# Pecan Diseases and Their Control

**Cooperative Extension Service**
**College of Agriculture and Home Economics**

**Guide H-645**
**Replaces 400 W-11**

**Revised by Natalie P. Goldberg, Extension Plant Pathologist**

This publication is scheduled to be updated and reissued 6/01.

The pecan is well adapted as a commercial crop or an ornamental shade tree in southern New Mexico. Relatively few parasitic disease organisms are a problem because of dry atmospheric conditions during the growing season. There are some disease problems, however, that can cause extensive losses to pecan growers and home gardeners.

## ABIOTIC DISEASES (caused by non-living factors)

### Freeze Injury

Freeze injury causes more pecan tree losses in New Mexico than all other diseases combined. Most losses occur in newly planted orchards; however, older trees also can be affected by freezing temperatures.

Injury has resulted from early winter freezes, such as the ones that occurred in November 1976 and October 1992; extreme mid-winter freezes (January 1978); and late spring freezes. Severe tree losses resulted from the November 1976 freeze, which occurred before trees had properly hardened off during the fall.

*Symptoms.* Limb die-back is the most noticeable symptom of freeze injury. Splits, cracks, cankers on the bark, and entry of various borers into the bark are also symptoms. Young trees may not leaf out in the spring, but may produce an abundance of sucker growth from below the ground level. Young trees injured in the spring may bleed severely when sap starts to flow. Damage to the trunk and larger branches may be much more severe on the southwest (sunny) side of the tree where sap started to flow during warm periods in the winter.

About a year after a severe freeze has occurred, light-colored bark can often be seen, particularly around bud scars and below branches. Growers should cut into these off-colored areas with a sharp knife. If the bark and tissue below (cambium and xylem) is dead, this is good evidence that severe injury has occurred.

Injury from a freeze may not be evident until two, three, or even four years after a severe freeze has occurred. This type of injury is "subtle injury," and may be more noticeable in a tree that produces a heavy nut crop two or three years after a freeze. Usually the nuts do not mature, and most of them may become sticktights (see explanation of sticktights on page 3).

Occasionally, numerous fruiting structures of the fungus *Cytospora* sp. will grow on the bark of trees affected by freeze injury. The fungus appears as pinhead-sized bumps that produce masses of orange spores following wet, humid periods. No special controls are needed for this fungus. (See prevention of freeze injury, below.)

*Prevention of Freeze Injury.* If possible, avoid planting highly freeze-susceptible trees such as 'Wichita'.

Stimulate rapid spring growth by providing adequate nutrients (especially nitrogen and zinc) and water, but do not stimulate late fall growth with late fertilizer application. Apply all nitrogen fertilizers before July 1. It is best to try to encourage early dormancy in pecan trees, especially in young orchards planted with 'Wichita' trees. Stop irrigation in late September, unless the temperatures in October remain high.

Paint the southwest side of trunks and larger limbs of young trees with white latex paint or whitewash. Other measures include wrapping trunks with burlap strips, aluminum foil, or other products. It is important to keep bark tissue in a dormant condition during the winter and early spring. If these protective measures are not taken, sap will start to flow on the southwest side of the tree where the sun has heated the trunk and severe freeze injury can result.

Additionally, freeze injury can be minimized by applying one or two heavy irrigations during December and January.

*Care of Winter-Injured Trees.* Prune all suckers except one on young trees that have been killed to the ground. This sprout can be used later for re-budding.

Severely prune trees that have extensive injury. Where subtle injury has occurred, growers should prune out dead and weak limbs as they appear. This

recovery may take two or more years. In the spring after the last freeze, water and fertilize trees to stimulate new growth.

**Mouse Ear**

Mouse ear is another problem caused by freeze injury. Leaves of affected trees are smaller than normal, rounded on the ends to the shape of a mouse's ear. These symptoms were present on many young trees in the spring of 1977 following the severe freeze in November 1976. Examine trees with mouse ear symptoms for evidence of freeze injury, and prune severely affected branches.

Molybdenum deficiency, though not reported in New Mexico, can present similar symptoms.

