

Insect and Mite Pests

Introduction

In the East, in addition to foliar-feeding aphids and mites, there are several serious direct pests of the nut. Researchers have developed advanced IPM programs to minimize damage from these pests, and in most cases a biological control or otherwise organically acceptable control is available. However, two key pests throughout most of the eastern pecan production areas, the pecan weevil and the hickory shuckworm, present serious obstacles to organic production. In western production regions where pecan and its relatives (especially the hickories) are not native, some of the worst pecan pests have been left behind. In such areas the most troublesome pests are likely to be aphids and mites that feed on the foliage and stems.

Aphids and Mites

Aphids and mites are similar in that they are "indirect pests" (i.e., they feed on plant parts other than the harvested nut), have multiple generations through the growing season, and are often raised to pest status by the inadvertent killing of their natural enemies by pesticides targeted for them or other pests. This last characteristic has provided a major impetus for researchers to investigate the refinement of ecologically-based pest management systems to preserve the beneficial organisms and achieve natural biological control of aphids and mites.

Two species of yellow aphids attack pecans: the black-margined aphid (*Monellia caryella*) and the yellow pecan aphid (*Monelliopsis pecanis*). The primary damage caused by yellow aphid feeding is the deposit of honeydew on leaves, which supports the growth of sooty mold and reduces photosynthesis.

The black pecan aphid (*Melanocallis caryaefoliae*) can be more destructive than other aphids found on pecans. If left unchecked, its feeding can cause premature defoliation of the orchard. It is a pest in southeastern pecan groves and in Texas. While it can also be found in Oklahoma and

Kansas, it rarely occurs in densities sufficient to cause concern.

There are many natural enemies of aphids and mites, including ladybeetles, lacewings, damsel bugs, assassin bugs, spiders, and predacious mites. The planting of cover crops to provide refuge, insect prey, honeydew, nectar, pollen, and a water supply for these beneficial insects is how growers and researchers are beginning to solve aphid and mite problems through biological control (5,21,22).

USDA-SARE research conducted in Oklahoma (5) and Georgia (21) evaluated cool-season legumes as beneficial insect refuge. The goal was to identify which cover crops support predators and parasites of pecan pests, and to identify when they actually migrate from the ground covers into the trees to achieve biological control of the pecan pests.

Research thus far indicates that predators like lady beetles and green lacewings are attracted to cover crops to feed on pea aphids, cowpea aphids, and blue alfalfa aphids which inhabit the legumes. The number and species of beneficials found in the tree tops varied, but an increase in canopy numbers of predators was apparent where a crimson clover-hairy vetch ground cover was grown (5).

Dr. Glenn 'Cat' Taylor (23), former pecan specialist (retired) at the Noble Foundation in Ardmore, Oklahoma, said the need for aphid insecticide application is regionally specific as determined by the presence of aphid species. As an example, the only aphid occurring in sufficient numbers in Oklahoma is the yellow aphid. He advises Oklahoma growers to go with a "soft spray" program – using pesticides with low-toxicity to beneficials and with short environmental persistence – and foregoing aphid control because the yellow aphid causes more concern than actual damage.

At the other extreme, aphid problems in Georgia are severe enough to warrant the registration and use of the highly toxic, systemic insecticide aldicarb for aphid control. Dr. Jim Dutcher (24) reported that a four-step, less-toxic alternative

has been developed for Georgia growers. The program includes: [1] a row of legumes planted in the aisle; [2] controlling fire ants by spraying the trunks with insecticides (fire ants are indiscriminate predators and kill beneficial insects that would otherwise prey on aphids); [3] irrigation to ameliorate the stress to trees caused by aphid feeding; and [4] releases of aphid predators.

In short, while pesticides may occasionally be necessary to control mite or aphid problems, the manipulation of the orchard floor to provide habitat for beneficials and the release of beneficials into the grove or orchard will in many cases be sufficient to control aphid problems. Arnold Brothers Biological Insect Pest Control (25) is an insectary in New Mexico specializing in aphid control for pecan orchards.

Pecan Weevil

The pecan weevil (*Curculio caryae*) emerges as an adult from the soil under or near pecan trees primarily during August and September. The weevils mate and begin feeding on the developing pecan nuts soon after emergence.

Females lay eggs in the nuts, the eggs hatch, and the larvae feed on kernels inside the nutshells for approximately six weeks. Larvae then burrow out through the shell, fall to the ground, and enter the soil where they pupate and overwinter as adults. If conditions are favorable over several years, weevil "populations can increase until virtually all pecan nuts are infested" (26).

