



Insect Monitoring and Control



Pecan IPM Toolbox

Economic Species Number 20+

- ☞ Insects inflict significant losses to pecan foliage and nut crops each year.
- ☞ More than 20 species of insects may become economically important in any given year.
- ☞ Although most species do not cause damage every year, insect populations should be monitored to make sure that they are controlled when they do exceed damaging levels.

Species Not Uniformly Distributed

- ∞ In Texas, pecan insects are not uniformly distributed across the state. Pecan weevils, for instance, are not found in most parts of far west Texas, nor within approximately 150 miles of the Gulf coast.
- ∞ The hickory shuckworm is usually more prevalent in areas where unsprayed native trees grow wild and hickory shuckworms can reproduce unabated.
- ∞ Yellow aphids are mostly a problem of the more humid areas of the state where sooty mold develops on leaves, blocking sunlight to the foliage.
- ∞ Phylloxera is worse in some orchards than others because of its varietal specificity.

Each Orchard Monitored Separately

- ☞ Every pecan orchard will harbor different pest species and population densities.
- ☞ Neighboring orchards may have the same pest species, but due to the varieties planted, tree age and vigor, management practices and other related factors, pest populations will not be equal in all orchards.
- ☞ Monitor each orchard separately for insect pests that develop.

Introduction

Insect Monitoring and Control



The pecan nut casebearer is the primary nut feeder in most parts of Texas and may account for 100% nut loss when left uncontrolled.

*PNC egg (see arrow)
Photo courtesy of Allen Knutson.*

Pecan Nut Feeders



The pecan weevil can be devastating if not managed properly.

Pecan weevil, adult. Photo credit unknown.



The hickory shuckworm enters the shucks after half-shell hardening, lowering the quality and overall harvest weight of the pecan crop.

Hickory shuckworm, pupa. Photo courtesy of Louis Tedders, Bugwood.org

Pecan Foliage Feeders

- ☞ Numerous foliage feeding insect pests of pecans.
- ☞ Periodical and disciplined observations must be made to see that their numbers remain low.
- ☞ Outbreaks of these pests must be controlled early to minimize damage.
- ☞ Critical assessment of pest populations determines the effectiveness of a pest management strategy.

Survey Methods and Action Levels

- ☞ The following control suggestions, survey methods and action levels have been established for use in orchard monitoring programs.
- ☞ These survey methods and action levels are designed to help growers assess insect populations and decide when sprays should be applied.
- ☞ Factors such as existing crop loads, weather conditions, plant development stages, and expected needs for future pesticide applications, should all be considered when using these action levels.

Obscure Scale Control

- ☞ Scale weakens trees
- ☞ Obscure scale attacks hickory, oak, and other trees including pecan and can become a significant pest if neglected.
- ☞ Scale draws sap out of tree branches.
- ☞ Heavy populations weaken trees and entire limbs may die.
- ☞ Trees are more susceptible to wood borers
- ☞ Leaves on infested limbs become weak and vulnerable to foliage diseases
- ☞ These factors combine to reduce pecan yields.

Scale Attacks Unsprayed Pecan Trees

- ☞ Problem of neglected trees that have not been sprayed in several years with an early season insecticide.
- ☞ This condition is possible in trees that have not developed other pest problems early in the season and, hence, insecticides have not been used when the scale insects are in the crawler stage and subject to control.

Survey Scale in Dormant Season

- ☞ Survey for scale each year during the dormant season to determine the need to spray.
- ☞ Inspect limbs for the presence of female scales overwintering on one and two year old wood.
- ☞ Usually, scales are either absent or they are found in significant numbers.
- ☞ If conditions are right for scale development, a low-density scale population can reach significant levels in a single season.

Dormant Oil or Insecticide?

- ☞ Scale can only be controlled in the winter with a dormant oil spray or in the early spring with a precisely timed insecticide application.
- ☞ Scale must be watched very closely to observe the crawler stage, if the latter strategy is used.
- ☞ Dormant oils provide satisfactory control when applied between leaf drop and budbreak.
- ☞ Timing is not as critical with the dormant spray method, so it is often preferred to insecticides.

Applying Dormant Oil

- ☞ Thorough coverage is the key to scale control with dormant oil.
- ☞ All major limbs and shoots, including the one-year-old shoots, should be coated with the dormant oil solution. Because scale insects are controlled by suffocation and scale that are not completely covered with the oil will still be able to breathe, poor coverage results in poor control.

Good Agitation is Important in Applying Dormant Oil

- ☞ Sufficient agitation of dormant oil in a sprayer tank is important.
- ☞ Because oil does not dissolve in water, it must be mixed under strong agitation.
If the oil is allowed to separate from the water, some trees will not receive enough oil, while other trees will receive too much.
- ☞ Since trees must breathe just as insects must, a rate of oil exceeding the recommended concentration may result in tree or limb death by suffocation.

Correct Air Temperature

- ☞ Apply dormant oil when temperatures will be between 40 degrees and 70 degrees F for 48 hours following the application.
- ☞ Unstable weather patterns during late January and February often limit opportunities for an application
- ☞ Look for a favorable weather pattern beginning January 1.
- ☞ Best to wait until a favorable weather pattern because scale insects do not feed much once trees go dormant and the scales must survive on their own body food reserves.
- ☞ The longer the scales must live through the winter, the weaker they become and the better the control.

Thorough Coverage

- ☞ Once an application is made, coverage must be thorough. Only one application is recommended per year. When two applications of dormant oil are made, tree injury may result.

Obscure Scale Survey

Sampling	Time
(a) Inspect 3 limbs on each monitor tree*	(a) December
(b) Rate each tree:** 0 = no limbs with scale 1 = 1 limb with scale 2 = 2 limbs with scale 3 = 3 limbs with scale	(b) December

*Survey at least 5 percent of trees in the orchard

**Record tree ratings under "scale" on the [Foliage Pest Report](#) form

Obscure Scale Action Level

- ☞ Spray dormant oil if an Orchard Rating (see last bullet) of .5 or greater is recorded.
 - ☞ When surveying, rate each limb either scale present or scale absent
 - ☞ Do not judge whether the scale population is light or heavy on a limb basis.
 - ☞ Record one number 0-3 for each tree. When 5-10% of the trees have been surveyed, average the ratings for each tree to determine the orchard rating and the need to spray.
 - ☞ **Orchard rating** = sum of tree rating divided by number of trees rated
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Phylloxera Damage is Progressive

- ☞ Damage to pecan trees from phylloxera can become serious if left untreated. There is no certainty that an infestation will get worse each year, if it is not controlled, but this is the usual progression. Each pecan variety appears to have its own degree of resistance to phylloxera. In native orchards, this means every tree is damaged to a greater or lesser degree than every other tree. In improved orchards, each variety carries its own degree of resistance.

Phylloxera Moves Slowly

- ☞ Phylloxera move from one tree to the next, but do not move far each year.
- ☞ A population will develop in a host tree, where it overwinters, and will usually spread only to trees around its periphery.
- ☞ Susceptible trees that are separated by a block of unsusceptible trees are unlikely to share the same population.

Survey Phylloxera in May

- ☞ Surveys for phylloxera are conducted in May of each year.
- ☞ Although phylloxera cannot be treated in the same year in which the survey is made, the population in the following year is usually equal to or greater than the previous year's population, such that treatments can be based on the previous year's gall formations.

Survey Each Native Tree for Phylloxera

- ☞ Survey native trees individually.
- ☞ Since most managed groves do not have major phylloxera problems, many trees will not have any galls.
- ☞ Where galls are seen, a survey to determine the actual degree of infestation will relieve any doubts about whether to spray or not.

Survey Each Variety for Phylloxera

- ☞ In improved orchards, each variety should be rated separately.
- ☞ Unlike the natives, not all of the trees need to be rated.
- ☞ Many varieties can be quickly dismissed from phylloxera treatments if no galls are observed.
- ☞ At least 5 percent of the trees in a block of a single variety showing gall formation should be rated, to determine the actual need to spray.

