



# Commercial Pecans

## Controlling Rosette, Diseases and Zinc Deficiency

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**F**or pecan trees to be healthy and vigorous and for nut quality and yield to be satisfactory, producers must establish sound disease-management programs. Producers can prevent losses from diseases and insufficient zinc by implementing effective grove management practices.

### Disease development

Throughout the year, producers need to pay close attention to their groves and be able to recognize the factors—including weather, plant stages and disease development—that can contribute to disease outbreaks during the different seasons.

**Spring and early summer:** The fungi that cause pecan diseases require moisture and mild temperatures when the spores are germinating and infecting the immature leaves and nutlets. To reduce losses to these fungi, producers should follow cultural practices that shorten the time that leaves and young nutlets are wet after rain, dew or irrigation.

Also during this period, the leaves and nutlets are immature and most susceptible to the pecan scab fungus. In susceptible cultivars, the foliage is vulnerable also to downy spot fungus. Even when

sound cultural practices are followed, producers may need to apply a protective fungicide in some locations and on scab-susceptible cultivars. Continue these applications on 14-day intervals as long as weather conditions favor infection.

**Mid summer:** In summer, rain and dew are less likely to occur for extended periods, which reduces the chance of infection. If you carefully monitor weather conditions and disease development, you can reduce your fungicide costs by reducing rates and increasing intervals between applications when the weather is dry.

**Late summer and early fall:** Producers must continue to monitor weather conditions during the late summer and early fall. Although the foliage is mature and no longer susceptible to the scab fungus, the shucks surrounding the nuts are immature and vulnerable to late-season infections.

### Factors influencing disease development

As you develop a spray program, consider these factors:

- ◆ The susceptibility of certain pecan varieties to diseases, especially pecan scab
- ◆ Current weather conditions
- ◆ Predicted weather conditions for next 1 to 2 weeks
- ◆ Status of disease pressure in and near the orchard

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- ♦ Tree spacing
- ♦ Age of the trees
- ♦ History of disease in the orchard
- ♦ Date of last fungicide applications
- ♦ Last fungicide applied

## Periods when pecan diseases are common

In most locations, producing high-quality pecans that are both appealing and disease free requires multiple sprays during the growing season. See Table 1 for periods when pecan diseases are most often observed and when zinc can be used effectively.

For information on suggested fungicides approved for use on pecans, see Table 2.

## Fungicide activity

Fungicides differ in how they act on fungi. Two types of fungicides are contact fungicides and systemic fungicides. Contact fungicides are those that act on the fungus when it is on the surface of the leaf or nutlet. Systemic fungicides are taken in by the plant and become part of the sprayed tissue.

Systemic fungicides must retain their activity even after they are taken in by the tissue. On pecans, the movement of the fungicides is restricted—it does not move freely throughout the tree. The fungus is exposed to the fungicide both on the surface of the tissue and below the epidermal cells (Table 3).

Some systemic fungicides can act on a disease-causing organism, or pathogen, even after it has

penetrated the leaf and started to develop outward. This is known as “kickback.” Although the length of time after infection that the fungicide will still control the pathogen varies with fungicides, it is normally 24 to 72 hours.

To help prevent fungicide resistance:

- ♦ Rotate a contact fungicide with any other group.
- ♦ Rotate a first-generation fungicide with any other group.
- ♦ Rotate a second-generation fungicide with any fungicide that does not contain a second-generation fungicide.
- ♦ Rotate a third-generation fungicide with any fungicide that does not contain a third-generation fungicide.

## Label restrictions

Although all the products listed in this publication are approved for use on pecans, label restrictions and environmental concerns may restrict their use. You must consider these when selecting products. Always read the label and follow it closely.

## Zinc nutrition

Pecans require zinc for normal stem and leaf growth. Trees not receiving zinc do not produce enough indoleacetic acid (IAA), which is a naturally occurring growth hormone responsible for shoot elongation, leaf development and other critical plant functions. In trees lacking in zinc, the internodes between the leaves and stems are shortened.

This compaction of the annual growth is known as zinc rosette. Leaves are smaller, thickened and

Table 1. Periods when pecan diseases are observed most often and when zinc can be used effectively<sup>1</sup>.

