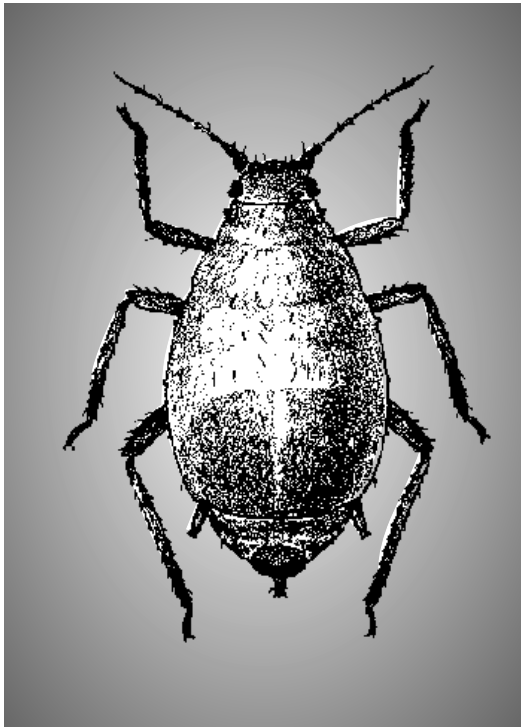


# Commercial Pecan Pest Control

Diseases, Insects, and Weeds



# Commercial Pecan Pest Control

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## Diseases, Insects, and Weeds

Management of diseases, insects, and weeds, combined with proper fertilization, culture, and management, improves production and quality of pecans. An experienced pecan grower should be able to develop a satisfactory control program using these pest control guidelines. The effectiveness of any pest control program, however, depends upon sound knowledge of the pests and the factors influencing their control.

### Sanitation and Cultural Control Practices

To control diseases and insects effectively, follow good sanitary and cultural practices. The following are important supplemental control practices to use with your regular spray programs:

1. Control weeds with herbicides or frequent mowing to reduce overwintering insects and disease organisms.
2. Knock old shucks and leaf stems off the trees before buds burst in the spring. This will reduce infection of the leaves by rain-washed scab spores. After a rain or on misty or foggy days, a slight jarring of branches will cause most of the old, wet shucks and leaf stems to fall.
3. Wherever possible, turn under all leaves, leaf stems, and shucks, or rake and burn them in the winter. Where this is not practical, as in sodded orchards, keep weeds mowed close to the ground.
4. Remove low-hanging limbs to improve air circulation and sunlight penetration. Leaves and nuts will dry more quickly after rains and heavy dews, and there is less chance of infection by fungus spores.
5. Maintain the optimum level of fertility to keep trees growing vigorously. Many leaf diseases thrive on weak trees.

### Spraying for Disease and Insect Control

The cost of spraying to control diseases and insects may constitute a significant portion of the total cost necessary to produce a crop of pecans. Therefore, you should understand the three main factors that make up a successful spray program. These factors are (1) timing, (2) coverage, and (3) rates.

**1. Timing**—To control diseases and insects, proper timing of spray applications is essential. Scab and other diseases are more severe following rainy weather and may rapidly reach damaging levels if young foliage and developing nuts are not protected by properly timed fungicide applications. Since sprays for disease control are largely preventive in nature, apply fungicides before infection occurs. Apply the first spray just as the new leaves begin to unfold; follow with the second spray 14 days later. These two sprays are the most

important because this is the most susceptible stage for leaf infection by the scab fungus, as well as several other fungi that cause leaf disease. Failure to reduce early scab development on foliage increases fungus inoculum potential for the remainder of the season. Follow with fungicide spray applications every 14 to 21 days until the first week in September to ensure that a protective fungicide cover is always present. In extremely wet weather, intervals between applications may have to be shortened. Insect control sprays are not necessarily required in each scheduled fungicide application.

**2. Coverage**—Spraying pecan trees for disease and insect control requires complete coverage of leaves, twigs, and nuts. To get complete spray coverage, the spray equipment used must be capable of delivering the pesticide to the top of the highest trees. It is important that the spray equipment is calibrated properly and that the operator is conscientious to ensure coverage of the tree from top to bottom. When using an air-blast sprayer, you must have 10, 15, and 20 gallons of water per tree to get adequate coverage on trees less than 25 feet, 25 to 35 feet, and more than 35 feet tall. For aerial applications, you must have at least 20 gallons of water per acre for coverage. Poor coverage can cause severe disease and insect damage.