Treat for Phylloxera at Budbreak

- ☞ In most instances there will be only a few trees that need treatment. These can be sprayed while unaffected trees are passed.
- ☞ Using this method, trees that are marked for spraying can be watched from first to last to break bud.
- ☞ As soon as all the marked trees have broken bud, they can all be sprayed.
- ☞ Spot treatment of infested trees is advantageous because
 1. the grower does not have to wait until the last trees in the orchard break bud
 2. the trees can be covered in a shorter period of time
- ☞ Growers often find that only a few varieties or only a few native trees need a phylloxera spray.

Phylloxera Control

Insect Monitoring and Control

Phylloxera Survey

Sampling	Time
(a) Observe leaves and shoots on trees to determine need to rate foliage for phylloxera. Observe trees representative of each variety and block (all natives).	(a) First week in May*
(b) Survey 5 shoots per tree and one leaf per shoot on 5-10% of trees from each infested variety and block, (all infested natives). Divide the total rating by 5 and record for each tree.	(b) May
(c) Rate 0, 1, 2 or 3 as: ** 0 = no galls 1 = 1 - 3 galls/leaf or shoot*** 2 = 4 - 9 galls/leaf or shoot 3 = 10 + galls/leaf or shoot	(c) Survey once each year, if necessary

* Shoot galls may be surveyed in the dormant season

** Add the ratings per leaf or shoot for each tree and divide the sum by the number of shoots or leaves rated and record the average rating per leaf or shoot for that tree under "phylloxera" on the **Foliage Pest Report form** (see attachments)

*** Leaf and petiole galls are rated per leaf; stem galls are rated per shoot

Phylloxera Action Level

- ☞ Spray at budbreak next year if orchard rating equals 1.0 for leaf galls or 0.5 for stem or petiole galls.
- ☞ Mark trees to be sprayed with tree paint so the mark can be seen from the direction of sprayer travel. In natives, this may mean circling the trunk with tree paint.

Examples

Rating

shoot #	1	2	3	4	5	=	4
rating	2	0	1	1	0		

shoot #	1	2	3	4	5	=	11
rating	2	3	1	3	2		

Record

5 = 0.8 for that tree

5 = 2.2 for that tree

Spring Leaf Feeders Are Sporadic

- ☞ A variety of leaf feeders attack pecan foliage in the spring between budbreak and pollination.
- ☞ They are present every year, but natural environmental forces usually keep them at sub-economic levels.
- ☞ Pest outbreaks can occur in any given year, so
- ☞ Survey pecan foliage during the spring to insure that these pests do not inflict significant damage to the leaf crop.

Leaf Tatterer and Defoliator Control

Insect Monitoring and Control

Survey

Sampling	Time
a) Rate insects on 5 leaves on each monitor tree*	(a) April through mid-May
(b) Rate each leaf ** 0 = 0 larvae per leaf 1 = 1 - 2 / larvae per leaf 2 = 3 - 5 / larvae per leaf 3 = 6+ larvae per leaf	(b) Rate on weekly interval

* Survey 5 - 10% of trees in orchard.

** Sum ratings from 5 leaves per tree and divide by five to obtain tree rating. Record one rating for each tree. Average tree ratings to obtain orchard rating and the need to spray.

Leaf Tatterer and Defoliator Control

Insect Monitoring and Control

Action Level

Pest	Orchard Rating
Sawfly	0.5
Cigar leaf casebearer	1.0
Pecan leaf casebearer	1.0
Catacola	0.2
May beetles	0.5
Leafminers	1.0
Spittlebugs ***	0.1

*** Inspect 5 shoots instead of 5 leaves if spittlebug is suspected to be a problem. Rate number of shoots with spittlebug.

First Generation PNC Control

- ☞ The pecan nut casebearer, *Acrobasis nuxvorella* Neunzig, is the number one insect threat to pecan production in Texas.
- ☞ This nut feeder accounts for total crop losses in many years on unsprayed trees.
- ☞ But with proper timing of a labeled insecticide, economic losses can be minimized.

Pecan Nut Casebearer Control

Insect Monitoring and Control

First Generation PNC Appears in May

- ☞ Normally, the first generation of this insect is found damaging nuts within a 2-week period.
- ☞ In Texas, this 2-week time frame usually starts during the first week of May in the southern and coastal areas, and during the first week of June in north and far west Texas.

Timing is Critical

- ☞ The timing of the insecticide application is crucial to effective casebearer control.
- ☞ Ideal timing is signaled by the initial appearance of newly hatched larvae. Insecticides, currently labeled for the casebearer, kill primarily larvae. One well timed treatment when needed achieves maximum control and conserves natural enemies needed to aid in control of aphids, mites and leafminers that come later in the season.
- ☞ See the [Decision Window map](#) and related materials to aid management of this pest.

Check for Egg Lay

- ☞ To determine when to spray, inspect a minimum of 200 clusters for casebearer eggs.
- ☞ Select trees that have had heavy casebearer infestations in previous years.
- ☞ The nut casebearer prefers some trees over others so that if you check those trees first you will normally detect the earliest eggs laid.
- ☞ Once egg laying is detected, spread the egg survey over a wider distribution of trees to obtain a representative sample.

Tag Clusters That Contain Eggs

- ∞ Consult the materials provided in the [Decision Window](#) section for determining the best time for monitoring/spraying. The following is a guide to further fine-tune diagnosis/evaluation of control.
 - Just prior to the onset of pollination, inspect small nutlets on approximately 310 clusters for first generation pecan nut casebearer eggs. Tag those clusters, in permanent ink that have eggs noting date and condition (eggs turn from white to red in the 3 - 5 day period before hatch).
 - Continue monitoring and tagging until the first larvae hatch. If $>1\%$ of clusters are infested and you are at or before the Decision Window, economic damage is expected to result. If treatment is made, return 5 to 7 days later and inspect fate of eggs/larvae on previously tagged clusters. If they are still alive, consider a need for a re-treatment by surveying 100-300 clusters.

Extend Spray Residual

- ☞ After hatching, larvae feed on developing buds and shoots for 2 to 3 days before entering nuts.
- ☞ Apply an insecticide to obtain coverage by the third day after the first eggs hatch.
- ☞ By this method of timing, you will use the full residual activity of your insecticide treatment.
- ☞ Since the casebearer may hatch over a 1 - 2 week period, residual activity is very important.
- ☞ Further, the casebearer may be delayed by cool weather by as much as 2 weeks, so growers should not spray until definite signs indicate the casebearer has arrived.

Pecan Nut Casebearer Control

Insect Monitoring and Control

First Generation Survey

Sampling	Timing
(a) Survey 200 - 400 clusters*	(a) Prior to pollination
(b) Survey clusters for eggs	(b) 5 days before expected egg lay
(c) Survey eggs every 2 - 3 days	(c) During egg lay
(d) Observe first egg hatch	(d) 3 - 5 days after first egg laid

Pecan Nut Casebearer Control

Insect Monitoring and Control

Action Level: Spray

Clusters: Two to three days after first eggs hatch if a 1 egg per 100 count is accumulated within a single 7-day interval.**

Sampling	Timing
(e) Reenter orchard and survey clusters for additional egg lay.	(e) 5 days after insecticide application ***
(f) If white eggs are found on the re-entry date, continue to survey at 2 - 3 day intervals until no white eggs are found.	(f) 5 days after insecticide application and thereafter

** Sprays must be applied 2 - 3 days following the first egg hatch and just before nut entry. Eggs hatch in a maximum of 5 days after oviposition. If egg lays are accumulated over more than 7 - 8 days, then the first larvae that hatched have already entered a nut and cannot be controlled.

*** Insecticides labeled for use against the pecan nut casebearer are only effective for about 10 days. If eggs are laid 5 days after the insecticide application and do not hatch until 5 days later, larvae will not be controlled with the first spray.

Action Level: Retreat 10 days after first application if...

- ☞ One percent eggs are accumulated within a single 7-day interval, beginning with the first white eggs laid 5 days after first insecticide application, i.e., counted as white eggs after reentry following first spray.
- ☞ To obtain a representative sample, distribute cluster survey over five percent of the trees. Five percent of 50 acres with 17 trees/acre, with 10 clusters surveyed per tree, would equal 425 clusters surveyed.