Nut development or insect occurrence	Diseases most likely to occur at this stage	Stages when trees best respond to zinc
Bud break	Scab, downy spot	Rosette (zinc deficiency)
Prepollination	Scab, downy spot, vein spot	Rosette
Casebearer	Scab, downy spot, vein spot	Rosette
1st cover (14 days after casebearer)	Scab, fungal leaf scorch	Rosette
Cover sprays (continue at 14- to 21-day intervals as long as weather conditions favor disease development)	Scab, brown leaf spot, fungal leaf spot, powdery mildew	
Water stage	Scab, stem end blight	
Shuck worm	Scab	

<sup>1</sup>The exact time for fungicide applications varies. The number and timing of fungicide applications are influenced by varieties, fungicide applied, disease pressure and current and predicted weather conditions. Rosette treatments are effective only on immature foliage. On mature trees, all foliage is mature by mid June. On young trees, the foliage is receptive to zinc during the entire growing season.

**Table 2. Suggested fungicides approved for use on pecans.**

Common name	Chemical name	Company	Rate/acre	Diseases	Remarks
Abound	Azoxystrobin	Syngenta	6.21–2.3 oz	Scab, anthracnose	Maximum 1.16 qt/year. No more than 3 applications before switching fungicides. 7–21-day interval
Sovran	Kresoxim-methyl	BASF	Pre-pollination 2.4–3.2 oz Post-pollination 3.2–4.8 oz	Scab	Maximum 4 applications per year and 3 before switching fung. 14 day interval pre and 21 day post pollination
Enable 2F	Fenbuconazole	Dow AgroSciences	8 oz	Downy spot, leaf scorch, powdery mildew, scab, vein spot, leaf blotch, gnomonia leaf spot	Must use wetting agent. Maximum 1.5 qt per year. 10- to 14-day interval pre- and 14- to 21-day post-pollination
Orbit 45WP+ Super Tin 80WP	Propiconazole+ Triphenyltin hydroxide	Griffin	5 acres/20 Orbit 45WP + 25 oz Super Tin 80WP Agpak	Scab, brown leaf spot, powdery mildew, liver spot, sooty mold, leaf blotch, vein spot, zonate leaf spot, fungal leaf spot	Ground-enclosed cab only. Only 6 treatments/yr
Super Tin 80WP <sup>8</sup>	Triphenyltin hydroxide	Griffin	5–7.5 oz	Scab, brown leaf spot, downy spot, powdery mildew, liver spot, sooty mold, leaf blotch	Enclosed cab only. Only 30 oz/season
Thiophanate Methyl 70W WSB	Thiophanate -methyl	Micro Flo	2–1 lb	Scab, brown leaf spot, downy spot, powdery mildew, liver spot, zonate leaf spot, stem end blight	Use higher rate for trees over 30 ft tall
Topsin 4.5FL		Cerexagri	20 fl oz		Do not exceed 60 oz/season
PropiMax	Propiconazole	Dow AgroSciences	4 oz Prepollination 6 oz Postpollination	Scab, downy spot, liver spot, vein spot, zonate leaf spot, leaf scorch	14-day interval
Stratego	Propiconazole+ Trifloxystrobin	Bayer	10 oz/A	Scab, anthracnose	No more than 30 oz/season. No more than 3 applications at a time before alternating. 14- to 21-day interval
Headline	Pyraclostrobin	BASF	6–7 oz/A	Scab	Maximum 4 applications/season or max of 28 oz/season. No more than 2 applications before switching fungicides to 14-day interval
Quilt	Azoxystrobin+ Propiconazole	Syngenta	14–27.5 oz/A	Scab	Do not apply after shuck split. Higher rates for high disease pressure

**Table 3. Groupings of fungicides for rotational purposes to avoid resistance development.**

Group	Fungicide
First-generation systemic fungicides	Topsin M 70W Topsin 4.5 fl
Second-generation systemics—sterol inhibitors	Enable 2F Orbit 45 WP Propimax Quilt
Third-generation systemics—strobilurins	Abound Sovran Stratego Quilt
Mixture of second- and third-generation systemics	Stratego Quilt
Mixture of second-generation systemic + contact fungicide	Orbit/Super Tin
Contact fungicide	SuperTin

somewhat distorted. When the deficiency is severe, the affected leaves develop necrotic areas between the veins. Fungi are often associated with these necrotic lesions.