**3. Rates**—Some pecan pesticide labels specify amount per acre, and others specify amount per 100 gallons of water. Since different types of sprayers (hydraulic, air-blast, mist blower, and airplane) are used for spraying pecans, we prefer to make recommendations as “amount per acre.”

The pesticide rates presented in the spray guide are based on 35-foot trees spaced 60 feet apart (12 trees per acre). On smaller trees, use three-fourths of the indicated amount; on larger trees, increase the indicated amount by one-fourth.

### Pesticide Precautions and Restrictions

The label on the product you are using is the best source of information on the handling and application of that product. The warning, danger, or caution statements, depending on the product involved, will provide information on the proper use, protective equipment needed, effects on wildlife and environment, empty container disposal, and what to do if poisoned.

**Follow label directions.** Many labels are being changed in the reregistration of products. Amounts of active ingredients may be different, and the interval from the last application to harvest could change. Read the label, and be sure you are using a material that has the crop, the pest, and the site listed on the label. Follow directions and work safely.

**Table 1. Pesticide Information and Restrictions**

<b>Name Brand</b>	<b>Preharvest Interval; Other Comments</b>
Abound	Do not apply near apple trees. Do not make more than 3 applications per acre per year. Do not apply within 45 days of harvest. Do not apply more than 1.16 qt per acre per season.
Enable 2F	Do not graze. Do not apply after shuck split or within 28 days of harvest. Do not apply more than 1.5 qt per acre per season.
Enable 75 WSP AgriTin*	Do not graze. Do not apply after shuck split or within 30 days of harvest. Do not exceed 10 applications during a single growing season. Do not apply in combination with emulsifiable concentrate insecticides.
Orbit 45 WP SuperTin 80 WP*	Do not apply within 30 days of harvest. Do not exceed 9 applications during a single growing season. Enclosed cabs only for ground application. Do not use in Lowndes, Monroe, or Noxubee counties.
Sovran 50WP	Do not apply within 45 days of harvest. Do not apply more than 25.6 oz in a single growing season. Do not rotate with Abound or Stratego.
Stratego	Do not apply after shuck split or within 30 days of harvest. Do not apply more than 30 fl oz per acre per season. Do not make more than 3 applications per acre per year. Do not mix or rotate with Abound.
Super Tin 80WP*	Do not graze. Closed cabs only for ground application. Do not apply more than 25.6 oz in a single growing season.
Syllit 65 WP	Do not graze. Do not apply after shuck split. Do not apply to Barton, Moore, Shawnee, and Van Deman varieties.
Topsin 70 WP	Do not apply after shuck split.
<b>Insecticides</b>	
Ammo* (cypermethrin)	21 days; do not exceed 0.8 lb a.i./a** per season. Do not graze.
Asana* (esfenvalerate)	21 days; do not exceed 0.3 lb a.i./a per season. Do not graze. This material is a skin irritant, so protect skin and eyes during application.
Bt Sprays	0 days; only controls caterpillars.
Dimethoate	21 days; do not graze.
Dormant Oils	Do not apply after foliage appears because of phytotoxicity. Follow all label directions to avoid phytotoxicity.
Guthion*	45 days; do not graze within 21 days of treatment.
Fulfil (pymetrozine)	14 days; do not exceed 8 oz/a per year.
Kelthane MF (dicofol)	7 days; do not exceed 2 applications per year. Obtain copy of special 24C label.
Lannate* (methomyl)	30 days; do not graze within 10 days of last application.
Lorsban (chlorpyrifos)	28 days; maximum of 5 applications per season. Do not graze. Do not apply by air.
Malathion	0 days; grazing permitted. Follow label directions.
Mustang MAX* (zetamethrin)	21 days; do not exceed 0.15 lbs a.i./a per season. Do not graze.
Phaser (endosulfan)	No application after shuck split. Do not graze. Phaser is extremely toxic to cattle and fish. Do not exceed 2 applications per year.
Sevin (carbaryl)	14 days; grazing may be allowed.
Temik 15G* (aldicarb)	Preharvest interval depends on rate used. See label for details. Temik is extremely toxic; follow label carefully. Note restrictions pertaining to wells and groundwater. Do not graze or harvest forage or hay.
Thiodan (endosulfan)	No application after shuck split; do not graze. Thiodan is extremely toxic to cattle and fish. Do not exceed 2 applications per year.
Vendex*	14 days; maximum of 2 applications per season. Do not graze.
Warrior* (cyhalothrin)	14 days; do not exceed 0.16 lb a.i./a per year. Do not graze.
Provado (imidacloprid)	Do not exceed 0.5 lb a.i./a per year.
Intrepid (methoxyfenozide)	14 days; do not exceed 1 lb a.i./a per year.