Second Generation PNC Control

- Approximately 42 days (6 weeks) after the first generation of pecan nut casebearer, a second generation will appear.
- In the southern parts of Texas, this normally occurs in mid to late June.

Larger Nuts by Mid-June

- Second generation egg surveys are made in the same way as the first.
- Since nuts are larger by mid-June, the casebearer does not usually destroy the entire cluster.
- Consequently, a higher threshold is used to initiate spraying for the second generation.

Two Eggs Per 100 Clusters

- Two eggs per 100 clusters is considered the economic threshold.
- Sprays should be timed so that trees are covered by the third day after the first eggs hatch.

Third Generation PNC Control

- ∞ The third, and final, potentially damaging generation of the pecan nut casebearer is reached roughly 42 days after the second generation egg hatch.
- ∞ This normally takes place in the first half of August in south Texas, usually just prior to the first spray for the hickory shuckworm, but after the first stem end blight spray.

Large Nuts Can Be Direct Loss

- ∞ Nut clusters, by this stage, have normally thinned to their final size. The clusters are not as large as they are during the second generation, but the nuts have tripled in size and each larva does not destroy as many nuts. The economic threshold of 2 eggs/ 100 clusters is retained for the third generation, however.

Pecan Nut Casebearer Control

Insect Monitoring and Control

2nd and 3rd Generations Survey

Sampling	Time
(a) Survey eggs on 200 – 400 * clusters	(a) 40 days after the first egg found in the previous generation
(b) Survey eggs every 2 - 3 days	(b) During egg lay
(c) Observe egg hatch	(c) 3 - 5 days after first egg laid

* Eggs for the second and third generations are commonly laid on the sides, instead of the tips, of nuts.

Action Level

Spray if two eggs per 100 clusters found within a single 7-day interval. Apply insecticide so that coverage is achieved 2 - 3 days following first egg hatch.

NOTE:

To determine whether a second application is needed for the second generation, follow the sampling procedure described in (e) and (f), for the first generation, but substitute an egg lay of 2% for the 1% used in the first generation.

A Temperature Prediction Method for PNC Adult Activity

- ∞ Insects respond to temperature and most of their activities are highly dependent on temperature.
- ∞ Recent investigations have indicated that pecan nut casebearer adult emergence can be predicted using temperatures to calculate day degrees.

Temperature Versus Calendar

- ☞ Day degrees allow the prediction of a certain stage of insect development based on temperature rather than date.
- ☞ Local monitoring of weather can produce a prediction that is more specific to a particular orchard.

Base Temperature 38°F

- ☞ Day degrees are a measure of the amount of heat units absorbed during a day above a base temperature.
- ☞ Calculate day degrees by averaging the maximum and minimum temperatures and then subtracting 38.

Indication for Cluster Inspection

- ⌘ This prediction method is not intended to replace the cluster inspection method of surveying casebearer eggs.
- ⌘ It can be used to more accurately predict when casebearer eggs are likely to be laid.
- ⌘ In years when springs are warmer than average, eggs are likely to be laid earlier than usual.
- ⌘ In years when springs are cooler than usual, delayed egg lays can be expected and surveys for eggs may be initiated later than usual.

Pecan Nut Casebearer Control

Insect Monitoring and Control

Day Degree Accumulations Table

		Overwintering Generation		1st Summer Generation	
		Adult Female			
Percentile	Pupation ^{a/}	Emergence ^{b/}	Oviposition ^{c/}	Hatch ^{c/}	Nut Entry ^{c/}
1st observed		1350.3	1440.42	1680.9	1733.3
1st significant	---	---	---	---	1831.1
10	955.9	1521.1	1822.5	1877.2	1908.8
25	1057.0	1631.0	1915.5	1008.7	2100.2
50	1183.0	1740.3	1932.5	2062.1	2136.1
75	1311.5	1865.1	1978.0	2274.0	2368.3
90	1413.0	1940.6	2146.0	2365.4	2610.3
Last observed	1733.5	2140.9	2420.8	2450.7	2610.3

¹ Developed by the Texas Agricultural Experiment Station, Department of Entomology, Texas A&M University

^{a/} Verify by banding.

^{b/} Verify by black light traps.

^{c/} Verify by inspecting 20 nut clusters on each of 20 trees every day.

Pecan Nut Casebearer Control

Insect Monitoring and Control

Steps for Using Day Degrees as a Prediction of PNC Adult Emergence

- 1) Record daily maximum and minimum temperatures starting from ten days before 50% budbreak. Obtain weather data and when budbreak occurs, count back 10 days and start accumulating day degrees from that date.
- 2) Calculate day degrees using the formula below.
- 3) Keep a cumulative total of day degrees in the space provided on the form.
- 4) When cumulative day degrees occur equal to or greater than 956, then tree bands for collecting pupae should be in place.
- 5) When cumulative day degrees occur equal to or greater than 1,521, then 10 percent adult emergence has occurred.
- 6) When cumulative day degrees occur equal to or greater than 1,822, then 10 percent oviposition has occurred.
- 7) When cumulative day degrees occur equal to or greater than 1,831, then first significant nut entry has occurred. This is when controls should be made.

Formula for calculating day degrees: $(\text{max.} + \text{min.}) - 38^{\circ} F = \text{number of day degrees}$ (See item 2 above)

Example: $(65^{\circ} + 42^{\circ}) - 38^{\circ} F = 53.5 - 38 = 15.5 \text{ day degrees}$

Fall Webworm Control is Rarely Economical

- ☞ The fall webworm, *Hyphantria cunea* (Drury), is unsightly in homeowner trees, but rarely causes economic damage to managed pecan groves.
- ☞ Webworms feed in colonies much like walnut caterpillars, but have conspicuous dirty-white webs that enclose the feeding area.

Webworms May Attack Unsprayed Trees

- ☞ Sprays for other pests, such as for the first generation pecan nut casebearer, usually keep this pest under control.
- ☞ However, when pesticides are not applied, the fall webworm may become a problem.

Spot-treat Colonies

- Because of its webbing, the fall webworm is easily recognized.
- When the population exceeds one colony per tree, they can be spot-treated.
- Make sure that most of the eggs from the target generation have hatched by waiting 7 - 10 days after the first webs are found.
- Then go through the orchard and spray only the area of each tree where the colonies are feeding.

Penetrate Webbing with Spray

- In order to achieve control of fall webworm, the insecticide must penetrate the web and contact the larvae.
- Either high water pressure from a hydraulic rig or a high wind velocity from a mist blower will achieve this.

Fall Webworm Survey and Action Level

Sampling	Time
(a) Inspect trees for webbing.	(a) Pollination through October
(b) Survey trees to determine number of colonies per tree, if webs become numerous.	(b) As needed through the season

Action Level

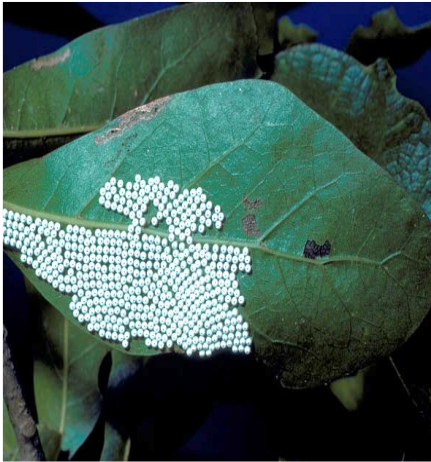
- ☞ Spot spray if colonies exceed one per tree.
- ☞ NOTE: This action level is only a suggestion -- there is no clear evidence that this level is economic.
- ☞ Since trees are spot sprayed, sprayer operation is the primary cost consideration, not the cost of insecticide.

Environmental Restraints

- ∞ The walnut caterpillar, *Datana integerrima* (G. & R.), can cause widespread defoliation of pecan trees.
- ∞ Outbreaks covering several Texas counties have occurred in recent years.
- ∞ In most years, however, this pest is held in check by beneficial insects and other factors, including tree condition and weather conditions.