Zinc sprays are essential for early-season pecan growth. The most effective applications are early and frequent. Several formulations of zinc are approved for use on pecans (Table 4).

Elemental zinc is the most toxic to plants other than pecans and grapes. To protect nearby plants from poisoning, avoid drift. If drift is a possibility, use NZN™ or a similar formulation. Do not use any zinc product at a rate higher than that specified on the product label. If you are applying more than one zinc spray within 2 weeks, reduce the rate by half. Never spray young trees that are not actively growing.

## Aerial application

Aerial application of fungicides either by fixed wing or rotary aircraft has not proven as effec-

**Table 4. Zinc sources and rates per 100 gallons of water.**

Source	Rate
Zinc Sulfate™ (36% WP)	2 lb
Zinc Nitrate™ (17 L)	20 fl oz
Tracite-N-Zinc™ (17% L)	1 qt
ZN Special™ (13.5% WP)	2 lb

tive as are ground applications. However, it may be necessary to make an aerial application when the disease potential is severe and weather conditions prevent the use of ground equipment.

To achieve satisfactory disease control, take into consideration the tree height, the density of leaf canopy and the requirements for maximum coverage.

## Chemical use precautions

For the most effective, safe, economical control, use suggested materials. All suggested materials are poisonous, but proper handling reduces the hazards associated with use. Read and comply with the manufacturer's label directions for storage and handling of toxic chemicals.

## Residues

The EPA has established pesticidal residue tolerances on pecans. These regulations establish the amount of a specific chemical that can be present in or on pecans at harvest. Always consult the product label for specific restrictions, and be sure the pesticide used is registered for use on pecans and is used only in accordance with specific application instructions.

## Caution

All pesticides are poisonous; some are poisonous to humans, animals, nontarget crops, etc. Use them carefully, and store them out of reach of children, irresponsible persons, livestock and household pets. Dispose of leftover spray solution and empty containers properly.

## Pesticide drift

Avoid spray drift into urban areas, rivers, lakes or crops that will be used for food for human consumption or livestock feed, unless the product is approved for use on that crop and the rate and timing follow the label recommendations.

To reduce the chances for pesticide drift, follow these guidelines:

- ◆ When using an air blast sprayer, direct the force of the air blast away from the two or three rows next to a sensitive area.
- ◆ Avoid spraying when the wind is blowing in the direction of a sensitive area.

- ♦ Take care when spraying toward county or state highways. Drift onto vehicles traveling on the road can cause accidental exposure and concern.
- ♦ Do not spray when it's foggy. Pesticides can be captured in the fog droplets and carried far from the application site.
- ♦ When spraying around sensitive areas, use the least toxic materials.
- ♦ Use buffer zones to prevent drift onto sensitive areas. A buffer zone can be:
  - An open space where native or planted grass can be used to catch drift.
  - A dense grass buffer between the sprayed trees and surface water that can filter out much of the pesticide runoff from pecan trees.
  - Hedge rows or closely planted trees that do not require spraying. Research has shown that in some instances, the drift will be carried by air currents over the plant material.
- ♦ Cut off the spray in open spaces between trees.
- ♦ Make sure that the upper two-thirds of the nozzles are directed to the upper 70 percent of the top canopy, but do not go above the tree.
- ♦ Remember that smaller droplets are more likely drift.
- ♦ If there is a drift problem, stop and consider precautions to avoid movement of pesticides into sensitive areas.

## Poisoning symptoms

Symptoms of pesticide poisoning include headaches, nausea, cramps, blurred vision, weakness, muscular twitching and diarrhea. If any of these symptoms occurs during or after handling a pesticide or spraying, consult a physician immediately.

Always maintain a copy of the label and the Material Data Sheet.