\*Indicates a compound is classified as restricted use and can be applied only by certified individuals. Some formulations of other compounds may also be classified as restricted use. Refer to label for more detailed information on restrictions.

\*\*a.i./a = active ingredients per acre

# Disease Control

**Table 2. Diseases Controlled**

Fungicide	Scab, Downy Spot, Brown Leaf Spot	Powdery Mildew	Liver Spot	Leaf Blotch	Fungal Leaf Scorch
Abound	X				
Enable 2F	X	X		X	X
Enable 75 WSP					
AgriTin	X	X	X	X	X
Orbit 45WP					
SuperTin 80WP	X	X	X	X	X
Sovran	X				
Stratego	X				
SuperTin 80WP	X	X	X	X	
Syllit 65 WP	X		X	X	
Topsin 70 WP	X	X	X		

**Table 3. Disease Control Recommendations—Amount of Fungicide Required Per Acre**

Time of Application	Pest	Fungicide	Amount/Acre	Comments
First Prepollination Spray—when buds are bursting and first leaves are showing.	Scab, Downy Spot	Enable 2F	8 fl oz	Do not mix Syllit 65WP with Orbit as crop injury may occur. Do not alternate Enable and Orbit. Enable/AgriTin and Orbit/SuperTin consist of two water-soluble packs that must be used together.
		<b>Or</b>		
		SuperTin 80WP	5.0–7.5 dry oz	
		<b>Or</b>		
		Sovran 50WP	2.4–3.2 oz	
		<b>Or</b>		
		Topsin 70WP	½–1 lb	
		<b>Or</b>		
		Syllit 65WP	2 lb	
		<b>Or</b>		
Second Prepollination Spray—14 days after first prepollination spray.	Scab, Downy Spot	Abound	6.2–12.3 fl oz	This and the previous spray are essential for control of scab. Thorough coverage is essential to prevent scab establishment.
		<b>Or</b>		
		Enable 2F + Syllit 65WP	4 fl oz 1 lb	
		<b>Or</b>		
		Enable 2F + SuperTin 80WP	4 fl oz 3.75 oz	
		<b>Or</b>		
		Enable 75WSP/AgriTin	See label	
		<b>Or</b>		
		Orbit 45WP/SuperTin 80WP	See label	
		<b>Or</b>		
First Cover Spray—when young nuts first appear, or two weeks after second prepollination spray.	Scab, Downy Spot	See above		
Second Cover Spray—three weeks after first cover spray.	Scab, Powdery Mildew, Brown Leaf Spot, Leaf Blotch	See above		See Table 2 for fungicides that control powdery mildew.
Cover Sprays—every 21 days following second cover spray. Continue until end of August.	Scab, Downy Spot, Powdery Mildew, Brown Leaf Spot, Vein Spot, Liver Spot, Leaf Blotch	See above		Apply cover sprays at 2-week intervals in rainy weather. Fungicide applications for scab may be omitted after August 30, provided the incidence of scab is low and climatic conditions are not extremely humid. Do not apply fungicides after shucks have started to open.

## Aerial Applications

Apply fungicide(s) in a minimum of 20 gallons of water per acre; refer to product labels for recommended rates per acre.

# Insect Control

## Scouting for Pecan Insects

Treatments for pecan insect control should be based on information gained by timely scouting. Although decisions about phylloxera control are based on scouting information obtained the previous year, most treatment decisions are based on weekly scouting reports. In many cases (aphids, for example), economic thresholds have been established, and treatments are applied only when the scouting report indicates the pest population has exceeded this set level. In other cases (pecan weevils, for example), scouting is important in timing insecticide applications for maximum effectiveness.