The pecan weevil is present throughout most of the South wherever pecans and hickories grow and is considered the most important pest of managed pecans in the southeastern U.S. (27). A large percentage of damaged nuts can render a crop practically unmarketable.

Interestingly, the pecan weevil is mysteriously absent from certain areas within states where the weevil is otherwise common. As an example, Brent Wiseman explained that areas around Stephenville and El Paso, Texas, harbor few weevils while the central Texas region is heavily

Biological Control

Adverse weather, inadequate food supply or natural enemies may hold insect and mite populations below damaging levels. It is important to recognize the impact of these natural control factors and, where possible, encourage their action.

Biological control is the use of living organisms (parasites, predators and diseases) to reduce pest numbers. Important natural enemies of pecan pests include lacewings, spiders, lady beetles, assassin bugs, predatory mites and many kinds of tiny wasps that parasitize insect pests.

Biological control includes conserving, augmenting and importing natural enemies. Conserve existing populations of natural enemies in the orchard by minimizing insecticide applications and by using insecticides least toxic to the natural enemy.

Examples include B.t. (*Bacillus thuringiensis*) insecticides (Dipel®, Javelin®), which are toxic only to certain moth caterpillars and not to insect predators or parasites. Ground covers such as legumes can provide food and shelter for natural enemies. Unsprayed native pecans serve as reservoirs of natural enemies that can move into adjacent sprayed orchards.

Augmentation involves periodically buying and releasing natural enemies. Research is under way to determine if such releases control pecan pests effectively and practically. Natural enemies can also be imported from other countries, then colonized and released. Once established, these natural enemies maintain themselves without further releases.

Source:

Managing Insect and Mite Pests of Commercial Pecans in Texas

Texas Agricultural Extension Service, B-1238
<http://entowww.tamu.edu/extension/bulletins/b-1238.htm>

Resources:

Farmscaping to Enhance Biological Control

ATTRA
<http://www.attra.org/attra-pub/farmscape.html>

Suppliers of Beneficial Organisms in North America

<http://www.cdpr.ca.gov/docs/ipminov/bensuppl.htm>

infested. Consequently, *location influences the degree to which pecan weevil control is necessary and where organic production is most feasible.*

The *Pecan Weevil Wanted Poster* from Texas A&M shows the distribution — the presence or absence — of pecan weevil in Texas. It is located on the web at:

<http://pecankernel.tamu.edu/publications/pwwanted.PDF>

Biological control options for pecan weevils are limited. Fire ants prey on pecan weevils, but they also prey on beneficials and are a nuisance to farm workers. Researchers have tried using soil-applied, beneficial, parasitic nematodes as well as entomopathogenic fungi, but nothing reliable has emerged from these efforts as yet.

Several methods have been developed to monitor weevil emergence, thus allowing for accurate spray timing. Heretofore, the two most important techniques have been the cone trap developed at Oklahoma State University (28), and the pyramid trap developed by USDA-ARS at Byron, Georgia (29). This latter trap is shaped like a pyramid, about 21 inches wide and 48 inches tall, painted brown, and capped with a screen funnel trap. When adult weevils emerge from the soil, they normally fly to the dark trunk of a pecan tree, but by whitewashing the tree trunks researchers found they could divert the weevils from the trunks to the traps. Ten to 15 traps per 100 acres is enough to monitor weevil emergence.

More recently, the Circle trap (named for its inventor, Kansas pecan grower Edmund Circle) has proved to be cheaper to construct and reliable as a monitoring tool, plus it is mounted on the trunk and therefore out of the way of grazing animals and mowing operations. Complete plans for fabricating this trap are available in *Monitoring Adult Weevil Populations in Pecan and Fruit Trees in Oklahoma*, OSU Extension Facts F-7190, on the web at: http://www.okstate.edu/OSU_Ag/agedcm4h/pearl/insects/cropbugs/f-7190.pdf.

The only viable control for pecan weevil at the present time appears to be one or two accurately

timed insecticide applications (e.g., Sevin®, Imidan®, Ammo®, Asana®, Fury®).

Pecan Nut Casebearer

The casebearer (*Acrobasis nuxvorella*) is a major pest in Texas, Oklahoma, Missouri, Kansas, Arkansas, and Louisiana, and occasionally reaches serious pest status further east. There is patchy distribution in New Mexico, but casebearers do not occur in Arizona or California.