**Zinc Deficiency**

Zinc deficiency, commonly called "rosette," is a prevalent nutritional problem of pecans in New Mexico. Zinc is an essential nutrient for growth in plants, but is needed in low quantities compared to other essential nutrients. For example, pecan trees usually need 25,000 ppm nitrogen, but only 50 ppm zinc. Zinc is needed to produce hormones that allow for cell enlargement in stems and leaves.

If zinc is not readily available to the tree, leaves become small, chlorotic, and misshapen. Under an extreme deficiency, yield and nut quality are reduced. Zinc deficiency symptoms usually are first noticed the second or third year after planting a new tree. The first symptom is small, narrow leaves that are yellowed and mottled. Reddish-brown areas often appear between the veins on older leaves. Internodes (the distance between nodes on the stem) become shortened, and an excess of smaller branches is formed, giving the foliage a rosette appearance. In the final stages of the disease, the shoots die back from the tips. Usually, the die-back is confined to the current year's growth, but it sometimes extends to older, larger branches.

Zinc is usually adequate in New Mexico soils, but it becomes unavailable in alkaline soil conditions (high pH) so tree roots cannot absorb enough of the element. This condition is usually more severe in sandy soils and soils that contain high phosphorus levels.

*Treatment of Zinc Deficient Trees.* Trees with a history of zinc deficiency, trees with obvious zinc deficiency symptoms, or those shown to be deficient in zinc following a leaf analysis should be treated with zinc. Foliar sprays with various zinc compounds are generally the most successful means of correcting zinc deficient-pecan trees. Because of the prevalence of this problem in New Mexico, yearly foliar applications have become a standard practice for many growers. Apply zinc sprays early in the season as the leaves are developing, then apply sprays weekly until leaf growth is complete. For mature trees, zinc is usually applied at bud break and then once every two weeks until five applications have been applied. Applications on young trees should continue until the end of July.

Zinc also may be applied as a soil treatment; however, the highly alkaline soil conditions prevalent in New Mexico often make this a less efficient application method. Soil applications may be tried on trees with little or no leaves (where absorption of the foliar materials is not possible) or on trees that fail to respond to foliar sprays. Zinc chelates are generally recommended. Soil treatment is most effective when applied in the early spring at the first sign of bud break.

More information regarding zinc and other nutrient requirements for pecans can be found in NMSU Cooperative Extension Service Guide H-602, "Pecan Orchard Fertilization."

**Chlorosis**

The causes of chlorosis (yellow leaves) are numerous. They include zinc deficiency, nitrogen deficiency, iron deficiency (not common in pecans), water-logged soils, freeze injury, root rot, crown gall, and herbicide injury.

When chlorosis is caused by a nutrient deficiency, adequate application of nutrients and water will usually correct the problem. Other control methods include improving soil drainage (see the following explanation under "Root Suffocation") when soils are water logged and control practices for root rot and crown gall. Trees with chlorosis caused by low to moderate freeze or herbicide injury will generally grow out of the problem as the trees begin to recover. Cultural practices such as those listed under "Herbicide Injury" may be useful in attempts to repair chlorosis caused by herbicide damage on more severely affected trees.

**Root Suffocation**

Pecans are not adapted to poor soil drainage, a condition found in many New Mexico growing areas. Poorly drained soils become saturated with water over time and do not have sufficient oxygen for normal tree growth. If not corrected, roots start to rot, trees begin to decline, and the top branches start to die. The soil may turn black and have a putrid odor.

Excessive water applied to trees growing in heavy, clay soils is the most common cause of root suffocation. This problem also can occur in orchards where layers of silt have accumulated around trees after

flooding or where additional soil has been applied around trees in orchards that have been re-leveled.

Every effort should be made to correct drainage problems. Trenches dug out from the trunk and refilled with loam soil will promote drainage. Trees that have died back should be pruned to remove weak and dying limbs.

