although the fungus may invade fruit wood, it is seldom cultured from affected branches. Death of the wood may result from a toxin rather than from colonization of the wood by the fungus.

Conditions for Development

All cultivars appear to be susceptible to anthracnose. Warm, rainy weather is ideal for anthracnose development. Pruning out infected woods helps reduce inoculum and limits the spread of disease.

Brown Rot Blossom Blight – *Monilinia laxa*, *M. fructicola*

Symptoms

Spore masses colored gray to tan collect on diseased flower parts.



Courtesy: Malcolm Media

Young blossom spurs and nearby leaves collapse to form shoot blight.



Courtesy: Malcolm Media

Infected twigs exhibit cankers with tan centers and dark margins. These cankers often exude gummy materials (gummosis).

Disease Cycle

The brown rot blossom blight fungus overwinters in twig cankers and on residual flower parts and spurs. Spore pads grow on these structures in late winter for primary inoculum in the spring. The spores are airborne or rain-splashed. Therefore, stigma, anthers and petals are all susceptible to infection, especially when the flower is open.

Conditions for Development

Blossom blight infections are most common at bloom until petal fall. Optimum conditions for development include foggy or rainy weather with temperatures around 75 F, but infection can develop with temperatures as low as 50 F to 60 F.

Green Fruit Rot (Jacket Rot) – *Botrytis cinerea*, *Sclerotinia sclerotiorum*, *Monilinia laxa*

Symptoms

Green fruit rot begins during the latter part of the bloom period when the fungus infects senescing petals and anthers. Infected petals develop water-soaked brown spots. Some infected petals may fall onto leaves causing secondary infections. Anther infections can spread to floral tubes or flower jackets causing them to wither and stick to developing fruit.



Courtesy: B. T. Teviotdale. Reproduced from Compendium of Nut Crop Diseases in Temperate Zones, 2002, American Phytopathological Society, St. Paul, Minn.

Disease Cycle

As fruit sets and starts to grow, a brown spot develops where the jackets stick to it. This is particularly a problem where nut clusters trap senescing flower parts. Frequently this leads to rot of entire nut clusters.

Conditions for Development

When conditions are cool and wet during bloom, it can cause severe losses. One or more of several pathogens may be involved.

Leaf Blight – *Seimatosporium lichenicola*

Symptoms

In spring and throughout summer, infected leaves wither (at the base of shoots), turn brown and die.



Courtesy: B. T. Teviotdale. Reproduced from Compendium of Nut Crop Diseases in Temperate Zones, 2002, American Phytopathological Society, St. Paul, Minn.

Disease Cycle

The fungus overwinters on dead petioles that remain attached to the tree. Spores are spread by rain. Leaf blight is usually not very severe or widespread – it rarely destroys more than 20 percent of the leaves in one season. But repeated sudden death of leaves will weaken trees and may contribute to yield loss.

Conditions for Development

The leaf blight fungus favors wet spring weather.

Leaf Rust

Leaf Rust – *Tranzschelia discolor*

Symptoms

Initial symptoms of this disease are yellow spots on the upper leaf surfaces.



Courtesy: Malcolm Media

Reddish to dark brown colored rust lesions appear on the lower leaf surfaces.



Courtesy: Malcolm Media

Disease Cycle

The leaf rust fungus overwinters on twigs or leaves, surviving in twig lesions or on other host parts. Rust is usually a late-season problem that can cause rapid defoliation.

Conditions for Development

The spread of infection occurs in moist conditions. Unless there are mid-season rains, leaf rust occurs only sporadically in the Sacramento Valley and is very uncommon in California cultivars.

Phytophthora Crown, Collar and Root Rot – *Phytophthora* spp.

Symptoms

Symptom expression depends upon how much of the root or crown tissues are affected and how quickly they are destroyed. Generally, crown rots advance rapidly and trees collapse and die soon after the first warm weather of spring. Leaves of such trees wilt, dry and remain attached to the tree. Chronic infections, usually of the roots, cause reduction in growth and early senescence and leaf fall. These trees may be unthrifty for several years before succumbing to the disease. *Phytophthora* infections typically kill young trees because their root systems and crown areas are small compared to those of mature trees.