The casebearer commits several types of damage. In the spring, partially grown larvae emerge from their overwintering site (a cocoon attached to a bud on a pecan twig) and burrow into buds and stems where they will pupate. Later in the spring (usually during May in most pecan growing regions) the moths emerge, lay their eggs on the tips of nutlets, and the resulting larvae feed on buds and the developing nutlets. These larvae will pupate within fruits, emerge as adults and again lay eggs on other fruits. The cycle continues throughout the summer, but third and fourth generation larvae usually cannot penetrate the hardened nut shell. The primary damage caused by the casebearer is dropping of nuts.

Monitoring is done by visual inspection of the nut tips. A hand lens can be used to look at nut tips more closely, though the trained eye is all that is necessary. The Texas Agriculture Extension Service and the University of Georgia have both developed models based on degree days that predict emergence and egg laying of the casebearer. Thus, monitoring of this pest can be very tightly managed by combining visual inspection with degree day reports from the Extension Service. Both the Georgia and Texas models can be seen at the *Oklahoma Pecan Management* website at:

<http://www.hortla.okstate.edu/pecan/>

Pecan nut casebearer pheromone traps, developed by Dr. Marvin Harris at Texas A&M University, are a recent innovation in pecan IPM monitoring.

A new low-impact pesticide effective against the casebearer is Confirm®, an insect growth regulator. Sprays of Confirm are most effective

when the majority of eggs on the nut tips are in the pink or red stage.

As the casebearer itself is a lepidopteran (moth) insect, organic growers can use the biological control *Bacillus thuringiensis kurstaki* (Bt). Trade names include Javelin® and Dipel®. Combined with a monitoring program, control is quite effective. Because Bt does not last long in the environment, sprays of Bt should be timed directly at the larvae rather than eggs. Apply when 1–2% of the nuts have been entered.

A rule-of-thumb method is to spray when the nut tips turn brown. This is not as accurate, so it is advisable if using this latter method to make a second application 7–10 days later.

Hickory Shuckworm

The adult hickory shuckworm (*Cydia caryana*) is a moth. Larvae of the shuckworm tunnel into pecan fruits from early spring until the shells harden in mid to late summer, thus destroying the fruit and resulting in premature nut drop. Three to four generations can occur each year. Later generations attack pecans after shell hardening; damage from larvae tunnelling into pecan shucks (hull) causes poor kernel filling and prevention of shuck split.

Early in the spring, the shuckworm feeds primarily on native hickory and is often found in phylloxera galls on pecan trees. Thus, one of the most effective control strategies for hickory shuckworm is targeting of phylloxera galls in spring. The soft-spray control method for phylloxera gall is a dormant application of horticultural oil. In northern production regions (Kansas, Missouri) where shuckworm pressure is not too high, the nut thinning process associated with hickory shuckworm may actually do more good than harm, according to Dr. William Reid at Kansas State University. The shuckworm is absent in the western pecan belt and in certain districts of other pecan-producing states.

Where it does occur, the shuckworm is considered a major pest for two reasons. The first reason is that, compared to the pecan weevil and

the pecan nut casebearer, the shuckworm is difficult to monitor. The second reason is that soft spray options like Bt are limited because the larval stage is spent mostly inside the pecan shuck and, therefore, short-lived pesticides sprayed on the foliage have limited efficacy.

The standard tool for monitoring of shuckworm until recent years was a blacklight trap. However, such traps attracted all kinds of insects and it was a time-consuming process to separate and count shuckworm moths. More recently, a pheromone that attracts female shuckworm moths was identified at Oklahoma State University. Pheromone traps for the hickory shuckworm are available through commercial pest management suppliers.

Several pesticides are registered for shuckworm control, including the insect growth regulator mentioned earlier, Confirm®. Growers raising certified organic pecans will have to rely on accurately timed applications of Bt, or use appropriately registered botanical insecticides.

Phylloxera

There are five known species of phylloxera (a.k.a. "plant lice") that attack pecan, but the pecan phylloxera, *Phylloxera devastatrix* is generally considered to be the most economically important. The pecan phylloxera is most common in its native range through Texas, Oklahoma, Arkansas, Louisiana, and Mississippi. This aphid-like pest causes galls or knots to appear, primarily on leaves though it also occurs on fruits and stems. Severe infestations, when they do occur, can result in plant stress, defoliation, terminal dieback, and reduction in yield and nut quality. Phylloxera galls also serve as a host for developing larvae of the hickory shuckworm.

