Disease Identification Guide for Tree Nuts
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Commitment to the Tree Nut Industry

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 maximized yield and quality potential

We are your valued partner:

- Invest and support the tree nut industry
- Help growers protect their investment
Introduction

Syngenta’s Commitment to Helping Growers Manage Disease Resistance

Syngenta provides products with a wide range of chemistries and different modes of action, so tree nut 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 for Almonds

<table>
<thead>
<tr>
<th>DISEASES</th>
<th>Dormant</th>
<th>Pink Bud</th>
<th>Full Bloom</th>
<th>Petal Fall</th>
<th>Two Weeks Post Petal Fall</th>
<th>Five Weeks Post Petal Fall</th>
<th>Spring Sprays</th>
<th>Hull Split</th>
<th>Harvest</th>
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</thead>
<tbody>
<tr>
<td>Alternaria leaf spot</td>
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<td>Quadris Top**</td>
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<tr>
<td>Anthracnose</td>
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<td>Inspire^</td>
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<tr>
<td>Brown rot blossom blight</td>
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<td>Vangard^</td>
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<tr>
<td>Green fruit rot (jacket rot)</td>
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<td>Vangard***</td>
<td></td>
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<tr>
<td>Leaf blight</td>
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<td></td>
<td>Quadris Top</td>
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</tbody>
</table>

** Quadris Top is recommended for strobilurin-resistant alternaria

*** Suppression only
<table>
<thead>
<tr>
<th>DISEASES</th>
<th>Dormant</th>
<th>Pink Bud</th>
<th>Full Bloom</th>
<th>Petal Fall</th>
<th>Two Weeks Post Petal Fall</th>
<th>Five Weeks Post Petal Fall</th>
<th>Spring Sprays</th>
<th>Hull Split</th>
<th>Harvest</th>
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<tbody>
<tr>
<td>Leaf rust</td>
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<td></td>
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<tr>
<td>Phytophthora crown, collar and root rot</td>
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<td>Scab</td>
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<tr>
<td>Shot hole</td>
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<td></td>
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<tr>
<td>Rhizopus hull rot**</td>
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</table>

* Syngenta supports a recommendation of FIFRA Section 2(ee) application of Bravo Weather Stik for tank-mixure 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 for Pistachios

<table>
<thead>
<tr>
<th>DISEASES</th>
<th>Dormant</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternaria late blight</td>
<td></td>
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<tr>
<td>Botryosphaeria panicle and shoot blight</td>
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<td></td>
</tr>
<tr>
<td>Botrytis blossom and shoot blight</td>
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</tr>
<tr>
<td>Septoria leaf and fruit blight</td>
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</tbody>
</table>
## Seasonal Calendar

### for Walnuts

<table>
<thead>
<tr>
<th>DISEASES</th>
<th>Dormant</th>
<th>Leaf Emergence</th>
<th>Rapid Leaf Development</th>
<th>Flowering/Nut Development</th>
<th>Nut Sizing/Fill</th>
<th>Hull Split</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phytophthora crown, root and collar rot (crown gall secondary)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Botryosphaeria</td>
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</tbody>
</table>

*Botanical images and descriptions of diseases are not provided.*

**Seasonal Calendar**

7
Treatments
Get Top of the Class Almond Disease Control with Inspire Fungicide

Inspire® fungicide is a powerful solo triazole for disease control in tree nuts. With high intrinsic activity, Inspire offers economical control of Alternaria and other damaging diseases.

Once absorbed, Inspire stays localized and provides residual protection against disease for confident late season disease control.
## Inspire Recommendations for Almonds*

<table>
<thead>
<tr>
<th>Target Diseases</th>
<th>Use Rate</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| Brown rot/hull rot (Monilinia spp.)  | 7 fl oz of product/A | Begin applications prior to disease onset when conditions are conducive for disease. Apply Inspire on a 14- to 21-day schedule, making no more than two sequential applications before alternating to another fungicide with a different mode of action. If monitoring or history indicates the presence of Alternaria, apply 7 fl oz/A of Inspire in the late spring (mid-April to beginning of May) and then repeat the treatment two to three weeks later. For blossom blight, begin applications at early bloom and continue through petal fall. If disease pressure is high, use the shortest interval. **Application:** For best results, sufficient water volume must be used to provide thorough coverage. Inspire 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. **Specific Use Restrictions:**  
  - 14-day PHI  
*Please consult the Inspire label for complete use instructions.* |
| Blossom blight (Monilinia spp.)      |                   |                                                                                                                                         |
| Alternaria leaf spot (A. alternata)  |                   |                                                                                                                                         |
| Scab (Venturia carpophilica)         |                   |                                                                                                                                         |
| Anthracnose (Colletotrichum acutatum) |                   |                                                                                                                                         |
| Shot hole (Wilsonomyces carpophilus) |                   |                                                                                                                                         |
| Powdery mildew (Podosphaera tridactyla, Sphaerotheca pannosa) |                   |                                                                                                                                         |