**Premature Nut Drop**

A certain amount of nut drop begins early in the growing season and continues until maturity. The August drop is occasionally quite severe and is of greatest concern to growers. In general, poorly grown trees with low vigor are most likely to drop nuts prematurely. Numerous causes and conditions may explain premature nut drop: insufficient food reserve resulting from excessive production during the previous year; poor pollination; poor nutrition; embryo abortion (causes unknown); poor planting sites (poor soils); excessive soil moisture; drought; heavy pest infestation, particularly infestations of nut casebearer, stinkbug, and leaf-footed plant bugs; shuck necrosis; herbicide injury; and wind storms.

**Shuck Necrosis**

"Shuck necrosis" is a term used to describe abnormal black spotting on shucks. This abnormality begins during the water stage of development and may continue to develop until frost. Two or more spots are usually found on affected shucks and appear at random, but may be more pronounced along the suture. The blackened spots are usually slightly sunken, but not necessarily so. There may be a definite or indefinite border between affected and unaffected shuck tissue. In many cases, the nuts drop prematurely. Nuts that remain on the tree usually do not develop properly and may cause a sticktight condition.

The cause (or causes) of shuck necrosis has not been determined. Many attempts have been made to isolate causal organisms from affected nuts, but no known pathogenic organisms have been identified.

Shuck necrosis should not be confused with normal darkening of shucks along the sutures at the stem end, which begins near the end of the growing season. Likewise, this problem should not be confused with shuck disease and stem-end blight diseases reported from other pecan-growing states.

**Sticktights**

Pecans with shucks that have failed to open properly at the end of the growing season are referred to as sticktights. Sticktights occur primarily as a result of immaturity. Its causes include early freeze; low heat units during the growing season; excessive nitrogen; low zinc levels; excessive water or drought conditions at the end of the growing season; water stress at the end of the season; excessive nut production on individual trees; or freeze injury of trunks and limbs in previous years. Correcting these problems should produce fewer sticktights.

**Herbicide Injury**

Careless herbicide applications often cause severe injury and even death in pecans and other trees. Unfortunately, many chemicals used to kill undesirable weeds affect undesirable and desirable plants alike. The three major types of herbicides that cause injury are contact herbicides, hormone-types, and soil sterilants.

Contact herbicides such as Paraquat® are often used to control weeds within the orchard along borders and ditch banks. Drift on windy days will cause circular, brown areas on leaves. Direct sprays on tree foliage will cause large areas of dead leaves, but injury is usually minimal.

Hormone-type herbicides such as 2,4-D and Round-up® are highly volatile, especially on hot days. These herbicides can cause injury for several miles if they are misapplied and the herbicide gets into wind currents. They can cause injury even at low concentrations. Sprayers previously used to apply herbicides also are a contamination source when they are used later to spray insecticides or fungicides. Compounds such as 2,4-D cause misshapen leaves that are curled, distorted, and twisted. In some cases, leaf and nut drop may result. Temporary injury can occur if trees get only a small dose of the chemical; however, severe limb die-back, chlorosis, and even death are possible if a considerable amount of the chemical is applied. Herbicides such as Round-up® often cause injury when they are applied to weeds around the base of young trees because the herbicides can penetrate the tree bark. Bark wraps with materials such as aluminum foil can be used to reduce this type of injury.

Soil sterilants such as Hyvar X® and Pramitol® have been used to kill weeds in waste areas for several years. Farmers and home gardeners often apply soil sterilants to cope with weeds in driveways, alleyways, farm machinery areas, and waste areas, but they may forget that tree roots can be growing in the treated area. Large trees sometimes have roots several feet past the drip line. Roots can absorb the chemicals as long as two or more years later, when they have grown into a treated area. Symptoms of injury include yellowing of veins, marginal leaf burn, browning, and death of cells between the veins causing white- to silver-colored leaves.

Death of entire leaves and branches usually follows. The side of a tree closest to a treated area is usually affected first.

Mitigating the damage to herbicide-affected trees is difficult, if not impossible, in most cases because the chemicals can be active for several years. High-value trees affected by herbicide injury may benefit from watering deeply at frequent intervals, pruning severely, adding large amounts of manure to the soil around the tree, and cutting roots that extend into the treated area. Some herbicides can be deactivated by applying activated charcoal at the rate of 7 lb/1000 $ft^2$.