Travel through the pecan orchard and stop at randomly selected trees to make appropriate counts for the insect species of interest. With aphids, collect one or more compound leaves from each of many trees. Determine the total number of aphids (be sure to count black aphids and their damage separately from yellow aphids), calculate the average number of aphids per compound leaf, and compare results to the economic threshold.

Scout other pests in a similar manner during the same trip through the orchard. While scouting, be alert for incidental pests such as fall webworms and borers, as well as for diseases, weeds, and pruning needs. Additional survey methods such as black-light traps, pheromone traps, emergence traps, or knockdown sprays applied to key indicator trees are also used to monitor certain pests.

The life stage, or type of damage scouted, varies from pest to pest, as does the location on the tree that is sampled. With some pests, such as stink bugs, it is not necessary to take organized counts until you observe the pest in the orchard during the weekly scouting trip. With other pests, sampling can be limited to a specific period of time when the pest is known to occur. The comments section of Table 4 provides information on how and when to scout for particular pests. Proper scouting will help avoid many costly spray applications and the resulting destruction of beneficial organisms. It will also increase the effectiveness of applications by allowing more timely application, as well as helping to gauge the effectiveness of treatments.

## Pecan Insect Use

There are a number of factors that must be considered when choosing pecan insecticides. These include: efficacy against the primary target pest, cost, safety of applicators and non-target organisms, efficacy against other pests that may be of concern, potential for flaring secondary pests, and potential for resistance. Concerns over resistance are particularly important for aphid control. Although the synthetic pyrethroid compounds (Asana, Ammo, Mustang Max, and Warrior) are initially effective against aphids and will control many other pests as well, experience proves that aphids will rapidly develop resistance to these compounds when exposed to repeated applications. Therefore, use these compounds with restraint to prolong their usefulness in your orchard. Limit pyrethroid applications to no more than two before rotating to a non-pyrethroid, and try to restrict pyrethroid use to the latter half of the season.

Many of the pyrethroids, as well as Sevin, tend to increase, or flare, mite populations. Be particularly alert for mite problems in orchards treated with these chemicals. Applications of Sevin also have a strong tendency to flare yellow aphid populations. Therefore, be especially alert for increases in aphid populations following the use of Sevin for pecan weevils.

See Table 1 for preharvest intervals and other restrictions. Always verify this information by carefully reading the product label before applying any insecticide. Be sure to follow all directions and restrictions specified on the label. Rates suggested in this guide are for medium-sized trees, 25 to 35 feet tall, spaced 60 feet apart. Reduce rate by 25 percent for trees less than 25 feet, or increase by 25 percent for trees more than 35 feet, but do not exceed the maximum labeled rate.

Only one formulation of any particular insecticide is given. Other formulations may also be labeled for use on pecans and can be used by determining an equivalent rate based on pounds of active ingredient per acre.