Walnut Caterpillar Control

Insect Monitoring and Control



EGG masses of 500 to 700 white eggs are laid side by side, one layer deep on the undersides of pecan leaflets. Egg masses are somewhat round and about the size of a half dollar. Eggs take about 2 weeks to hatch.

Eggs



LARVAE pass through five instars during the 20 -25 days they feed on foliage, before pupation. Newly hatched walnut caterpillar larvae are tiny, reddish brown caterpillars with black heads

Larvae



Full-grown **LARVAE** are about 2" long, black, with white stripes running the length of the body. They are covered with long, soft, white hairs.

Larvae

Ten Colonies Per Acre

- ☞ Currently, we must assume that the walnut caterpillar will become an economic problem if we find an average of 10 colonies per acre.
- ☞ Since all the colonies cannot be spotted easily, a random survey should be conducted to assess the population.

Survey at 3-week Intervals

- ☞ Surveys for the walnut caterpillar should be done at 3-week intervals, from pollination through October.
- ☞ Two to three generations occur during this period, having approximately a 6 to 8-week cycle from egg to egg.
- ☞ Once a generation is identified in a particular year, subsequent surveys can be done at 6-week intervals corresponding to their development cycle.

Walnut Caterpillar Control

Insect Monitoring and Control

Survey Eggs and Feeding Colonies

- ☞ Growers should survey both eggs and feeding colonies.
- ☞ Egg masses can be spotted at night by shining a flashlight up through the canopy and looking for white spots about the size of a half dollar on the undersides of leaves.
- ☞ Unless the egg masses can be reached, you cannot tell whether the eggs have hatched or not.
- ☞ Look in the neighboring branches and foliage for feeding damage and the larvae that may be present.
- ☞ Larvae strip the foliage, leaving only the leaf rachis (the extension of the petiole that bears the leaflets).
- ☞ They do not produce webs like the fall webworm, so colonies can be missed if trees are not checked carefully.
- ☞ Each monitor tree should be inspected from top to bottom and on all sides.

Economic Threshold

- When an average of 10 colonies per acre observed, then an economic threshold has been reached.
- A minimum of 5 - 10% of the trees in the orchard should be inspected to determine the number of colonies per acre.

Treat Before 4th Instar

- Research has shown that over 80% of the damage caused by the walnut caterpillar is done by fifth instar larvae during the last 3 - 4 days of feeding before pupation.
- Since the fully grown larvae are harder to kill, it is better to apply insecticides as soon as all the eggs have hatched for a given generation.

Walnut Caterpillar Control

Insect Monitoring and Control

Survey

Sampling	Time
(a) Survey tree canopy for eggs and/or feeding colonies on 5 - 10 percent of trees in orchard.	(a) Pollination through October on a 3-week interval
(b) Record number of colonies per acre.*	(b) On a 3-week interval

*An egg mass may be considered a colony once the larvae have successfully hatched and started feeding.

Action Level

Spray if:

☞ Ten colonies per acre are found. Spray after eggs hatch, but before the 4th instar.

Example:

17 trees per acre, 50 acres in an orchard, check at least 2.5 acres of trees (42 trees) at random, spray if 25+ colonies are found.

Stinkbug and Plantbug Control

Insect Monitoring and Control

Several Species Are Responsible

- ✎ The stinkbug and plantbug are in the "true bug" order Hemiptera.
- ✎ Have piercing, sucking mouthparts and feed on a wide range of hosts, including grasses and broadleaf weeds.
- ✎ Strong flyers and can move into pecan trees from neighboring fields and pastures.
- ✎ Several species feed on pecan fruit.

Two Types of Damage

- ✎ Before nuts enter the dough stage, pierced nuts fall from the trees.
- ✎ After the dough stage is reached, nuts stay on the tree, but the kernels develop a dark brown to black spot where the feeding occurs. This spot is bitter and, if large enough, can turn the entire kernel bitter.



Brown stink bug. Credit unknown.



Plant bug. Photo courtesy of Jerry Payne, USDA-ARS, Bugwood.org

Stinkbug and Plantbug Control

Insect Monitoring and Control

Migration into Pecan Trees

- ∞ Control of stinkbugs and plantbugs is difficult because they feed on a variety of plants found near most orchards and migrate into orchards.
- ∞ As hay is cut and baled or sorghum fields are shredded and plowed, stinkbugs and plantbugs move from nearby fields into pecan groves looking for food and shelter.
- ∞ These farming operations often occur in July, when the pecan water stage starts and stem end blight sprays are applied.
- ∞ Stinkbugs and plantbugs are suspected of transmitting stem end blight from one nut to another.
- ∞ Control of these bugs is especially important during the water stage.



Stinkbug damage to nuts. Photo courtesy of Bill Ree.

Keep Vegetation Down

Keeping weeds and/or sod in the orchard short or non-existent, will help prevent buildups of these insects. Breeding occurs mostly in low-growing vegetation, underneath the trees. Nymphs live in this vegetation until they develop wings and fly up into the pecan trees

Stinkbug and Plantbug Control

Insect Monitoring and Control

Check Nut Drop for Damage

Whether you have a population migrating into the orchard or you raise your own population, you should be aware of the damage that can result.

Stinkbug-damaged nuts will appear normal, except that a tiny spot of sap may be seen on the shuck where the stylet has pierced the nut. Nuts dropping from trees in July and August should be inspected for stinkbug damage.



Inspect Clusters for Adults

If significant drop indicates stink bugs are working the trees, make a survey of the orchard for stinkbug adults. Look at 200 plus clusters and note how many of the clusters have a stinkbug or plantbug on them. If one cluster in forty has a stinkbug on it, then a spray should be applied for control.

Stinkbug and Plantbug Control

Insect Monitoring and Control

Survey

Sampling	Time
(a) Watch neighboring fields for possible migration into orchard.	(a) July-October*
(b) If stink or plant bugs are expected to be found in damaging numbers, inspect 200 plus clusters for adults.**	(b) July-October

* A careful watch should be maintained during the water stage sprays for stem end blight.

** If a migrating population is targeted, border trees should be surveyed first and sprays may be limited to these areas in larger orchards. Record survey findings on "Nut Casebearer and Stinkbug Report" form for easy tabulation.

Action Level

Spray if one cluster in forty has an adult stinkbug or plantbug on or near it.

Yellow Pecan Aphid Control

Insect Monitoring and Control



Yellow pecan aphid, laying egg.
Louis Tedders, USDA-ARS,
Bugwood.org



Yellow pecan aphid, immature.
Louis Tedders, USDA-ARS,
Bugwood.org



Yellow pecan aphid, adult.
Jerry Payne, USDA-ARS,
Bugwood.org



Yellow pecan aphid, infestation.
James Dutcher, University of
Georgia, Bugwood.org

An Annual Occurrence

Among the summer pests of pecan, yellow aphids, *Monellia caryella* (Fitch) and *Monelliopsis pecanis* Bissell, stand apart as a reliably present feature in pecan production. Present in low numbers through the year, these "honeydew aphids" reach peak densities in mid-summer of most years. The outbreak typically occurs over approximately 2 to 3 weeks and declines, leaving foliage photosynthetically intact and harboring lacewings, spiders and other natural enemies. Aphid densities <25 aphids per compound leaf are not considered economically damaging. Low aphid densities attract natural enemies, which aid in control of all pests.

Yellow Pecan Aphid Control

Insect Monitoring and Control

Honeydew

The primary mode of damage by yellow pecan aphids is from leaf shading by a mold that grows over the upper surface of affected leaves. Yellow aphids feeding on the undersides of leaves secrete “honeydew” (sugar water) that falls down through the tree and is deposited on the upper leaf surfaces.

Sooty Mold

“Honeydew” is a perfect substrate for “sooty mold,” a fungus that is everywhere in the environment. Under high humidity, sooty mold grows on the honeydew to form a dark gray to black covering over the upper leaf surface. Dense sooty mold can shade the leaf, reducing photosynthetic activity.

Sooty mold problems are typically highest in the humid southeast and decline in arid areas to the west. Periodic rains also aid removal of sooty mold from leaf surfaces.