Courtesy: B. L. Teviotdale. Reproduced from Compendium of Nut Crop Diseases in Temperate Zones, 2002, American Phytopathological Society, St. Paul, Minn.

Disease Cycle

Proper water management is the most important aspect in controlling root and crown rot. Do not allow water to accumulate or stand around crowns of trees. Provide adequate drainage to low spots in the orchards, areas that flood frequently and places where water penetration is extremely poor or leave areas unplanted.

Conditions for Development

Periods of 24 hours or more of saturated soil favor *Phytophthora* infections. Conversely, good soil drainage and more frequent but shorter irrigations reduce the risk of root and crown rot. Surface water from irrigation districts is mostly contaminated with *Phytophthora* species.

Rootstocks vary in susceptibility to the different *Phytophthora* species; none are resistant to all pathogenic species of the fungus. Thus, the success of a rootstock may depend in part upon the species of *Phytophthora* present in the orchard. In general, plum rootstocks are more resistant than are peach or peach-almond hybrids. Of the plum rootstocks, Marianna 2624 is the most tolerant to *Phytophthora* species.

Rhizopus Hull Rot – *Rhizopus stolonifer*

Symptoms

Black fungal growth
on the inside of the hull.



Source: Syngenta

Disease Cycle

Fungi produce a toxin that kills the shoot attached to the fruit. This causes other green fruit to not mature and therefore remain on the tree after harvest. Productivity is reduced in future years due to dieback and fruiting wood.



Source: Syngenta

Conditions for Development

Rhizopus hull rot threatens almonds from the beginning of hullsplit until the hulls dry. Depending on fertilization and irrigation, this period that can last from 10 days to 2 months.

Scab – *Cladosporium carpophilum*

Symptoms

Spots are soft-looking and grayish-black lesions. They can appear on leaves, nuts and twigs.



Courtesy: Malcolm Media

To check for young lesions, hold a leaf up to the light and look for indistinct yellow specks. Defined lesions are usually not visible until late spring or early summer.



Courtesy: Malcolm Media

Severe early-season epidemics incite premature leaf drop that may result in early nut drop.



Courtesy: J. Adaskaveg

Disease Cycle

The scab fungus overwinters in twig lesions. Starting in March, spores are spread by wind, rain and sprinkler irrigation. The disease often occurs in orchards where the irrigation is sufficient to reach the foliage at the bottom of the tree.

Conditions for Development

Scab favors prolonged, wet spring weather.

Shot Hole

Shot Hole – *Wilsonomyces carpophilus*

Symptoms

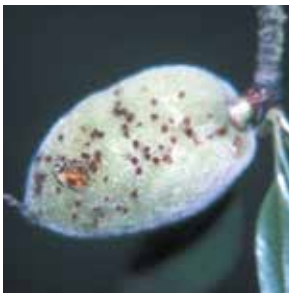
Leaf lesions start as reddish specks that grow into spots with tan centers and purplish margins. A small dark dot (the sporulating structure) appears inside the spot. Spots on young leaves usually fall out, leaving a shot hole effect.



Courtesy: B. L. Teviotdale. Reproduced from Compendium of Nut Crop Diseases in Temperate Zones, 2002, American Phytopathological Society, St. Paul, Minn.