**Always follow all label directions.**

**Table 4. Insect Control Recommendations**

Insects and Insecticides	Amount of Formulation Per Acre	Thresholds, Timing, and Comments	
<b>Phylloxera</b>			
Lorsban 4EC	1 qt	Phylloxera control has to be initiated at bud break (about April 1) while the insect is in the crawler stage. Controls applied after the start of gall growth are not successful. <b>Treat trees that had infestations last year as well as surrounding trees.</b> For best results, make applications during the part of the day. If a tree had as much as a 70 percent infestation rate last year (70 terminals out of 100 with galls present), two applications 7 to 10 days apart will give better control. Apply 1 pint of Lorsban at bud break and follow in 7 to 10 days with an additional pint.	
Thiodan 3EC	1 qt		
Phaser 3EC	1 qt		
warmest Sevin 4F	2 qt		
Provado 1.6F	3.5–7 fl oz		
<b>Pecan Nut Casebearer</b>			
Guthion 2L	2 qt	The pecan nut casebearer is sporadic in its occurrence across the state. It occurs around the middle of May, plus or minus one week. Orchards that have not had an insect management program or orchards with a recent history of nut casebearer problems should be monitored closely. <b>Treat if you find 3 percent of the nut clusters infested with eggs, larva, and/or damage.</b> If infestations are high, a second application may be necessary	
Sevin 80S	3 lb		
Confirm 2F	8–16 fl oz		
Javelin WG	1 lb		
Spintor 2SC	4–10 fl oz		
Warrior 1CS	2.56–5.12 fl oz		
Intrepid 2F	4–8 fl oz		
<b>Spittlebug</b>			
Guthion 2L	2 qt	Overwintering spittlebug eggs hatch in May, and spittle masses appear soon after fruit set. Second-generation spittle masses appear around mid-July. Controls are not necessary in most years. <b>If infestations are higher than 5 percent (1 spittle mass per 20 terminals), treatment is necessary.</b>	
Sevin 80S	2 lb		
Lorsban 4E	1 pt		
Thiodan 3E	1 qt		
Phaser 3EC	1 qt		
Provado 1.6F	3.5–7 fl oz		
<b>Yellow Aphids</b>			
(liquid sprays)		Yellow aphids overwinter as eggs that begin to hatch in late March and early April. The young aphids will crawl onto the developing leaves and begin feeding. The insects can be found on the underside of the leaves, and the early generations seem to prefer the apical ends of the leaves. Populations usually occur in two peaks: the first in late May and June, followed by a second peak in August and September. Use the following infestation levels to determine if treatments are necessary: Prior to July 1, 30 aphids per compound leaf; after July 1, 15 aphids per compound leaf. See comments in other sections about pyrethroid resistance in aphids.	
Thiodan 3EC	1 qt		
Phaser 3EC	1 qt		
Asana XL 0.66E	4.8–14.5 fl oz		
Ammo 2.5EC	3–5 fl oz		
Mustang MAX	2.5–4.0 fl oz		
Warrior 1CS	2.56–5.12 fl oz		
Fulfill 50WG	4 oz		
Provado 1.6F	3.5–7 fl oz		Provado is generally less disruptive of beneficial insects than other available aphid treatments, so it is recommended for early aphid control.
Lorsban 4E	1–2 pt		Lorsban is recommended for yellow aphids only in combination with one of the pyrethroid insecticides. See labels for appropriate rates for combinations.
(Granular Systemics)		Be especially careful to heed all label directions when using these granular compounds—they are extremely toxic. These granular systemic insecticides may be incorporated into the soil once per season in early spring. They are less disruptive to beneficial insects than foliar sprays but have the disadvantage of having to be applied as preventive treatments before the economic threshold is exceeded.	
Temik 15G		Temik 15-percent granules are labeled for aphid and mite control using either a single early season application or a split application (spring and midsummer). Make the single application of 33 to 67 lb of granules per acre from bud break to nut set (about April 15 to May 15). No additional applications can be made. With the split application, a lower rate of 17 to 33 lb per acre is applied from bud break to nut set, followed by a second application at midsummer of 17 to 20 lb per acre. <b>This midsummer application must not be made after July 15, and the preharvest interval is 15 weeks.</b>	
Single Application	33–67 lb		
Split Application	24C		
(Spring)	17–33 lb		
(Midsummer)	17–20 lb		
Newly transplanted trees	5–20 oz per tree	On trees up to 5 years old, apply 5 to 20 ounces per tree and work into the top 2 to 3 inches of soil for aphid, mite, and bud moth control, and for suppression of pecan leaf phylloxera. Do not graze or harvest forage or hay from Temik-treated areas.	

### Black Pecan Aphid

Same as for yellow aphids

Same as for yellow aphids

Black pecan aphids usually occur in late season. **Treat when counts exceed an average of one black pecan aphid or damaged area per compound leaf.** Note that the threshold is much lower than for yellow aphids because of the toxin injected into the leaf. Thus it is critical to distinguish between black and yellow aphids when making surveys. Also, dead, parasitized yellow aphids can be mistaken for black aphids. Use a hand lens when scouting for aphids and mites.

Provado 1.6F 7–14 fl oz

### Also

Dimethoate 4EC 0.666 pt

Lorsban 4E 1 pt

The materials listed for control of yellow aphids will also control black pecan aphids, but where black aphid is the only target, Cygon or Lorsban are also effective.