Yellow pecan aphid, honeydew. Photo courtesy of H.C. Ellis, University of Georgia, Bugwood.org



Yellow pecan aphid, adult and immatures. Photo courtesy of Louis Tedders, USDA-ARS, Bugwood.org

Damage Affects Current and Next Year's Crop

- Defoliation does not usually result from yellow aphid feeding during the summer unless earlier sprays have eliminated natural enemies and aphid densities increase unchecked. Aphid densities in excess of 25 aphids/compound leaf for a week or more may withdraw enough leaf photosynthate to cause a reduction in leaf cell growth and productivity.
- Leaves make food for all parts of the tree. With reduced numbers of functioning leaves, all other parts of the tree can suffer. This means losses to both the current year's crop, in the form of reduced packing and filling of nuts, and to next year's crop, in the form of reduced carbohydrates available for storage in roots, limbs, and buds.

Survey Foliage for Action Level

- ☞ To determine the need to spray for yellow aphids, survey 5 percent of the trees in your orchard, using trees distributed throughout the orchard to achieve a representative sample.
- ☞ Examine 10 leaflets on each tree.
- ☞ If (on average) more than 25 aphids are found per compound leaf, you have reached the economic threshold and should consider treating this infestation.
- ☞ If lacewings, lady beetles, spiders and other natural enemies are also observed present and increasing, you may wish to delay making a decision for a few days to see if the aphids will be contained by the beneficial insects.

Yellow Pecan Aphid Control

Insect Monitoring and Control

Beneficials Are Helpful

- ☞ Yellow aphids are attacked by several parasites, predators and fungal diseases.
- ☞ Spiders are important in delaying the onset of outbreaks by preventing aphid colonies from establishing.
- ☞ Once an outbreak begins, lacewings and lady beetles become more effective in reducing aphid numbers; both larvae and adults of these insects are predaceous on black aphids as well as yellow aphids.
- ☞ Entomophagous fungi can devastate high densities of aphids in the humid southeast in some outbreaks, but regular fungicide use needed for scab control may interfere with this natural control.
- ☞ High densities of these natural enemies are helpful in keeping aphid densities low and these beneficials should be surveyed to assess their densities and their potential effect on the aphid outbreak.
- ☞ Note that pecan aphids and mites have a long history of developing resistance to pesticides and over-reliance on chemicals is expected to result in resistance that will render the chemical useless.
- ☞ Judicious application when needed and rotation of chemical classes (if available) is suggested.

Yellow Pecan Aphid Control

Insect Monitoring and Control

Survey

Sampling	Time
(a) Observe foliage for evidence of honeydew.	(a) June-October
(b) Rate aphids on 10 leaves on each of the monitor trees representative of each variety and block of the orchard. (typically, 100-500 leaf samples).	(b) Rate every 3 weeks if "honeydew" is observed on foliage
(c) Rate aphids either - or + on a per leaf basis where: <ul style="list-style-type: none">• In dry regions:<ul style="list-style-type: none">(-) = less than 230 aphids per leafand (+) = 231 or more aphids per leaflet• In humid regions:<ul style="list-style-type: none">(-) = 250 aphids per leaf and(+) = 126 or more aphids per leaf	(c) Rate weekly once 30% of the leaves rate a (+)

Action Level

Consider spraying if more than half the leaves rate a plus (+)

Black Pecan Aphid Control

Insect Monitoring and Control

Premature Defoliation Causes Crop Reductions

- ☞ The black pecan aphid, *Tinocallis caryaefoliae* (Davis), can cause serious defoliation of pecan leaves well before the normal time of fall leaf drop.
- ☞ Return of new shoot growth and bloom the next spring depends on reserves produced by leaves in the late summer and fall.
- ☞ Premature defoliation of pecan trees by black aphids lowers the tree's vigor and crop potential for the following year.
- ☞ Black aphid problems increase as orchards mature and begin to crowd.
- ☞ Infestations typically begin in the lower interior area of the tree and expand outward as the outbreak progresses.
- ☞ Thinning and pruning to improve sunlight penetration and air drainage reduces risk of black aphid.

Low Action Level

Black aphids can be found throughout most of the year, but low populations are usually maintained until August, when rapid increases in their populations often occur.

In any given year, the population peak may be delayed to, as late as October. In other years, two or more significant peaks occur from August to October.

Effective control is obtained by monitoring aphid populations and applying a labeled insecticide, when populations reach 3+ black aphids per leaf.

Black Pecan Aphid Control

Insect Monitoring and Control

Feeding Damage

- ⇒ This small, soft-bodied insect is greenish-black and about 1/16-inch long at maturity. Short bristles can be seen along its body with the aid of a 10X hand lens. They are found on the underside of leaves where they feed with piercing, sucking mouthparts. Not only is sap drawn from the leaf, but a toxin is injected into the leaf, which causes the leaf tissue to die around the immediate area of feeding. This dying tissue is called blotching.



Black pecan aphid, adult. Photo courtesy of Louis Tedders, USDA-ARS, Bugwood.org



Black pecan aphid, damage. Photo courtesy of University of Georgia Plant Pathology Archive, Bugwood.org

Blotching Is Good Indicator

- ⇒ Bright yellow blotches, about 1/4-inch wide, form between the major leaf veins where the aphid feeds. This blotching is often the first indication growers have that black aphids are in the trees. Once leaf tissue has turned yellow, that damage cannot be reversed. However, treatments are advised to prevent further damage, unless major defoliation has already occurred and aphids are not found.

Black Pecan Aphid Control

Insect Monitoring and Control

Survey

To determine the need to spray, make a general orchard inspection to observe any degree of blotching. Usually, heavy feeding is preceded by a low population which will produce light blotching, before a major peak is reached. If any blotching is seen, inspect the leaves more closely to determine the actual level of infestation. Inspect the underside of leaves on each of 5 percent of the trees in the orchard. Select leaves from all sides of the tree. Each variety in the orchard should be represented in the sample, because each variety has a different susceptibility to black aphid damage. When an average of 3+ black aphids per compound leaf is found, then an economic threshold has been reached, and an insecticide should be applied.

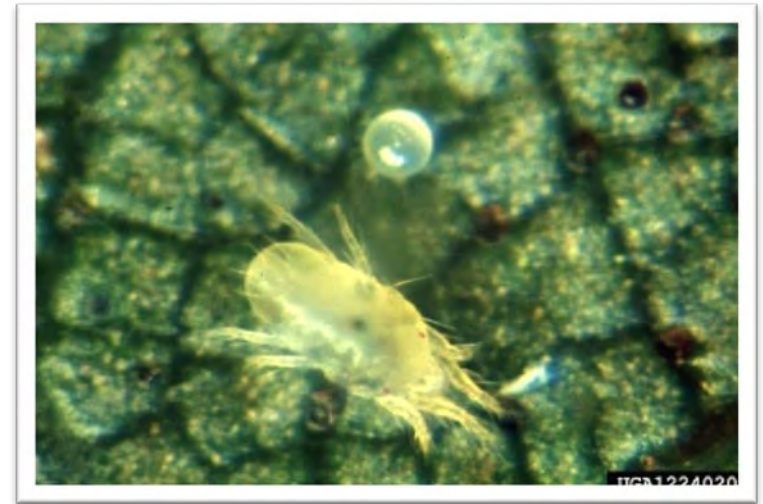
Sampling	Time
(a) Observe foliage for early signs of blotching and/or black aphids.	(a) July-October
(b) Rate aphids on 5 leaves per tree, on monitor trees representative of each variety and block of the orchard.	(b) Every 3 weeks once blotching is observed.
(c) 0 = 0 aphids/ leaf 1 = 1 aphid/ leaf* 2 = 2-3 aphids / leaf 3 = 4+ aphids/ leaf	(c) Rate weekly when orchard rating exceeds 1.5

* Aphids need not be counted. With experience, a glance will tell what rating each leaf falls into. Add each leaf rating on the tree (5 leaves), divide by 5 and record that number for that single tree. When 5-10 percent of the trees have been sampled, average the tree ratings to determine the orchard rating and the need to spray.

Action Level: Spray if aphid density reaches 2.0 rating.