Disease Cycle

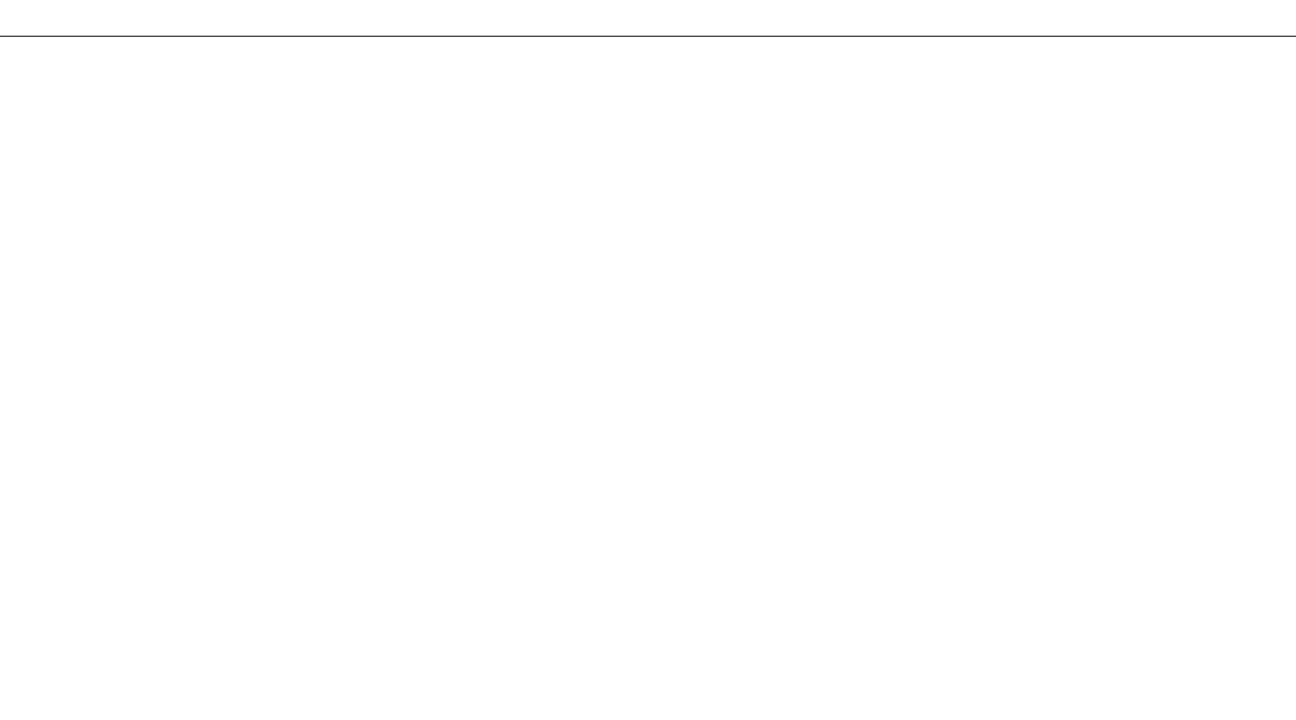
On fruit, lesions are small and raised, with purple borders. They usually appear on the top of the fruit as it hangs on the tree. Severe infection may distort the fruit or cause gumming.



Courtesy: B. L. Teviotdale. Reproduced from Compendium of Nut Crop Diseases in Temperate Zones, 2002, American Phytopathological Society, St. Paul, Minn.

Conditions for Development

Shot hole is most severe during prolonged wet spring weather. Mild temperatures and free moisture are necessary for spores to be produced, germinate and infect plant tissue. Prolonged periods of wetness due to either rain or sprinkler irrigation can enhance the spread and intensity of the disease, particularly in the lower branches.



A close-up photograph of a pistachio branch with several green, oval-shaped fruits. The background is dark and out of focus. The top of the image has a white perforated edge, suggesting it's a page from a binder.

Disease Identification Pistachios

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Pistachio Diseases

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Alternaria Late Blight – *Alternaria alternata*

Symptoms

Small leaf lesions form with characteristic chlorotic margins. On immature (green) nuts, lesions are black and small (about 1 mm in diameter). Lesions on mature nuts are black, vary in size and are surrounded by reddish margins.



Courtesy: T. J. Michailides. Reproduced from Compendium of Nut Crop Diseases in Temperate Zones, 2002, American Phytopathological Society, St. Paul, Minn.

Disease Cycle

Alternaria commonly occurs in nature and can easily develop on crop debris and senescing leaves of weeds. Spores are spread by air currents or splashed by water drops. “Late blight” describes Alternaria in pistachios because it develops – in its most severe form – late in the season during maturation of pistachio nuts. Early fruit symptoms show in late June, with the disease becoming very severe from late August to September on mature pistachios.