### Hickory Shuckworm

Guthion 2L 2 qt

Asana XL 0.66E 4.8–14.5 fl oz

Lorsban 4E 1 qt

Ammo 2.5EC 3–5 fl oz

Mustang Max 2.56–4.0 fl oz

Confirm 2F 8–16 fl oz/a

Spintor 2SC 4–10 fl oz/a

Warrior 1SC 2.56–5.12 fl oz

Intrepid 2F 4–8 fl oz

Shuckworms overwinter as larvae within the shucks either on the ground or on the tree. Adult emergence begins in late March or early April. These early moths lay eggs on pecan foliage, the galls of pecan phylloxera, and nuts of early developing hickories. Larvae emerging from eggs deposited on the foliage usually die before completing their life cycles; however, those that are deposited in galls or hickories can complete the cycle, thus maintaining the population until pecan formation. Although the shuckworm is present in most orchards, damaging populations are sporadic in the state. Control is most likely to be required against the late summer and fall generations. Light traps are very useful as survey tools to help time sprays. Where shuckworm is a problem and no light trap information is available, the best approach is to treat at the shell-hardening stage and follow with two additional applications at 10- to 14-day intervals. Sevin also will provide some shuckworm control when it is applied for pecan weevils.

### Mites, Pecan Leaf Scorch Mites

Kelthane MF 4E 1.5–2 qt

Vendex 50WP 1–2.5 lb

Pecan leaf scorch mites cause brown, scorched areas on the undersides of leaflets beginning at the midrib and spreading outward. Populations are normally higher during the latter part of the season. Previous insecticide sprays, especially pyrethroid insecticides or Sevin, may stimulate outbreaks. Populations usually begin in the shaded interior portion of the tree. **Treat when you observe mites on lower, interior limbs; re-treat in 5 to 7 days.**

### Pecan Weevil

Sevin 80S 3 lb

Sevin 4F 4–5 pt

Begin sampling around the last week in July or the first week in August. **Use sampling information to identify time of weevil emergence and time sprays for maximum effectiveness. Treat on a 7- to 10-day interval until surveys indicate that emergence has ceased.** Weevil populations can be monitored by several methods. One method is to lay a sheet or other material under the tree and jar the limbs directly above the sheet with a padded pole. If weevils are present, they will fall to the sheet and remain motionless for a short time. Other survey methods involve the use of cone-shaped emergence traps or knockdown insecticide sprays applied to indicator trees in the orchard.

### Stink Bugs

Ammo 2.5EC 3–5 fl oz

Guthion 2L 2 qt

Thiodan 3EC 2 qt

Phaser 3EC 2 qt

Mustang Max 0.8 EC 4 fl oz

Warrior 1CS 5.12 fl oz

No materials are specifically labeled for stink bugs in pecan trees. The insecticides listed here are effective against stink bugs in other crops. Stink bugs can be present in the grove throughout the year. However, numbers usually reach their peak in the latter part of July and remain high through September. Evidence indicates that although they feed on pecans, they do not breed on them; instead, they use plants such as peas, soybeans, clovers, and weeds for breeding sites. Control can be very erratic because of the high mobility of this insect. Help minimize infestations by mowing weeds and avoiding planting alternate hosts, such as those previously mentioned. **Scout by observing presence of adults, and initiate treatments if populations exceed one insect per 40 terminals.**

### Obscure Scale

Dormant Oil 3 gal per 100 gal of water

Although not common, this insect can weaken trees. It is difficult to detect because its appearance is similar to lichens on the bark. Apply in late February to bud break; use only 2 gal of oil per 100 gal of water on weakened trees. Follow label directions carefully, because oils can be phytotoxic when used improperly.

### Hickory Shoot Curculio

Same as for phylloxera

Where this insect is a problem, apply treatments when buds show  $\frac{1}{4}$  to 1 inch of growth.

### Hickory Nut Curculio

Sevin 80S	3 lb
Sevin 4F	4–5 pt

Hickory nut curculios will occasionally cause noticeable nut drop in some orchards. They are true weevils but are much smaller than pecan weevils ( $\frac{1}{4}$  inch or less). Damage occurs when adult weevils emerge in early summer, puncture immature nuts, and lay eggs. Punctured nuts exhibit a dark "tobacco-juice-like" stain on the husk around the puncture site and usually drop from the tree. There is only one generation per year. Treatment is rarely needed specifically for this insect. In areas where it has historically caused problems and treatment is necessary, sprays can be applied when nut drop and punctured nuts are first observed. Prompt removal and destruction of dropped nuts will break the life cycle by destroying developing grubs.