*Inspire Recommendations for Almonds*
Get Top of the Class
Pistachio Disease Control
with Inspire Super Fungicide

For control of damaging pistachio diseases, growers can rely on Inspire Super® fungicide. Combining a trusted chemistry with the active ingredient cyprodinil, Inspire Super offers superior disease control. This unique fungicide provides excellent rainfastness and flexible application options, easily fitting into existing disease control programs for optimal yield and quality. For top-notch pistachios, use the product that is top of its class: Inspire Super.
### Inspire Super Recommendations for Pistachios*

<table>
<thead>
<tr>
<th>Target Diseases</th>
<th>Use Rate</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternaria late blight (Alternaria spp.)</td>
<td>16-20 fl oz of product/A</td>
<td>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. <strong>Application:</strong> 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. <strong>Specific Use Restrictions:</strong> • Do not apply within 14 days of harvest.</td>
</tr>
<tr>
<td>Botrytis (Botrytis spp.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panicle and shoot blight (Botryosphaeria dothidea)</td>
<td></td>
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</tr>
</tbody>
</table>

*Please consult the Inspire Super label for complete use instructions.
Optimized to Deliver Sustained Peak Performance across a Broad Spectrum of Diseases in Tree Nuts

A robust combination of an industry-leading strobilurin and one of the most powerful triazoles on the market, Quadris Top® fungicide protects tree nuts from a broad spectrum of profit-robbing diseases. Quadris Top exhibits preventive, systemic and curative activity to offer foliar disease control whenever it’s needed. Tree nut growers can rely on Quadris Top for an increased yield and a maximized return on investment.*

*Product performance assumes disease presence
Quadris Top Recommendations for Almonds*

<table>
<thead>
<tr>
<th>Target Diseases</th>
<th>Use Rate</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternaria leaf spot</td>
<td>12–14 fl oz</td>
<td>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.</td>
</tr>
<tr>
<td>(A. alternata)</td>
<td>of product/A</td>
<td></td>
</tr>
<tr>
<td>Anthracnose</td>
<td></td>
<td>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-Qol (Group 11) mode of action.</td>
</tr>
<tr>
<td>(Colletotrichum acutatum)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blossom blight</td>
<td></td>
<td>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. If disease pressure is high, use the shortest interval and highest rate.</td>
</tr>
<tr>
<td>(Monilinia spp.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leaf blight</td>
<td></td>
<td><strong>Application:</strong> For best results, sufficient water volume must be used to provide thorough coverage. Quadris Top can be applied by 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.</td>
</tr>
<tr>
<td>(Seimatosporium lichenicola)</td>
<td></td>
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</tr>
<tr>
<td>Leaf rust</td>
<td></td>
<td><strong>Specific Use Restrictions:</strong> • 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 • 28-day PHI</td>
</tr>
<tr>
<td>(Tranzschelia discolor)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scab</td>
<td></td>
<td><strong>Remarks:</strong> 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.</td>
</tr>
<tr>
<td>(Venturia carpophila)</td>
<td></td>
<td>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-Qol (Group 11) mode of action.</td>
</tr>
<tr>
<td>Shot hole</td>
<td></td>
<td>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. If disease pressure is high, use the shortest interval and highest rate.</td>
</tr>
<tr>
<td>(Wilsonomyces carpophilus)</td>
<td></td>
<td><strong>Application:</strong> For best results, sufficient water volume must be used to provide thorough coverage. Quadris Top can be applied by 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.</td>
</tr>
</tbody>
</table>

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

**Quadris Top Recommendations for Almonds* continued**

<table>
<thead>
<tr>
<th>Target Diseases</th>
<th>Use Rate</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| Rhizopus hull rot *(Rhizopus stolonifer)* | 14 fl oz of product/A in a dilute application at 1-10% hull split | **Application:**
For Rhizopus hull rot, apply at a rate of 14 fl oz/A in a dilute application at 1-10% hull split. If needed, a second application should be made at 20-40% hull split but not closer than seven days.

**Specific Use Restrictions:**
- 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
- 28-day PHI

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

<table>
<thead>
<tr>
<th>Target Diseases</th>
<th>Use Rate</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| Alternaria late blight (Alternaria spp.) | 12-14 fl oz of product/A | 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-QoI (Group 11) mode of action. If disease pressure is high, use the shortest interval. **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. **Specific Use Restrictions:** *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.*  

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

<table>
<thead>
<tr>
<th>Target Diseases</th>
<th>Use Rate</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| Botryosphaeria canker and blight             | 14 oz product/A| **Application:** Apply 14 oz/A of Quadris Top fungicide to control Botryosphaeria canker and blight. Make a second application 14 to 21 days later then alternate to another fungicide with a non-QoI (Group 11) mode of action.  
**Specific Use Restrictions:**  
• Do not apply more than 56 oz product of Quadris Top per crop per year  
• 45-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 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 and Walnuts*