Conditions for Development

This pathogen favors high relative humidity and dew formation. It is a particular problem in orchards irrigated by sprinklers or flooding, although it can be a problem in orchards irrigated with micro-sprinklers, particularly in lower areas where relative humidity can be high and dew formation is frequent.

Botryosphaeria Panicle and Shoot Blight – *Botryosphaeria dothidea*

Symptoms

In mid-spring, young fruit clusters of shoots blight because of infected buds from the previous buds from the previous growing season. Advancing cankers also appear.



Courtesy: T. J. Michailides

Infected shoots quickly turn black and their leaves wilt and dry.



Courtesy: T. J. Michailides

Infected fruit covered with pycnidia (black structures) of the fungus (August to September).

In late summer and fall (August to October), large brown necrotic lesions develop on leaves.

Disease Cycle

The fungus overwinters on the tree inside the infected shoots (cankers), panicles, buds, leaf stems, nuts and leaves. Primary infections are caused by spores contaminating vegetative and flowering buds. Secondary infections of shoots, rachises, nuts and leaves are caused by spread of spores in water from spring and summer rains, via water from sprinkler irrigation, or other means (birds, insects, etc.). Under favorable conditions in August, the disease can

increase to epidemic proportions within two to three weeks and can kill most clusters on the trees.

Conditions for Development

This fungus is favored by high temperatures (80 F to 90 F) and produces new generations of spores in pycnidia by mid-summer and fall. The optimum temperature for growth, sporulation of fungus and disease development is 80 F to 86 F. The disease becomes very severe during late spring to summer when temperatures and relative humidity in pistachio orchards are high.

Botrytis Blossom and Shoot Blight – *Botrytis cinerea*

Symptoms

The first symptoms observed in the spring are wilting of tender shoots into a curved shepherd's hook at the tip as it dries.

Infection of inflorescence results in large cankers above and below the inflorescence. *Botryosphaeria* can also colonize these cankers.



Courtesy: T. J. Michailides

Shoots above the cankers are girdled and blighted in late spring or summer, turning bleached, bright brown or reddish brown.



Courtesy: T. J. Michailides

Disease Cycle

Blighted shoots provide spore inoculum of the fungus — not only during the growing season, but also the following spring. Under spring humid conditions, the fungus can colonize and sporulate on the male inflorescences on the tree or on those dropped on the ground. Other sources of inoculum come from sporulation of the fungus on weeds or spores blown in from other orchards.

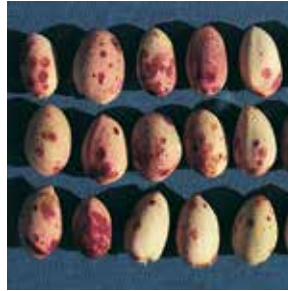
Conditions for Development

Botrytis blossom and shoot blight is prevalent during cool and wet springs and can cause losses, primarily killing current season shoots and thus reducing fruiting wood for the following season. Botrytis disease is restricted to blights that only occur in early spring. Symptoms are more severe in male than female trees because the inflorescences of these cultivars are larger and favor the retention of free water.

Septoria Leaf and Fruit Blight – *Mycosphaerella pistaciarum*

Symptoms

Leaf spots are round to irregular and 1-2 mm in diameter. Severe infection can cause extensive premature defoliation. Distinct grayish to brown lesions 1-4 mm in diameter appear in mature fruit surrounded by a distinct reddish halo.