In native groves, removal of susceptible trees during normal thinning programs can reduce or eliminate phylloxera problems (8).

Some cultivars are known to be more susceptible to phylloxera than others. Resistant cultivars include Mohawk, Chickasaw, Cherokee,

Shawnee, Sioux, Kiowa, Caddo, Cowley, Shoshoni, and Sumner (30). Cape Fear, Mahan, Wichita, Cheyenne, and Tejas appear only moderately susceptible, while Apache, Riverside, Stuart, Success, Schley, and Desirable are known to be susceptible (30-31).

By the time galls appear it is too late to do anything, since the galls encase the insect and thereby protect it from insecticides. If damage is anticipated, a dormant oil can be applied as part of a certified organic program though control may not be as effective. Regular pecan insecticides are typically applied at bud break to one-inch shoot growth. If sprays are delayed past this period there is a risk the pest will already be sequestered within a gall.

Diseases

Pecan Scab

Pecan scab, caused by the fungus *Cladosporium caryigenum*, is the most serious disease of pecans. Scab pressure is particularly bad in the Southeast where humidity and rainfall are high. It presents few problems in West Texas, New Mexico, Arizona, and California. In northern pecan groves, where the climate is drier than in the deep South and where genetic variation keeps scab from becoming epidemic, fungicidal control is not a regular practice.

Dr. Bruce Wood (32), horticulturist with the USDA Fruit Research Station located in Byron, Georgia, explained that while scab-resistant cultivars exist, many of the best commercial pecan cultivars are susceptible. Additionally, scab resistance has been found to diminish over time. For instance, 'Stuart' was rated as very resistant to scab for over 40 years, but by 1956 was considered susceptible (33).

Nevertheless, where scab is a factor most horticulturists are now suggesting that scab resistance be taken into account when selecting varieties and planning an orchard. Susceptible cultivars simply require too many fungicide sprays to be profitable.

See the table in the **Appendix** for a list of pecan cultivars currently rated as scab resistant.

Standard pecan fungicides can provide adequate control for scab. Some of the copper fungicides are permitted in certified organic production. In any case, early-season control is important.

Failure to control scab on susceptible cultivars early in the season can lead to 50–100% crop loss (33).

Abound®, a new-generation fungicide synthesized from a compound first discovered in strobilurin mushrooms, is very effective against scab and registered for that use. However, due to Abound's mode of action, *C. caryigenum* could develop resistance if Abound is over-relied upon. Therefore fungicide rotation is strongly encouraged.

In the humid Southeast, the standard recommendation for scab control may call for fungicide sprays every 2–3 weeks from early spring to near harvest. Fortunately, models for scab prediction are being developed. One such model, developed by Sharon von Broembsen of Oklahoma State University, can be viewed at the *Oklahoma Pecan Management* website at: <http://www.hortla.okstate.edu/pecan/>.

Other Diseases

There are several foliar diseases, including powdery mildew, downy spot, zonate leaf spot, vein spot, leaf blotch, et al., which can be troublesome for pecans, but rarely outside of commercial plantings in the Southeast. In most cases, sprays for scab will also control these problems.

Appendix:

Scab Resistant Pecan Cultivars



References:

- 1) Reid, William and R.D. Eikenbary. 1991. Developing low input management strategies for native pecan orchards. p. 69-76. In: Bruce W. Wood and Jerry A. Payne (eds.) Pecan Husbandry: Challenges and Opportunities. ARS-96. USDA-Agriculture Research Service, Washington, D.C.
- 2) Taylor, Glenn 'Cat'. 1990. Thinning native pecan trees. p. 187-190. In: Proceedings of the 9th Annual Oklahoma Horticulture Industries Show. Held January 5-6, Tulsa, OK.
- 3) Sparkes, Darrell. 1993. Leaf levels of zinc required for maximum nut yields and vegetative growth in pecan. p. 104-110. In: 84th Annual Report of the Northern Nut Growers Association. Held August 1-4, Pittsburg, Kansas.
- 4) Rice, N.R., et al. 1993. Evaluation of low input pecan orchard floor management systems. p. 95-103. In: 84th Annual Report of the Northern Nut Growers Association. Held August 1-4, Pittsburg, Kansas.
- 5) Smith, Michael W., et al. 1994. Screening cool-season legume cover crops for pecan orchards. American Journal of Alternative Agriculture. Vol. 9, No. 3. p. 127-134.
- 6) Smith, Michael W., Asrat Shiferaw, and Natasha R. Rice. 1996. Legume cover crops as a nitrogen source for pecan. Journal of Plant Nutrition. Vol. 19, No. 7. p. 1117-1130.
- 7) Hedger, George H. 1988. Considerations involved in purchasing pecan production equipment. p. 108-111. In: Proceedings of 7th Annual Oklahoma Horticultural Industries Show. Held January 28-29, Tulsa, OK.
- 8) Dr. Mike Smith
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360 Agricultural Hall
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405-744-6463
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- 9) Whitcomb, Carl E. 1981. Growing Tree Seedlings in Containers. Oklahoma Agricultural Experiment Station Bulletin 755. Oklahoma St. University, Stillwater, OK. 18 p.
- 10) Dr. William Reid
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Kansas State University
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316- 597-2758 Fax
- 11) Dr. Bill Gustafson
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serc004@unlvm.unl.edu
- 12) Anon. 1991. Pecans move north. American Horticulturist. September. p. 11.
- 13) Wolf, Margaret E. and Michael W. Smith. 1999. Cutleaf evening primrose and Palmer amaranth reduce growth of nonbearing pecan trees. HortScience. Vol. 34, No. 6. p. 1082-1084.
- 14) Foshee, W.G, W.D. Goff, M.G. Patterson, and D.M. Ball. 1995. Orchard floor crops reduce growth of young pecan trees. HortScience. Vol. 30, No. 5. p. 979-980.
- 15) Patterson, Michael G. and William D. Goff. 1994. Effects of weed control and irrigation on pecan (*Carya illinoensis*) growth and yield. Weed Technology. Vol. 8. p. 717-719.
- 16) Smith, Michael W., Becky L. Carroll, and Becky S. Cheary. 2000. Mulch improves pecan tree growth during orchard establishment. HortScience. Vol. 35, No. 2. p. 192-195.
- 17) Soil Foodweb, Inc.
980 NW Circle Blvd
Corvallis, OR 97330
541-752-5066
541-752-5142 Fax
Contact: Dr. Elaine Ingham
sfi@soilfoodweb.com
<http://www.soilfoodweb.com>
- 18) McCraw, Dean, M.W. Smith, R. Eikenbary, and D. Arnold. 1995. Use of Legumes in Pecan Orchards. Current Report No. 6250. Cooperative Extension Service, Oklahoma State University. 4 p.

- 19) Pecan Production in the Southeast: A Guide for Growers. 1989. ANR-459. Alabama Cooperative Extension Service, Auburn University. 230 p.
- 20) Brent Wiseman, Coordinator for Organic Programs
Texas Dept. of Agriculture
P.O. Box 12847
Austin, TX 78711
512-463-7476
- 21) Bugg, R.L., M. Sarrantonio, J.D. Dutcher, and S.C. Phatak. 1991. Understory cover crops in pecan orchards: Possible management systems. American Journal of Alternative Agriculture. Vol. 6. p. 50-62.
- 22) Tedders, W.L. 1983. Insect management in deciduous orchard ecosystems: Habitat manipulation. Environmental Management. Vol. 7. p. 29-34.
- 23) Dr. Glenn 'Cat' Taylor (retired)
The Samuel Roberts Noble
Foundation, Inc.
P.O. Box 2180
Ardmore, OK 73402
405-223-5810
[Scott Landgraff at The Noble Foundation can provide current pecan recommendations]
- 24) Dr. Jim Dutcher
Associate Professor of Entomology
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Coastal Plain Experiment Station
Box 748
Tifton GA, 31793
913-386-3567
- 25) Arnold Brothers Biological Insect Pest Control
P.O. Box 450
Fairacres, NM 88033
505-526-6165
- 26) Harris, Marvin. 1985. Pecan phenology and pecan weevil biology and management. p. 52. In: W.W. Neel (ed.) Pecan Weevil: Research Perspective. Quail Ridge Press, Brandon, MS.
- 27) Mizell, R. F., III. 1985. Risk rating: A fruitful approach to management of the pecan weevil. p. 69. In: W. W. Neel (ed.) Pecan Weevil: Research Perspective. Quail Ridge Press, Brandon, MS.
- 28) Eikenbary, Raymond D. et al. 1994. Monitoring Adult Pecan Weevil Populations, OSU Fact Sheet No. 7175. Cooperative Extension Service, Oklahoma State University. 4 p.
- 29) Anon. 1995. Pyramidal weevil traps offer option to cone trap. Pecan South. July. p. 22-23, 26.
- 30) Calcote, V.R. 1985. Resistance of pecan clones to *Phylloxera devastatrix* Pergande and *P. russellae* Stoetzel. p. 63-69. In: W.W. Neel, et al. (ed.) Aphids and Phylloxeras of Pecan. Georgia Agricultural Experiment Station Special Publication 38.
- 31) *Pecan Entomology in Louisiana*
Louisiana State University
<http://www.agctr.lsu.edu/agcenter/research/pecan/MJH/ento.htm>
- 32) Dr. Bruce Woods
USDA Fruit and Research Station, ARS
P.O. Box 87
Byron, GA 31008
912-956-5656
- 33) Ellis, H.C. et al. 1984. Pecan Pest Management in the Southeast. University of Georgia Cooperative Extension, Athens, GA. p. 35-37.