### Wind Damage

High winds, especially in March and April, can cause severe leaf injury in newly planted trees. This problem is of special concern in newly planted fields with no protection from nearby trees or buildings. Wind-damaged leaves are usually scorched around the margins. The leaves may be quite puckered and have a ragged appearance.

Limbs broken by high winds should be pruned as quickly as possible.

### Limb Die-Back

Dying limbs at the ends of branches can be caused by zinc deficiency, winter injury, broken limbs, root suffocation, drought, crown gall, herbicide injury, wind damage, heart rot and wood rot, highly alkaline soils, or mechanical injury to trunk, scaffold limbs, and roots. To control these disorders, refer to other sections in this publication. When the cause cannot be determined, prune affected branches, apply extra water (if overwatering is not the cause), and fertilize to help trees recover.

## BIOTIC DISEASES (caused by infectious disease agents)

### Phymatotrichum Root Rot

This fungal disease is also called “cotton root rot” or “Texas root rot.” It is occasionally a problem in southern New Mexico at elevations below 5000 ft, but it is a problem only in the southwestern U.S. and northern Mexico. The fungus requires warm soils that have low organic matter and high calcium salts. It is known to attack 2000 or more species of dicotyledonous (broad-leafed) plants but none of the grasses and other monocotyledonous (monocots) plants are susceptible. If not treated, this disease can become severe on newly developed land that has never been cultivated or on land where the fungus has developed on alfalfa, cotton, or other susceptible crops.

The first symptom is a slight yellowing of the leaves. Growers who have experience with this disease can detect this early symptom two to three weeks before wilting actually occurs. Sudden foliage wilting and drying follow a few days later. These symptoms occur only during the summer and early fall months.

When roots are examined, rotting is quite noticeable. A magnifying lens may reveal delicate strands of the fungus wrapped around diseased roots. A microscopic examination by a plant pathologist is sometimes needed to confirm the disease as Phymatotrichum root rot.

During the summer when high humidity occurs, the fungus can be seen on the ground surface, especially in shady areas. It appears as white mats of cottony fungus material that turn to buff-colored powdery masses of spores within two to three days. The mats may be circular or have an irregular outline, and they are 4–6" or more in diameter. These spore mats indicate the presence of the pathogen; however, the spores produced are not viable, and the mats do not spread the fungus to healthy trees.

*Treatment of Diseased Trees.* If possible, start treatment when trees first exhibit root rot symptoms, i.e., when slight yellowing symptoms occur. If wilting symptoms occur or if leaves become dry, prune one-half or more of the top growth, or pull all of the leaves from the tree to reduce the transpiration rate.

Treat the soil with sulfur, ammonium sulfate, and manure using the following steps.

1. Loosen soil around affected trees out to the drip line of the branches.

2. Cover ground 2" deep with manure. Other forms of organic matter such as moldy hay can be substituted for manure.

3. On the prepared surface, scatter ammonium sulfate or an equivalent at a rate of 1 lb/10 $ft^2$.

4. Add the same amount of soil sulfur on top of the ammonium sulfate. A circle 12 ft in diameter (suitable for a tree 6–8" in diameter) would need 11 lb of ammonium sulfate and 11 lb of soil sulfur. Nitrate fertilizers such as ammonium nitrate should not be used where root rot is a problem.

5. Apply deep water following treatment and keep the soil moist until trees recover.

Some trees may not recover even if this treatment is used. Known root rot areas should be treated annually during March or April.

*Treatment at Planting Time to Avoid Root Rot.* Disease incidence can be minimized in an orchard by treating each planting hole with manure, soil sulfur, and ammonium sulfate.

1. Dig a broad and comparatively shallow hole.

2. Distribute a generous amount of manure (up to one-fifth of the hole by volume).

3. Apply soil sulfur at the rate of 1/4 lb/ft$^3$ of the tree hole.

4. Apply ammonium sulfate (21% nitrogen) or its equivalent at the rate of 1 oz/ft$^3$ of tree hole.

A round planting hole 4 ft in diameter and 2.5 ft deep has 30 ft$^3$. It should be treated with 6 ft$^3$ of manure, 7.5 lb of sulfur, and 1.75 lb of ammonium sulfate.