Many Species of Mites

- As many as 27 species of mites are known to feed on pecan trees.
- At least one is economically important throughout the pecan belt, the **pecan leaf scorch mite**, *Eotetranychus hicoriae* (McGregor).
- Mites are not insects, but are in the subclass of arthropods called Acari, which also contains ticks.
- Adults are tiny, wingless, light-green arthropods with eight legs and no antennae.
- They can be seen with the naked eye, but cannot readily be identified as mites without a 10X hand lens.



Pecan leaf scorch mite, female and egg. Photo courtesy of Jerry Payne, USDA-ARS, Bugwood.org



Leaf Bronzing

- ☞ Leaf cells, fed upon by mites, turn reddish-brown, giving leaves a metallic or speckled look similar to spider mite damage on beans or marigolds.
- ☞ Once bronzing starts to appear, permanent damage to the leaves has occurred.
- ☞ Bronzed leaves do not recover their full productive capacity and may drop from the tree



Pecan leaf scorch mite, bronzing. Photo courtesy of University of Georgia Plant Pathology Archive, Bugwood.org

Outbreaks Possible

Mites have a high reproductive capacity and outbreaks occur quickly. Normally, beneficial insects and predaceous mites keep them at sub-economic levels. However, imbalances do occur and mites are problems in some years, usually in August and September. Carbaryl has demonstrated a tendency to kill the beneficials that control mite populations, allowing mites to reach economically-damaging populations.

Resistance to Chemical Control

- ☞ Several species of mites have become resistant to the miticides that once controlled them.
- ☞ Mites have an apparent ability to build tolerance to pesticides faster than most arthropods.
- ☞ It is important to spray only when necessary and when sprays are used to achieve thorough coverage to kill as many mites as possible.
- ☞ Survivors receiving sub-lethal doses are likely to produce offspring that are more resistant to pesticides.

Survey

Sampling	Time
(a) Inspect 5 pairs of leaflets* on monitor trees for "bronzing."	(a) Every 3 weeks from August to October once "bronzing" is observed in orchard.
(b) Rate trees:** 0 = no leaflets with bronzing 1 = 1 pair with bronzing 2 = 2 pair with bronzing 3 = 3 pair with bronzing 4 = 4 pair with bronzing 5 = 5 pair with bronzing	(b) Rate on weekly basis when orchard rating exceeds 1.5

* Inspect the second pair of leaflets from the apex of the leaf. Inspect 5 leaves from a tree for a total of 10 leaflets.

** Give each pair of leaflets a 1 if it shows bronzing and a 0 if it does not show bronzing. Sum the rating from 5 pairs of leaflets to get the tree rating. Record either 0, 1, 2, 3, 4 or 5 for each tree surveyed.

Example:

2 pairs of leaflets with bronzing = a tree rating of 2.

Average tree ratings to obtain the orchard rating. Survey 5-10% of trees in the orchard.

Action Level

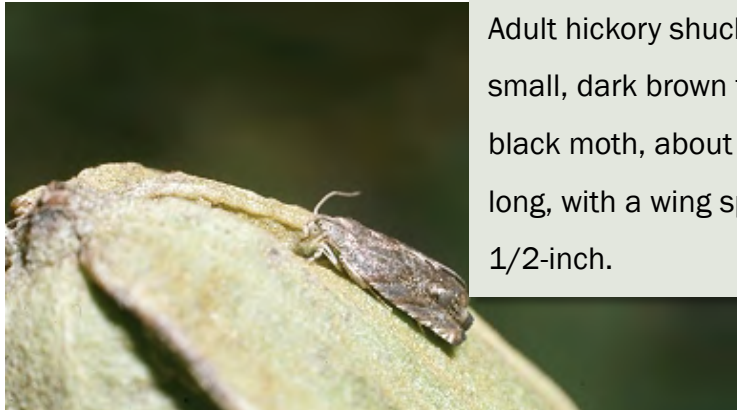
Spray if orchard rating of 2.0 is reached.

Nature of Damage

- ☞ The hickory shuckworm is a significant nut feeder of pecans.
- ☞ Damage is inflicted by larvae as they feed within the shuck.
- ☞ Since the pecan kernels obtain their nourishment through the shuck, damage to the shuck can seriously impair nut quality.
- ☞ At harvest, shucks often stick to the shell where feeding has resulted in premature shuck death.
- ☞ The removal of shucks from these "stick-tights" is costly and largely preventable.

Hickory Shuckworm Control

Insect Monitoring and Control



Adult hickory shuckworm is a small, dark brown to grayish black moth, about 3/8-inch long, with a wing span just over 1/2-inch.

Photo: Hickory shuckworm, adult. Courtesy of Jerry Payne, USDA-ARS, Bugwood.org

Following pupation in early spring, adults emerge to lay eggs on leaves and young nuts of the hickory, and possibly on some early-breaking pecans. Larvae are often seen in pecan phylloxera galls in May and early June. There is evidence that a portion of the overwintering population delays emergence until mid-summer. This may account, in part, for the increased population surge when nuts undergo shell hardening.

Larva - about 3/8-inch long, creamy white with a light brown head. Spends winter before pupation in hickory or pecan shucks.

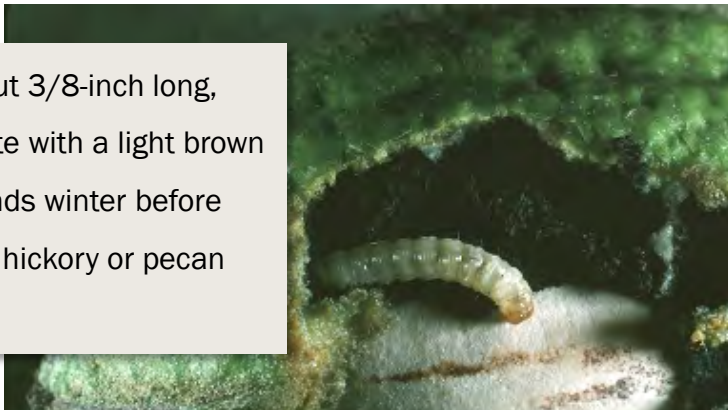


Photo: Hickory shuckworm, larva. Louis Tedders, USDA-ARS, Bugwood.org



Photo: Hickory shuckworm, pupal case, pupae emerging. Louis Tedders, USDA-ARS, Bugwood.org

Nut Drop and Shell Hardening

- ☞ As many as five generations occur each year. Early generations usually maintain low populations.
- ☞ Light nut drop will often result from larval feeding, but economic losses are rare before shell hardening.
- ☞ Nuts fed upon before shell hardening simply fall off the tree and do not complicate harvesting or reduce the overall nut quality of the harvested crop.
- ☞ Once shell hardening occurs halfway down the shuck there is usually a significant increase in hickory shuckworm activity.
- ☞ Female moths begin to lay eggs in greater numbers and more of the larvae survive to infest pecan shucks.
- ☞ This nut stage usually occurs in the middle of August in central Texas.

History of and Damage Treatment

- ☞ When the nuts reach half-shell hardening, treatments for hickory shuckworm should be considered if hickory shuckworm populations have a history of infesting over 20 percent of the harvested nuts in recent years. Infestations below this level are usually not economically important.
- ☞ Recent research indicates that [Confirm](#) or [Intrepid](#) can provide good control with a single properly timed treatment, and other materials may require a second insecticide treatment 10-14 days after the first application for best results.

Hickory Shuckworm Control

Insect Monitoring and Control

Survey

Sampling	Time
(a) Inspect 100 nuts for signs of hickory shuckworm damage. Sample nuts from different varieties and areas of the orchard.	At harvest
(b) Record the percentage of damaged pecans.	At harvest
(c) Sample nut development to determine half shell hardening.	August

Action Level

Spray at half-shell hardening if twenty percent (20%) of the nuts from unsprayed trees had shuckworm damage in the previous year. *

Note: Light traps can be used to detect the time of moth flight activity. In some years, sprays can be delayed until moth activity is indicated by light traps. Light traps must, be located in the trees to accurately detect moth activity. No action level has been established for moth catches in Texas.