Print Resources

Pecan Grower's Handbooks:

Pecan Production in the Southeast: A Guide for Growers. 1989. Alabama Cooperative Extension Service, Auburn University. 230 pages. 300 full-color photographs. \$45.00

Available from:

Alabama Cooperative Extension Service
Publications
6 Duncan Hall
Auburn University, AL 36849-5632
334-844-1592

Texas Pecan Grower's Handbook. 1994. Texas Agriculture Extension Service, Texas A&M University. 200 pages. \$15.00.

Available from:

Extension Horticulture
Texas A&M University
College Station, TX 77843-2134
409-845-8904

New Mexico Pecan Growers' Handbook. 1991. Cooperative Extension Service, New Mexico State University. 214 pages. \$35.00

Available from:

Dr. Esteban Herrera
New Mexico State University
Plant Sciences Dept.
Box 3AE
Las Cruces, NM 88003
505-646-0111

Books and Periodicals on Pecans:

Several good books and trade magazines on pecans are available from one source in Texas. Contact:

The Olde Pecan Bookstore
P.O. Drawer C
College Station, TX 77841
409-846-3285
409-845-1752 Fax
<http://www.texaspecan.com/books.htm>

Books:

Pecans – A Grower's Perspective. 1994. By Wes Rice. PecanQuest, Ponca City, OK. 198 pages. \$57.50 hardback, \$39.50 softcover.

Pecan Cultivars: Past and Present. 1985. By Tommy E. Thompson and Fountain Young. Texas Pecan Growers Association, College Station, TX. 265 pages. \$19.95 hardback, \$12.95 softcover.

The Pecan Tree. 1994. By Jane Manaster. University of Texas Press, Austin, TX. 109 pages. \$17.95.

Pecan Pest Management in the Southeast. 1984. By H.C. Ellis, et al. University of Georgia Cooperative Extension Service, Athens, GA. 62 pages. \$28.00.

Pecan Production in the Southeast: A Guide for Growers. 1996. By William D. Goff, John R. McVay, and William S. Gazaway. Alabama Cooperative Extension System, Circular ANR 459. 222 pages. \$45.00.

Periodicals:

Pecan South (monthly), \$18.00

The Texas Horticulturist (monthly), \$12.00

The Pecan Newsletter, \$85.00

[Pecan marketing information delivered in weekly issues through the harvesting and marketing season, late September thru late January].

All the periodicals listed above are available from The Olde Pecan Bookstore.

Pecan Grower (quarterly), \$8.00

Available through:

Georgia Pecan Growers' Association
4807 Woodland Dr.
Tifton, Georgia 31794
912-382-2187

Electronic Resources on Pecan Production and Pecan Pest Management

An Introduction to the Genus *Carya*

National Clonal Germplasm Repository for Pecans and Hickories

<http://extension-horticulture.tamu.edu/carya/species/index.htm>

Pecan Cultivars Index

Pecan Genetics and Improvement Research, Agricultural Research Service, USDA

<http://extension-horticulture.tamu.edu/carya/pecans/cvintro.htm>

Growing Pecans in Kansas

Kansas State University Extension Service, MF-1025

<http://www.oznet.ksu.edu/library/hort2/SAmplers/MF1025.htm>

Growing Pecans in North Carolina

North Carolina State University

<http://www.ces.ncsu.edu/depts/hort/hil/ag81.html>

Pecan Cultivar Performance at the Coastal Plain

Experiment Station, 1921-1994. Georgia Agricultural Experiment Station Research Bulletin 426. 34 p.