To distribute the materials well without the extra labor of mixing them, place them in thin layers alternating with layers of soil.

1. Place about 2" of manure or organic matter in the hole.

2. Scatter two handfuls of sulfur and one of ammonium sulfate over the first layer.

3. Cover with 3" of soil, and repeat layers until the hole is filled to 6" from the top.

4. Flood the hole to settle the soil.

5. Plant when soil is no longer muddy. If time permits, prepare tree holes 30–60 days before planting time.

Water after planting, then water frequently and lightly until trees are well established.

*Treatment of Planting Sites Where Trees Have Died from Root Rot.* Where trees have died from root rot, before replanting treat sites with a soil fumigant such as Vapam®.

1. Cultivate the soil thoroughly and keep it moist for a least five days before applying the fumigant.

2. Apply Vapam® when soil temperature is 55–90°F. Fall treatment is best.

3. Use 1.5 qt/100 ft$^2$ of Vapam® for sandy soils and 2 qt/100 ft$^2$ for heavy soils. Treat basins 5–10 ft in diameter, depending upon the size of tree that died in the site. (See table 1.)

4. Mix required amount of Vapam® with 2–3 gal of water and apply evenly over basin with a sprinkling can.

5. Flood basin to set soil to a depth of 4–6 ft; about 3" of water in sandy soils and 6" in heavy soils.

6. Cover treated area with a tarp or plastic sheet for five to seven days. After treatment, remove and cultivate soil lightly to allow the gas to escape. Wait at least two weeks after the tarp is removed before replanting.

*Precautions when using Vapam®*: Do not apply within 3 ft of the drip line of living plants, shrubs, or trees. Do not apply to dry soil, which causes Vapam® to be ineffective. Do not let Vapam® touch skin or eyes. Do not breathe fumes. Remove contaminated clothing and wash it. Check current registration before use and follow label directions very carefully.

**Table 1. Amount of Vapam® to apply to treat planting sites where trees have died from Phymatotrichum root rot.**

| Basin diameter (ft) | Basin volume (ft$^2$) | Vapam® dosage (oz) | |
|---|---|---|---|
| | | Sandy soil | Heavy soil |
| 5 | 19 | 9 | 12 |
| 6 | 28 | 13 | 18 |
| 7 | 38 | 18 | 25 |
| 8 | 50 | 24 | 32 |
| 9 | 63 | 30 | 40 |
| 10 | 78 | 37 | 50 |

## Heart Rot and Wood Rot

Heart rot and wood-rotting fungi enter trees through wounds that have not healed properly. The results of infections through wounds and improper pruning cuts are usually not noticed until trees are several years old. Such trees frequently have large cavities and wounds that have never healed. Woody or fleshy shelf fungi or mushrooms can be seen growing from the bark or wounds of severely damaged trees. Some affected trees may show little effects from heart rots and wood rots for several years. Other trees can become unproductive, die back severely, or die shortly after the disease is discovered.

This disease can usually be avoided by proper pruning and by avoiding unnecessary wounds, particularly at the base of the tree. Prune branches flush with the trunk so callus tissue can form and seal the wound. Never leave short projecting branch stubs next to the trunk, because they rarely heal and continue to provide entrances for wood-rotting fungi. Splintered and injured wood, particularly at the base of trees, should be removed cleanly with a sharp knife or chisel.

Treatment of pruning wounds with a wound dressing has been recommended for years, but the practice is not necessary and can be harmful. Research has shown that wound dressings containing asphalt can retard the healing process. Home gardeners wishing to dress a wound for aesthetic purposes can use outside latex house paint. Some benefit may be derived from swabbing wounds close to the ground with household bleach (Clorox®, Purex®) that has been diluted 1:5 with water.

**Powdery Mildew**

This fungal disease is considered to be of minor importance, but each year a few trees are affected following periods of high humidity and cool summer nights in areas where tree growth is dense. The fungus forms a white powdery growth on the nuts, and in rare cases may be found on the leaves. The white powdery fungus may disappear later, but affected nuts will have a brown russet appearance. Small nuts may result when they are infected early in the growing season, or the shucks may split prematurely and kernels may be shriveled.