## Spray application considerations

It is essential that the foliage and nuts be covered completely with fungicide. For conventional, high-volume hydraulic sprayers, a general rule for the volume of finished spray required is ½ to 1 gallon of spray mixture per foot of tree height.

Most high-volume sprayers require a pressure of 300 to 400 pounds per square inch. Low-volume sprayers (such as mist blowers, air blast sprayers and speed sprayers) use forced air as the carrier

to deliver a concentrated spray mix and require proportionately less water. Concentrated spraying saves water and time but not pesticides because the same amount of pesticide is needed to achieve control on each tree.

## Coverage

The pecan foliage and nuts must be thoroughly covered with spray solution. The fungi that affect pecans infect the tissue where they land on the leaf or shuck. Good coverage is important for both contact and systemic fungicides.

## Calibration

Before making any pesticide application, calibrate the sprayers. This is necessary to determine the amount of chemical to add to the spray tank.

One of the easiest ways to determine the amount of water being applied per acre is to spray half an acre with clear water. Record the amount of water required to refill the tank. Multiply this amount by 2 to determine the amount applied per acre. Table 5 lists the number of trees per acre and per half-acre at different spacing.

If the trees in an orchard are not planted in rows but spaced randomly, determine the number of acres of land involved and the number of trees being sprayed. To calculate the average number of trees per acre, divide the number of trees into the acreage. Although not exact, this will give you an approximate number of trees.

If the trees vary in size, spray representatives of each tree size when determining the amount of water being applied. This is the amount of water

**Table 5. Number of trees per acre and half-acre at various spacings.**

Spacing	Number of trees/acre	Number of trees/half acre
35 x 35 ft	35	17.5
35 x 40 ft	31	15.5
40 x 40 ft	27	13.5
45 x 40 ft	24	12.0
45 x 45 ft	22	11.0
50 x 50 ft	17	8.5
60 x 60 ft	12	6.0

used to spray 1/2 acre of trees. Multiply this number by 2 to determine the amount of water used per acre.

Using this rate and the rate of chemical per acre, you can determine the amount of pesticide applied per 100 gallons of water. Below are two examples (Table 6).

## Summary

Effective disease management programs require that producers use a wide variety of practices. These include:

- ◆ Select varieties that are productive and resistant to pecan scab fungus.
- ◆ Select orchard sites that have good air circulation.
- ◆ Space the trees to allow for air circulation and sunlight. At midday, 25 percent of the orchard floor should be in sunlight.
- ◆ Manage the orchard floor to remove diseased shucks and leaves.
- ◆ Apply zinc as a foliar spray.
- ◆ Take soil samples and follow fertilizer recommendations.
- ◆ Remove trees that are susceptible to pecan scab and cannot be sprayed properly.
- ◆ Apply insecticides when pest populations reach levels that require treatment. (Refer to current Extension publications that have pest thresholds.)
- ◆ Apply fungicides as needed.

Table 6. Amount of pesticide needed per 100 gallons of water.

Factor	Example A	Example B
Tree spacing	35 × 35 ft	60 × 60 ft
Sprayer tank capacity	300 gal	300 gal
Fungicide rate/A	Enable™ 8 oz/A	MicroFlo™ 1 lb/A
Water required to spray 0.5 A	85 gal	200 gal
Water required to spray 1 A	170 gal/A	400 gal
Number of acres covered A	300 (tank capacity)/170 gal to spray 1A = 1.8A	300 (tank capacity)/400 (gal/A) = 0.75 with full tank of spray
Amount of fungicide needed to charge tank	8 oz/A X 1.8 A = 14.4 oz/300 gal tank	1 lb/A X 0.75 A = 0.75 lb/300 gal tank





Suggested pesticides are registered and labeled for use by the Environmental Protection Agency and the Texas Department of Agriculture. The status of pesticide label clearances is subject to change, and many may have changed since this publication was printed. County Extension agents and appropriate specialists are advised of changes as they occur.

The user always is responsible for the effects of pesticide residues on livestock and crops, as well as problems that arise from drift or movement of the pesticide from one's property to that of others. Always read and carefully follow the instructions

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