<http://www.ces.uga.edu/pubs/PDF/RB426.pdf>

IPM for Alabama Fruit and Nut Trees

Alabama Cooperative Extension Service

<http://www.aces.edu/department/ipm/treefipm.htm>

Pecan Diseases in Alabama

Alabama Cooperative Extension Service, ANR 606

<http://www.aces.edu/department/extcomm/publications/anr/anr-606/anr-606.html>

Pecan Entomology in Louisiana

Louisiana State University

<http://www.agctr.lsu.edu/agcenter/research/pecan/MJH/ento.htm>

Pecan Insects, Images & Descriptions in South Carolina

Clemson University

<http://entweb.clemson.edu/cuentres/cesheets/pecan/>

Pecan Pest Management: Insects and Diseases

University of Missouri-Columbia, MP711

<http://muextension.missouri.edu/xplor/miscpubs/mp0711.htm>

New Mexico State University

Pecan Publications

http://www.cahe.nmsu.edu/pubs/_h/

The New Mexico State University website hosts about 36 different fact sheets on pecan production and pecan pest management.

Also at New Mexico State University:

Controlling the Pecan Nut Casebearer by Applying Insecticide Based on Heat Units

New Mexico State University

http://weather.nmsu.edu/nmcrops/pecans/pecan_nut_casebearer.html

Oklahoma Pecan Management

Oklahoma State University

<http://www.hortla.okstate.edu/pecan/>

The Oklahoma Pecan Scab Model

<http://blaze.ocs.ou.edu/~nassar/scab/>

The Oklahoma Pecan Nut Casebearer Model

<http://blaze.ocs.ou.edu/agwx/models/pecan/pnc/>

Oklahoma Cooperative Extension Service

Pecan Publications

<http://agweb.okstate.edu/pearl/hort/fruits/index.html>

The OSU website hosts about 17 different fact sheets on pecan production and pecan pest management.

Also at Oklahoma State University:

F-7642 - Pecan Diseases: Prevention and Control

<http://agweb.okstate.edu/pearl/plantdisease/f-7642.pdf>

Texas A&M University Aggie Horticulture

<http://aggie-horticulture.tamu.edu/>

Texas Nut Culture 418

Texas A&M online Horticulture Course

<http://aggie-horticulture.tamu.edu/syllabi/418/schedule.htm>

Managing Insect and Mite Pests of Commercial Pecans in Texas

Texas Agricultural Extension Service, B-1238

<http://entowww.tamu.edu/extension/bulletins/b-1238.html>

Controlling the Pecan Nut Casebearer

Texas Agricultural Extension Service, L-5134
[http://entowww.tamu.edu/extension/
/bulletins/1-5134.html](http://entowww.tamu.edu/extension/bulletins/1-5134.html)

Pecan Pest Management CD-ROM

Developed at Texas A&M University, the **Pecan Pest Management CD-ROM** features:

General Information – pecan tree overview, pecan phenology, calendar checklist, chemicals, cover crops, diagnostic key.

IPM Information – key pests, natural enemies, diseases, casebearer and pecan weevil management.

Tutorial – pecan tree, pest management graphics by region, early-, mid-, and late-season pests.

With 166 color photos and the ability to search by keyword. Available for \$60 through The Olde Pecan Bookstore.

Field Guide to the Insects and Mites Associated with Pecan, B-6055

[http://entowww.tamu.edu/extension/forsale/
/b-6055.html](http://entowww.tamu.edu/extension/forsale/b-6055.html)

Texas A&M's entomological field guide to important pests and beneficial insects found in pecan orchards, with color photos and descriptions; available for \$12.95 per copy (includes postage and handling). Make checks or purchase orders payable to: Texas Agricultural Extension Service Account #233206

Publication and Supply Distribution
Texas Agricultural Extension Service
P.O. Box 1209
Bryan, TX 77806-1209

Texas Pecan Pest Management Newsletter

Entomology at Texas A&M University
[http://entowww.tamu.edu/extension/
/newsletters/](http://entowww.tamu.edu/extension/newsletters/)

Published 8–10 times during the growing season between March and September. Back issues to 1998 are located online, as well as the current growing season.

Texas Pecan IPM Articles in The Pecan Press

<http://pecankernel.tamu.edu/newsletters/>

Pecan Kernel (Texas)

<http://pecankernel.tamu.edu/>

A pecan pest management site from Texas A&M entomology. It provides a convenient link to all the current and back issues of *Texas Pecan Pest Management Newsletter* and *Texas IPM for Pecan Press* articles. Here, you can also find a list of pecan specialists working at 19 land-grant universities and research and extension centers.