Much depends on the location of the trap(s) within the orchard, but several years experience in a single location should provide the grower with comparative moth levels, from one year to the next, that can be related to the percent damage at harvest.

* spray at half-shell hardening and again 10-14 days later.

Pecan Weevil Control

Insect Monitoring and Control

Identification

- ☞ Pecan weevil, *Curculio caryae* (Horn), where it exists, is a pecan nut feeder of primary concern to growers.
- ☞ Larvae feed on kernels from the gel stage to shucksplit.
- ☞ Damage results in unsalable nuts which must be removed from the harvested crop.
- ☞ The total yield is thereby reduced and inevitably some nuts escape the cleaning process, which lowers the grade of the marketed crop.



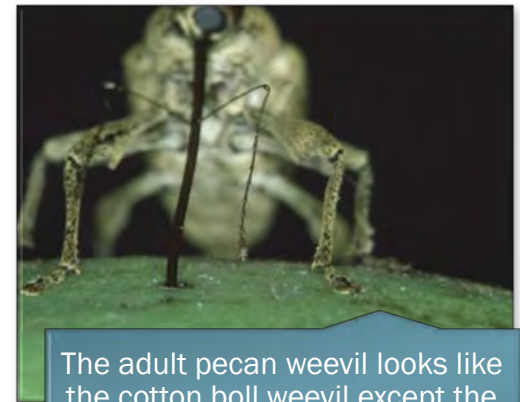
Tiny pecan weevil eggs (usually 3 to 4 in each nut attacked) are generally deposited on the distal end of maturing pecan

Photo courtesy of Jerry Payne, USDA-ARS, Bugwood.org



The larvae, which are found feeding in nuts, are creamy white grubs with reddish brown heads. They are about 3/5" long at maturity.

Photo courtesy of Louis Tedders, USDA-ARS, Bugwood.org

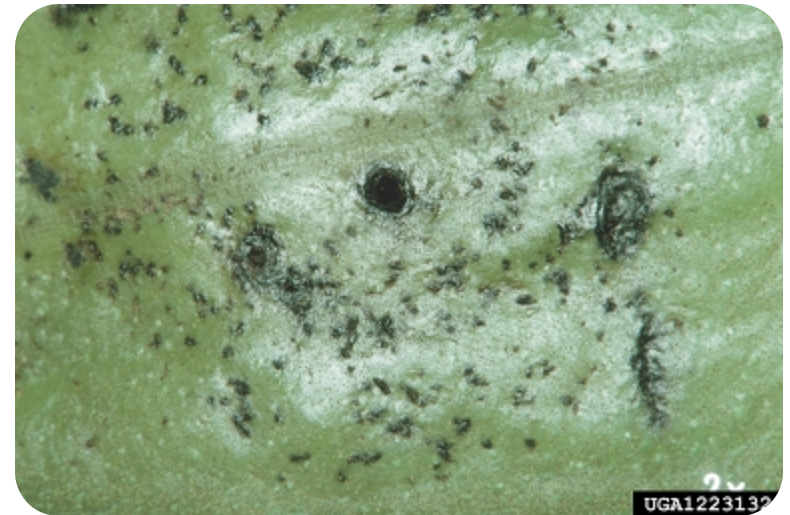


The adult pecan weevil looks like the cotton boll weevil except the pecan weevil is larger (3/8" long) and is dark to medium brown.

Photo courtesy of Jerry Payne, USDA-ARS, Bugwood.org

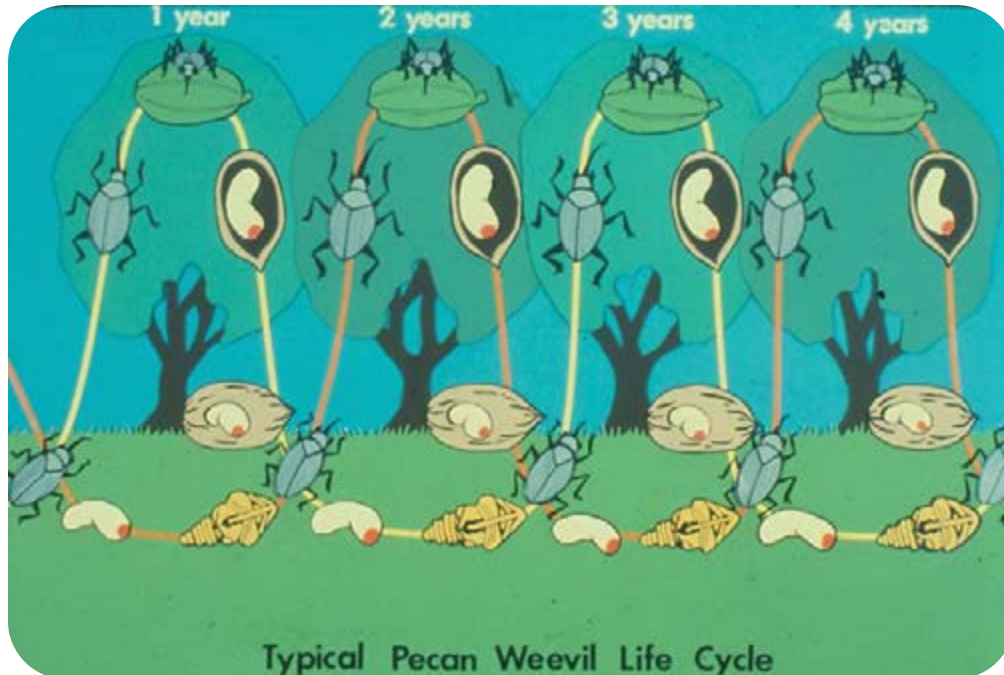
Larval Emergence

- ☞ Adult pecan weevils feed only in full-sized nuts with developed kernels, and infested nuts are very difficult to separate from sound nuts prior to larval emergence.
- ☞ Weevil larvae are easily transported long distances when in-shell nuts are moved.
- ☞ Freezing at 0°F for 7 days will kill them in the nut.
- ☞ Keeping nuts at approximately 80°F for a few weeks after harvest will allow larvae to emerge normally and sound nuts can be separated in an air cleaner.



Pecan Weevil Control

Insect Monitoring and Control



Life Cycle

When larvae reach maturity, they chew 1/8" holes in the shell, then drop to the ground, where they construct an earthen cell. After either one or two years as larvae, pupation occurs inside the cell during the late summer or fall. Pupation is completed in about 3 weeks, but the adults do not emerge from the soil until the following year, in the late summer or fall. The adults then emerge, primarily from mid-August to mid-September, to lay eggs in nuts. Note that soil emergence in the northern range of the pecan weevil may begin several weeks earlier to coincide with the earlier gel stage of nuts in those regions. The entire life cycle, from egg to egg, takes 2-3 years to complete, depending on whether one or two years is spent in the larval stage.

Graphic courtesy of LSU AgCenter, [Fact Sheet, Pecan Weevil](#)

Pecan Weevil Control

Insect Monitoring and Control

Control Adults After Emergence and Before Egg Lay

- ☞ Most of the pecan weevil's [life cycle](#) is spent underground.
- ☞ Applying insecticides to the soil has not achieved satisfactory control.
- ☞ Weevils must be controlled in the adult stage after they have emerged from the soil, but before egg laying begins.
- ☞ Once eggs have been laid, the opportunity is lost to control that portion of the population until 2 or 3 years later when progeny from the population that escaped may have increased about fivefold.



Pecan weevil, adult ovipositing. Courtesy of Jerry Payne, USDA-ARS, Bugwood.org

Monitor Adult Weevil Emergence

- ☞ Knowing when the adult weevils emerge from the ground can help the grower achieve satisfactory control before the adults lay eggs in nuts.
- ☞ This is because adult weevils generally do not lay eggs until 3-5 days after emergence.
- ☞ Once adult weevil emergence is detected, there is, in most cases, sufficient time to cover the orchard with insecticide before damage can occur.