Courtesy: T. J. Michailides

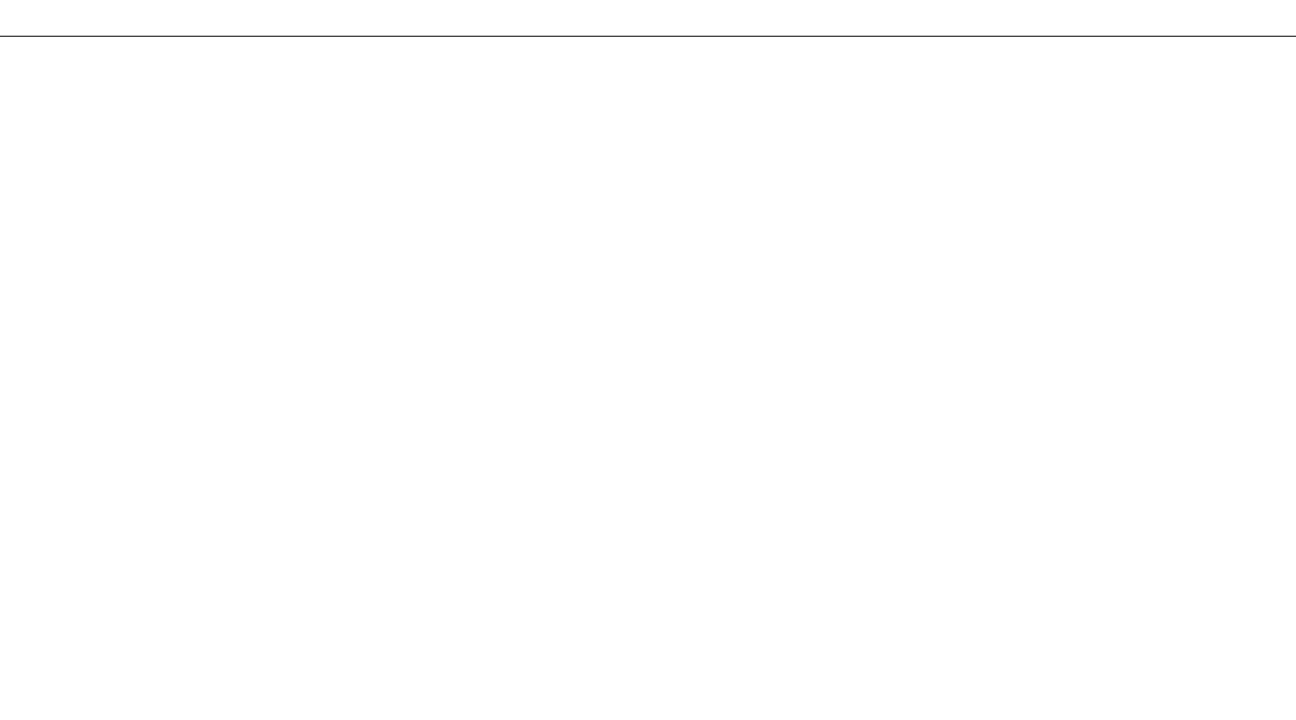
Pycnidia – tiny black spore-producing bodies – often develop in lesions. The spores exuded from pycnidia appear as white strings on leaf lesions.

Disease Cycle

The fungus overwinters in leaves on the orchard floor. The pycnidia, or spore-producing structures of *Septoria*, are spread by rain or sprinkler water.

Conditions for Development

Leaf blight has been observed on pistachios during the rainy season (July to September) in Arizona.



Syngenta Resources

Syngenta is committed to providing growers with the edge needed to grow excellent almonds and pistachios.

Syngenta Crop Protection
410 Swing Rd.
Greensboro, NC 27409

For emergencies call 1-800-888-8372
(exposure concerns, spills and leaks)

Syngenta Customer Center

- For product support and compliance call 1-866-SYNGENT(A) (796-4368)

www.syngenta-us.com

- Product labels
- Material Safety Data Sheets (MSDS)
- Sales representative finder to locate your local representative
- Company news and product updates

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Important: Always read and follow label instructions. Some crop protection products may not be registered for sale or use in all states or counties. Please check with your local extension service to ensure registration status. Syngenta supports a recommendation of FIFRA Section 2(ee) recommendations: Applications of Bravo Weather Stik for the control of anthracnose on almonds. Applications of Bravo Weather Stik for tank mixture with agricultural oil on almonds at the recommended rates in California. Applications of Quadris Top for the control of rhizopus hull rot on almonds.

None of the active ingredients in the aforementioned products are acutely toxic to bees.

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