UC Pest Management Guidelines: Pecans

University of California
[http://www.ipm.ucdavis.edu/PMG/
/selectnewpest.pecans.html](http://www.ipm.ucdavis.edu/PMG/selectnewpest.pecans.html)

1998 Sample Costs to Establish a Pecan Orchard and Produce Pecans (San Joaquin Valley, Flood Irrigated)

University of California
[http://www.agecon.ucdavis.edu/outreach/crops/
/cost-studies/98pecans.pdf](http://www.agecon.ucdavis.edu/outreach/crops/cost-studies/98pecans.pdf)

Routing Pecan Scab – Protecting a Popular Nut

USDA Agricultural Research Service
[http://www.ars.usda.gov/is/AR/archive/aug98/
/scab0898.htm](http://www.ars.usda.gov/is/AR/archive/aug98/scab0898.htm)

Crop Profile for Pecans in North Carolina

USDA Office of Pest Management Policy & Pesticide Impact Assessment Program
[http://pestdata.ncsu.edu/cropprofiles/
/Detail.CFM?FactSheets__RecordID=205](http://pestdata.ncsu.edu/cropprofiles/Detail.CFM?FactSheets__RecordID=205)

Crop Profile for Pecans in Texas

USDA Office of Pest Management Policy & Pesticide Impact Assessment Program
[http://pestdata.ncsu.edu/cropprofiles/Detail.CFM?
FactSheets__RecordID=291](http://pestdata.ncsu.edu/cropprofiles/Detail.CFM?FactSheets__RecordID=291)

The USDA Office of Pest Management Policy & Pesticide Impact Assessment Program website provides a state-by-state assessment of pesticide use in crop production. Reports provide crop status, key pests, and typical pesticide recommendations. Currently North Carolina and Texas are the only two states that have completed reports on pecans. These crop profiles are valuable because they summarize the important pests and what pesticides are used to control them. Where least-toxic or cultural controls are available, these are also included.

Northern Nut Growers Association, Inc.

Articles & Books on Pecans
<http://www.icserv.com/nnga/pecan.htm>

Texas Pecan Growers Association

<http://www.texaspecan.com/>

Darrell Sparks' Pecan Page

University of Georgia-Horticulture

[http://www.geocities.com/CollegePark/Campus/
/3370/](http://www.geocities.com/CollegePark/Campus/3370/)

IPM Pest Management Supplies

BioQuip Entomology Products

17803 LaSalle Ave.

Gardena, CA 90248-3602

310-324-0620

310-324-7931 Fax

bioquip@aol.com

Supplier of entomology books and supplies:
handlens, catch nets, blacklights, pheromones
traps, etc.

Gemplers IPM Products

P.O. Box 270

Belleville, WI 53508

1-800-332-6744 (Customer Service)

1-800-382-8473 (Phone orders)

<http://www.gemplers.com>

Supplier of IPM books and manuals; IPM field
products, & pesticide safety gear.

Trece

1143 Madison Lane

Salinas, CA 93907

831-758-0204

831-758-2625 Fax

<http://www.trece.com>

Supplier of pheromone traps & lures.

The electronic version of **Sustainable Pecan
Production** is located at:

<http://www.attra.org/attra-pub/pecan.html>

**By Steve Diver and Guy Ames
NCAT Agriculture Specialists**

Revised November 2000

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APPENDIX:**Pecan Cultivars Resistant to Pecan Scab***

Cultivar	Average rating ¹
Apache	5.0
Wichita	5.0
Burkett	5.0
Western Schley	5.0
Tejas	4.0
Cherokee	4.0
Cherokee	4.0
Cheyenne	3.5
Mahan	3.3
Shawnee	3.0
Sioux	2.7
Pawnee	2.5
Shoshoni	2.5
Mohawk	2.5
Maramec	2.5
Forkert	2.3
Osage	2.2
Colby	2.0
Barton	1.7
Peruque	1.7
Kiowa	1.7
Cape Fear	1.7
Podsednick	1.7
Choctaw	1.7
Chickasaw	1.5
Curtis	1.5
Desirable	1.5
Stuart	1.5
Caddo	1.2
Moreland	1.2
Sumner	1.2
Jackson	1.0
Success	1.0
Starking Hardy Giant	1.0
Gloria Grande	1.0
Melrose	1.0

¹No scab lesions = 1; Lesions on over half of nut surface area = 5

From: Thompson, Tommy E. and L.J. Grauke. 1994. Genetic Resistance to Scab Disease in Pecan. HortScience. September. p. 1078-1080.