Pecan Weevil Control

Insect Monitoring and Control

Monitoring

Limb Jarring

Adult weevil emergence can be detected by a variety of means. Jarring limbs with a padded pole or hook and catching the adults that fall from the tree onto a light colored ground cloth spread underneath the limb is a common method. It requires no special equipment and can be accomplished in a short time. However, there is no way of quantifying the population or knowing when the weevil first emerged, only that weevils are in the orchard.



Weevils emerge from the ground and some are captured when they enter the trap and seek the highest point, which ultimately leads them to confinement in a jar or container at the apex of the trap. The ground based cone trap allows a determination of their true density based on the area of the ground surface covered by the traps extrapolated to the ground surface under the tree canopies. Other traps provide relative estimates of density.



Emergence Cones

The most common method for monitoring pecan weevil is with the use of cone traps or trunk traps. These are constructed in a variety of designs using different materials, but they all have a pyramidal shape. Some cover a specific area of the soil surface and others can be affixed to the tree trunk (Circle Traps), and others mimic a tree trunk and are placed on the ground.



Cone Placement

Place cone traps under the tree canopy. Since weevil larvae fall from the tree and burrow into the soil where they fall, the adult weevils are found primarily within the dripline of the tree. Trees that have had a particularly heavy weevil infestation two years before are ideal for monitoring weevils. The probability of trapping emerging weevils is increased by using these "signal trees."

Top: Wire cone traps

Middle: Circle trap

Bottom: Pyramid trap

All photos courtesy of LSU AgCenter, Fact Sheet, [Pecan Weevil](#).

Population Density Economics

- ☞ Current estimates, given a uniform distribution of weevils in the orchard, suggest that one adult emerging under 50 square feet of cone traps will result in 56 pounds of native, or 83 pounds of improved, nuts lost per acre.
- ☞ A lower threshold would be preferred, if enough traps could be used to measure a smaller weevil population.

Knockdown Sprays

- ☞ Signal trees can also be used for a test spray or knockdown spray to detect the weevil.
- ☞ This is similar to the limb jarring method in that a light-colored ground cloth is spread under the tree and adult weevils that fall out of the tree 2 - 4 hours after spraying are observed.
- ☞ Fast-acting pyrethrins or carbaryl are effective "knockdown" compounds.

Nut Development Important

- ☞ The presence of the adult weevil is only one factor in the need to spray.
- ☞ The second is nut development.
- ☞ Weevil eggs must be laid in nuts in the late gel or early dough stage for the larvae to develop in the nuts.
- ☞ Nuts attacked before this stage fall off the tree and the larvae do not survive.
- ☞ However, once the late gel stage is reached, nuts need to be protected, if adult emergence has begun, to prevent weevil reproduction.

Timing Treatments

- ☞ Growers should check nut development in early August on the earliest trees.
- ☞ When the late gel stage is reached and adult weevils are found either in the trees or emerging from the ground insecticide treatments should begin.
- ☞ Do not assume that the first weevil has been caught and wait 3-5 days to treat. Start spraying immediately.
- ☞ Foliar application of carbaryl (wetable powder with no spreader sticker added) has been shown to be the most effective labeled insecticide for pecan weevil control providing 8-12 days of control following application.
- ☞ If stink bugs are also a problem, a tank mix may be considered as carbaryl does not appear as effective against stink bugs.

Monitor Through Shucksplit

- As long as adult weevils are emerging from the ground into the trees, an effective residual of insecticide should cover the nuts.
- If no weevils have emerged in the four consecutive days prior to the anticipated date of retreatment, spraying can be safely withheld.
- Monitoring for weevil emergence should continue until shucksplit to detect adults emerging late in the season.
- If adult weevils are again found in the orchard, resume treatments as before.
- Withhold treatment once shucksplit occurs.

Weevils Delayed by Drought

- ☞ Drought will often delay adult weevil emergence.
- ☞ Hard, dry, compact soils present physical resistance to weevils trying to leave the ground.
- ☞ Although some emergence will occur through cracks in the ground, the major emergence period must be accompanied by sufficient soil moisture to soften the soil in which the weevils occur.
- ☞ Most of the weevils are found at a depth of 4 - 6 inches, so rainfall that infiltrates to that depth will normally give rise to major adult weevil emergence if it has been delayed by hard, dry soils.
- ☞ Rainfall of 1 to 3 inches in September or October is usually sufficient to allow drought-delayed weevils to emerge.

Pecan Weevil Control

Insect Monitoring and Control

Survey

Sampling	Time
(a) Cut three nuts on earliest trees to determine nut development.	(a) August
(b) Deploy traps and continue to inspect nuts until gel stage is reached.	(b) Every 3 days once full water stage is reached.
(c) Shake lower limbs and catch adult weevils falling from limbs onto a light colored groundcloth. Inspect nuts for weevil feeding.	(c) Monitor traps, i.e. six weevil emergence cones or traps per tree under each of five sentinel trees in the orchard 3 times per week.
(c) Initiate treatment as needed. Continue monitoring weevil every 3 days after gel stage is reached until shucksplit, if needed.	(c) As gel stage approaches until risk of drought delay has passed, or until shucksplit

Action Level

Spray for pecan weevil if earliest nuts are in the late gel or early dough stage and adult weevils are found in trees or emerging into traps.

Note:

Some trees have pecan weevils year after year and should be monitored closely. Some orchards do not have weevils, but trees should be checked if weevils are known to be in the area. Weevils need pliable soil to emerge from the ground, and will often do so following rains.

Pecan Weevil Control

Insect Monitoring and Control

Adult Pecan Weevil Trap Construction Plans

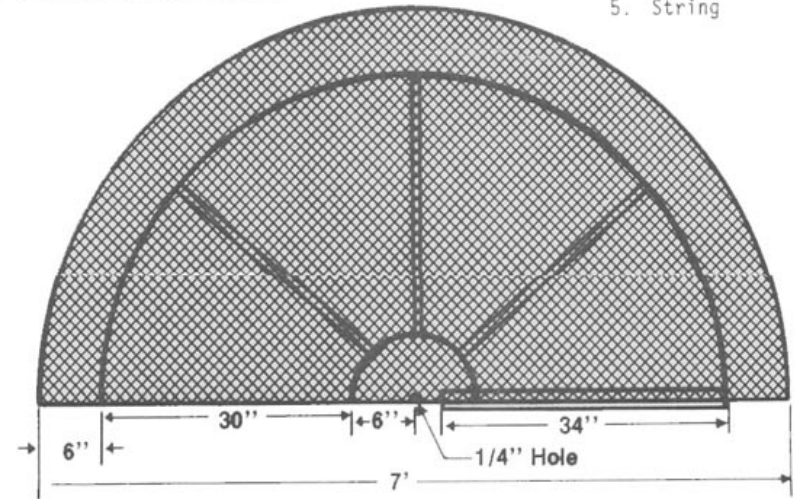
- ☞ Roll out screen and cut in the half circle pattern shown.
- ☞ Grasp the center of the straight side and set upright.
- ☞ Screen assumes a natural cone shape.
- ☞ Staple screen to the 34" lathe
- ☞ The 6" rim forms the skirt of the cage, which is covered with soil to hold the cage in place in the field.
- ☞ The collection jar (a small size baby food jar is sufficient) sits on the top of the cage
- ☞ Jar consists of a screw top with a hole in the lid which sits over the hole in the top of the cage.
- ☞ Secure lid with caulk
- ☞ Screw the jar onto the lid
- ☞ Snap-lid clear plastic boxes also work well by cutting a hole in the box away from the lid and setting it in the cage and caulking it down.
- ☞ Regardless of the type of top used, the screen top of the cage should be allowed to protrude about halfway into the collection device. This virtually eliminates weevils leaving the small hole from which they entered.

MATERIALS -

1. Screen 7' x 3½'
2. 3 Lath Boards 30" Long
1 Lath Board 34" Long
3. 1 Jar With Screw Top Lid

EQUIPMENT -

1. Tin Snips
2. Staple Gun
3. Felt Tip Marker
4. Yard Stick
5. String



Basic trap design from:
Raney, H.G. and R. D. Eikenbary. 1969. A simplified trap for collecting adult pecan weevils.
J. Econ. Entomology 62: 722-723.

[Download printable instructions \[PDF\]](#)