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### Fall Webworms, Walnut Caterpillars

Sevin 80S	2 lb
Lorsban 4E	1 qt
Bt sprays	See label
Confirm 2F	8–16 fl oz
Spintor 2SC	4–10 fl oz
Intrepid 2F	4–8 fl oz

These caterpillars are often controlled by many of the other insecticides used in spraying the orchard. The Bt sprays may be used to control caterpillars without affecting other beneficial insects. They are effective but take longer to work because the caterpillar must eat them.

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### Aerial Application

Aerial application is not allowed with some insecticides and may result in reduced levels of control in cases where it is allowed. See insecticide labels for recommended rates and amount of water required per acre.

## Weed Control

Weeds interfere with crop development by competing for resources essential for growth. Weeds reduce the amount of light, nutrients, and moisture available to cultivated plants. Weed interference results in reduced or slowed development of cultivated plants. Often, weeds serve as alternate hosts for insects and disease organisms that attack cultivated plants. You must use additional pesticides to prevent crop loss when this occurs. Weeds also reduce the efficiency of crop harvest. Clean orchard floors are necessary for fast and efficient pecan harvest.

Disking, once a standard practice for floor vegetation management, can cause severe root damage as well as erosion. Proper herbicide usage enables producers to maintain clean orchard floors year-round without the potential danger of root damage.

For adequate growth, small, newly established pecan saplings need only a narrow, weed-free strip (2 to 3 feet wide). Mature, nut-producing trees need a larger weed-free strip (10 to 15 feet wide). Weed control in this strip reduces competition for moisture and nutrients. Grass strips between rows help prevent erosion, and should be maintained for that purpose.

Several broad classes of herbicides are available for use in orchards, including the following:

- **Preplant incorporated herbicides** must be applied to the soil surface and mixed with soil to control weeds.

- **Preemergence herbicides** are applied to the soil surface before weed emergence and must be activated by rainfall or irrigation to control weeds. The amount of rain or irrigation needed to activate these herbicides varies. If you use irrigation, consult the label before application and plan to apply the required amount of water to move the herbicides into the soil.

- **Postemergence herbicides** are applied to emerged weed vegetation for control. Some herbicides yield a more satisfactory performance with the addition of a surfactant. Weed control with postemergence herbicides will be better applied to small (less than 4 inches tall), actively growing weeds than if applied to large, mature weeds or stressed weeds. Herbicide labels indicate the optimum weed size at which you should target the application.

Some weeds are more easily controlled with preemergence herbicides than with postemergence herbicides and vice versa. A combination of these materials will be necessary for year-round control. Likewise, split applications of postemergence herbicides may be needed for season-long control.

Many herbicides have preharvest interval restrictions. You must follow these restrictions. **Remember to read and follow all label directions for herbicide application.**