Trees should be sprayed with a fungicide when severe infection occurs early in the season. Available fungicides include Benlate®, Topsin M®, Orbit®, and wettable sulfur compounds. Repeat sprays may be needed if the fungus threatens to spread during periods of high humidity. Some fungicides can be mixed with insecticides and nutrient sprays. Be sure to check labels and compatibility charts before mixing. If a compatibility chart is not available, perform a jar test before mixing chemicals in the tank. To perform a jar test, add a small amount of each chemical you want to mix together in a clean glass jar. Shake. If the chemicals coagulate, they are not compatible.

**Sooty Mold**

Sooty mold is a conspicuous black, sooty fungus frequently found on leaves and nuts of pecans. This fungus is not parasitic on plants and can easily be removed by rubbing with a clean cloth. It grows on honeydew produced by insects. The direct damage to plants is minimal; however, severe infestations will reduce the amount of light getting to the leaf surface. Controlling aphids and other insects will help to control sooty mold. Severe infestations can be treated with fungicides such as Benlate®, which reduce fungus growth.

**Crown Gall**

Crown gall is a bacterial disease occasionally found in pecan trees. The disease also appears in many other species, and in more than 40 plant families. The most common symptom is the presence of wart-like growths or tumors on the roots, or more often at the base of the trunk at or just below the soil lines. The galls are usually rounded, with irregular rough surfaces. They can vary in size from pea-size to several inches in diameter. The callus tissue formed at the graft or bud union is sometimes mistaken for crown gall. Many trees affected by crown gall grow poorly and have severe dieback, and eventually die. Other trees may show no effect from infection and live for years.

The bacterium enters plant tissue through wounds caused by cultivation, chewing insects, and nematodes. In nurseries and young orchards, tillage equipment is frequently responsible for injuries that lead to crown gall infection. The bacterium can be passed from diseased to healthy plants by contaminated grafting and pruning tools. It can be carried long distances within root or crown tissue of nursery stock or in a contaminated soil that comes with nursery plants.

Growers should inspect nursery stock carefully upon arrival and reject any plants with suspicious knots or galls. If crown gall is discovered in a few trees in a new orchard, it would be wise to remove them with as much root as possible to prevent the disease organism from spreading to other trees. If the disease is discovered in older trees that are producing well, simply remove any loose galls and discard them or treat them with Gallex®. Replacement trees should not be planted for at least two years in a planting site where diseased trees have been removed. If this practice is not practical, remove infested soil from the planting site, and replace it with “clean” soil.

Growers can help avoid this disease by dipping newly purchased bare-root trees in a Galltrol® solution, a biological control product. Nursery owners can usually avoid the disease by selecting planting and propagation wood from sources free of crown gall. It is also helpful to dip budding knives in a 10% bleach solution after budding each tree. Every effort should be made to avoid wounds of any kind while cultivating an orchard.

**Nematodes**

Plant parasitic nematodes are microscopic worms that feed on the roots of susceptible plants. To date, pecan orchard samplings have not revealed abnormally high numbers of pathogenic species in New Mexico, and no information is available about the effect of moderate levels of nematodes on pecans.

Yield reduction as a result of nematode infestations has not been proven in New Mexico. The use of systemic insecticides such as Temik® in previous years may help explain why nematodes have not become a severe problem, as Temik® has nematicidal activity.

If pecans are planted in sandy soils with a history of root-knot nematode, infestations may cause injury to trees resulting in reduced yield. Isolated examples of such situations have been recently identified, but this is not believed to be a widespread problem.


## ACKNOWLEDGMENTS

Publication 400 W-11, from which this guide is adapted, was originally written by Emroy L. Shannon, Extension Plant Pathologist Emeritus.

The authors are indebted to Dr. Howard Malstrom, director of the Texas A&M Agriculture Research and Extension Center at El Paso, Texas and to Dr. Harold Kaufman, Extension Plant Pathologist, Texas A&M University, for their contributions to this publication.

**Revised June1996** **Las Cruces, NM**
1.5M