<table>
<thead>
<tr>
<th>Target Diseases</th>
<th>Use Rate</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crown rot</td>
<td>2 qt of product/A (2 lb a.i./A) or 1.5 fl oz of product/1,000 sq ft</td>
<td><strong>Application:</strong> Soil spray (broadcast, band or irrigation): Apply to soil beneath the tree canopy or apply through irrigation water (micro-sprinkler or drip) to cover the root zone two weeks after planting (new plantings) or in the spring before growth begins (established plantings). Additional applications may be made at 2- to 3-month intervals, depending on disease pressure. Make up to 3 applications per year. Pressurized Injection (Drip or Micro Sprinkler Irrigation): Ridomil Gold SL can be applied through a pressurized irrigation system (drip or micro sprinkler) at the rates and timings specified on the label.</td>
</tr>
<tr>
<td>Collar rot</td>
<td></td>
<td><strong>Specific Use Restrictions:</strong>  - 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.</td>
</tr>
<tr>
<td>Root rot (Phytophthora spp.)</td>
<td></td>
<td><em>Please consult the Ridomil Gold SL label for complete use instructions.</em></td>
</tr>
</tbody>
</table>

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*Please consult the Ridomil Gold SL label for complete use instructions.*
Outstanding Early season Disease Control for Almond and Pistachio Orchards

Vangard® WG fungicide offers almond and pistachio growers protection they can count on, both before and after infection, 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. This activity helps ensure a high level of disease control that growers can count on, for a better quality crop at harvest.
# Vangard WG

## Vangard WG Recommendations for Almonds*

<table>
<thead>
<tr>
<th>Target Diseases</th>
<th>Use Rate</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown rot blossom blight (Monilinia spp.)</td>
<td>5-10 oz of product/A</td>
<td><strong>Application:</strong> Apply Vangard WG at 5-10 percent bloom. Additional applications at 50-100 percent bloom and petal fall may be necessary.</td>
</tr>
<tr>
<td>Suppression Only:</td>
<td>When used for control of brown rot blossom blight, Vangard WG will provide suppression of shot hole. For suppression of green fruit rot, apply at full bloom.</td>
<td></td>
</tr>
<tr>
<td>Green fruit rot (jacket rot) (Botrytis cinerea)</td>
<td>For broad-spectrum disease control in tank mixture, apply Vangard WG at a minimum rate of 5 oz in tank mixtures with other fungicides registered for use on almonds.</td>
<td></td>
</tr>
<tr>
<td>Shot hole (Wilsonomyces carpophilus)</td>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

**Specific Use Restrictions:**
- Do not apply more than 30 oz/A of Vangard WG per plot of land per year
- Make no more than two applications by air
- 60-day PHI

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

<table>
<thead>
<tr>
<th>Target Diseases</th>
<th>Use Rate</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botrytis (Botrytis spp.)</td>
<td>5.5-7 oz of product/A</td>
<td>Make the first application during early bloom and repeat applications at 14-day intervals if conditions remain favorable for disease development.</td>
</tr>
<tr>
<td>Alternaria (Alternaria alternata)</td>
<td></td>
<td><strong>Application:</strong> Application may be by ground. Good coverage is essential for good disease control. Use a minimum of 20 gal/A spray volume by air.</td>
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<td><strong>Specific Use Restrictions:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Make no more than two applications by air.</td>
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<td>• 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.</td>
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<td></td>
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<td>• 7-day PHI</td>
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</tbody>
</table>

*Please consult the Vangard WG label for complete use instructions.*
Disease Identification
Almonds
Symptoms
Infections appear as brown, circular lesions that coalesce into large, irregular necrotic zones on leaves. 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.
Symptoms
Leaf infections are yellow, irregular lesions that begin at the leaf margin or tip and advance toward the middle of the leaf.Infected nuts show round, orange colored, sunken lesions on the hull. Profuse gumming occurs as the infection progresses into the kernel.
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.

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.

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

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.

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

Leaf Blight – *Seimatosporium lichenicola*

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

**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 – *Tranzschelia discolor*

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

Reddish to dark brown colored rust lesions appear on the lower leaf surfaces.
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 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.
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. When smaller amounts of water are applied over a longer period of time, the soils are wet in the top foot for days at a time, leading to more Phytophthora issues, as compared to flood-irrigated soil that gets wet about once every three weeks.

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 Hull Rot – *Rhizopus stolonifer*

**Symptoms**
Black fungal growth on the inside of the hull.
**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.

**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.

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

**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 – *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.
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.

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.
Disease Identification
Pistachios
Alternaria Late Blight

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.

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.

Infected shoots quickly turn black and their leaves wilt and dry.
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. Shoots above the cankers are girdled and blighted in late spring or summer, turning bleached, bright brown or reddish brown.
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.
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.

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.
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