**Table 5. Weed Control Recommendations**

Herbicide	Amount Active Ingredient and Formulation To Use Per Broadcast Acre	Remarks		
<i>Preplant Incorporated</i>				
<b>trifluralin</b>	0.5–1.0 lb/a	Apply before planting trees and incorporate into the top 2 to 3 inches. Use the lower rate on coarse soils and the higher rate for fine-textured soils. Controls most annual grasses and many small seeded broadleaf weeds from seed. Plant trees through the treated soil, keeping treated soil away from the lower root system.		
Treflan 4L	1.0–2.0 pt/a			
Trilin				
Tri-4				
Trifluralin				
<b>Preemergence</b>				
Active Ingredient	Rate	Bearing	Nonbearing	Comments
<b>napropamide</b>				
Devrinol	8 lb/a of 50 DF	X	X	Applied to soil surface or incorporated. If rainfall does not occur within 24 hours, use shallow incorporation or irrigation with sufficient water to wet the soil to a depth of 2 to 4 inches.
<b>oryzalin</b>	2–4 qt/a of	X	X	Higher rates increase length of control. Rainfall or irrigation of 1 inch or more is required for activation.
Surflan	4 lb/gal			
<b>isoxaben</b>	0.66–1.33 lb/a of		X	Only treat trees that are not expected to bear fruit for at least one year after application.
Gallery	75 DF			
<b>oxyfluorfen</b>	6–10 pt/a of	X	X	Should be applied to the soil or base of dormant trees. After buds begin to swell, do not apply again until completion of harvest. Can also be applied postemergence (see postemergence section).
Goal	1.6 lb/gal			
<b>trifluralin</b>	1–2 pt/a of		X	For new plantings. Apply and incorporate before transplanting. Soil texture determines rates.
Treflan HFP	4 lb/gal			
<b>norflurazon</b>	2.5–5.0 lb/a of	X	X	Rate depends on soil type. Apply when rainfall or irrigation is likely to occur within 4 weeks after application. Use as a directed spray.
Solicam DF	78.6 DF			
<b>trifluralin + isoxaben</b>	100–200 lb/a of		X	Length of control and species controlled depends on rate. Rainfall or irrigation of at least 0.5 inches is required for activation.
Snapshot 2.5G	2.5 G			
<b>benefin + oryzalin</b>	200–300 lb/a of		X	Apply only to established plantings. Rainfall or irrigation of at least 0.5 inches is required for activation.
XL 2G	2G			
<b>simazine</b>	2–4 qt/a of 4L or 2.2–4.4 lb/a of 90DF	X	X	Do not apply when nuts are on the ground. Do not apply to transplanted trees that have been established less than 2 years.
Princep 90DF				
Princep 4L				
Simazine 90DF				
Simazine 4L				
<b>diuron</b>	2–4 lb/a of 80DF	X	X	Use only on trees established in the grove for at least 3 years. Do not apply to eroded areas where roots are exposed or to trees that are diseased or lacking vigor.
Karmex DF				
Diuron 80 DF				

**Postemergence**

Active Ingredient	Rate	Bearing	Nonbearing	Comments
<b>glyphosate</b> Roundup Ultramax Touchdown and other brands	Dependent on lb/gal and target weed. Consult label.	X	X	Between and within rows of trees. Use shielded sprayer, wiper treatment, directed sprays. Do not spray green bark or foliage.
<b>bentazon</b> Basagran	1.5–2.0 pt/a of 4 lb/gal		X	Directed spray. Do not apply within one year of harvest.
<b>glufosinate</b> Rely	3–5 qt/a of 1 lb/gal	X	X	Directed spray. Do not apply within 14 days of harvest.
<b>clethodim</b> Select 2EC	6–8 fl oz/a of 2 lb/gal		X	Use of crop oil concentrate is not recommended. Use non-ionic surfactant at the rate of 1 qt/100 gal. Use only on plants that will not bear nuts for at least one year following application.
<b>fluzifop</b> Fusilade DX	16–24 fl oz/a of 2 lb/gal		X	Use crop oil concentrate at the rate of 4 qt/100 gal or non-ionic surfactant at 1 qt/100 gal. Use as directed spray and avoid contact of spray with foliage. Do not harvest nuts within 1 year after treatment.
<b>paraquat</b> Gramoxone Extra Boa Cyclone Max	Dependent on formulation. Consult label.	X	X	Use as directed spray. Do not allow spray to come in contact with foliage of trees and bark of young trees. Use with a non-ionic surfactant at the rate of 1 pt/100 gal or a crop oil concentrate at 1 gal/100 gal of spray solution.
<b>2,4-D amine</b> Weedar 64 Orchard Master other brands	1.5 lb a.e./a* of 3.8 lb/gal	X	X	Do not apply during bloom or to bare soil. Trees must be at least 1 year old and in vigorous condition. Do not harvest nuts within 60 days after application.
<b>oxyfluorfen</b> Goal 1.6E	2.5–10 pt/a of 1.6 lb/gal	X	X	Should be applied to the soil or base of dormant trees. Do not apply after buds begin to swell until completion of harvest. Add non-ionic surfactant at the rate of 1 to 2 qt/100 gal. Goal may also be used preemergence (see preemergence section).
<b>pelargonic acid</b> Scythe	3–10% solution of 4.2 lb/gal	X	X	For burndown of weeds. High spray volume of 75 to 200 gal/acre is required.
<b>sethoxydim</b> Poast	2.5 pt of 1.5 lb/gal	X	X	May be applied over the top of small, nonbearing trees or as a directed spray. Several additives may be used. See label for directions.

\*a.e./a = acid equivalents per acre

***The information given here is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended to other products that also may be suitable and have label clearances. Always read and follow current label restrictions on pesticide use.***



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