OKLAHOMA PECAN GROWERS ASSOCIATION

Volume LIV, No. VIII *Michael Smith, Editor* *October, November , December 2014*

In This Issue

Oklahoma Pecan Growers' Association is published 4 times per year and is a benefit of being an association member. Contact the Oklahoma Pecan Growers' Association c/o Horticulture & Landscape Architecture, Oklahoma State University, 358 Agriculture Hall Stillwater, OK 74078-6027 for further information.

President'S Corner

By Bob Knight

The new Dean of the Division of Agriculture at Oklahoma State met with four pecan growers, Bill Ihle, Chad Selman, Mike Spradling and me, at his office in Stillwater in August. Dr. Thomas G. Coon is from Michigan State University and his formal title is Vice President, Dean and Director for the Division of Agricultural Sciences and Natural Resources. We each explained the nature of our particular enterprises and expressed our concerns about the loss of the pecan extension horticulturalist as well as our interest in having Dr. Smith replaced when he retires in a couple of years.

Dr. Coon seemed to be supportive and was very interested in our unique sort of agriculture. As his background is in fisheries (not nuts), he asked a lot of questions and indicated his intentions concerning filling the positions in question.

A few weeks before this meeting we had been informed that the Boone Pickens Fund for creating professorships had turned up some extra money that, when accompanied with State of Oklahoma matching funds, would give us the opportunity to have an endowed professorship or chair for the faculty position currently held by Dr. Michael Smith. Pecan growers had raised about $100,000 over the past several years, but we had been told that the matching money was all gone so the effort had slowed and the money was in an account with the OSU Foundation.

We discussed this with Dr. Coon, and agreed that we should all work toward raising the additional money to get us up to the $250,000 needed to

trigger the matching money from the State and Mr. Pickens. Time was of the essence since other groups were also competing for this money. None of us ever imagined that the goal would be met so quickly.

Now there is a $1,000,000 professorship, the $250,000 given by pecan growers and $750,000 in matching money. Wow! That is a great deal. Since we have met the trigger level of $250,000, every dollar raised from now on is automatically matched at 3:1 until we reach $312,500 and then the match drops to 0.25:1. Interest from this professorship endowment would fund that position from now on. We have the chance to build on our success. This 3:1 match will continue until the Pickens money is used up (for every $1 you donate the endowment ends up with $4.00).

If you are an OSU graduate and have ever thought that you might want to give some money to your school, this would be a great opportunity. If you are not (I am a Sooner) join us anyway. If you have sons and daughters that are or will be pecan growers, this is your chance to insure that the kind of faculty support that we have taken for granted will be available to them in the future.

OSU Pecan Webpage Improvements

Becky Carroll, Extension Assistant

Have you ever browsed the OSU Pecan Webpage? It's available at www.okpecans.okstate.edu. On the webpage you can find information on the pecan management course, pecan pests, propagation & grafting, pecan fact sheets and a management section with links to many important sites.

There is a news section too. If you know of pecan activities, meetings or festivals that are coming up in your county or area, let us know and we can add to the news section.

Next time you are on the web, take a peek at what we have available!

Updated Fact Sheets

HLA-6200	A Calendar for Pecan Growers
HLA-6201	Pecan Varieties for Oklahoma
HLA-6204	Bark Grafting Pecans
HLA-6205	Splice and Tongue Grafting Pecans
HLA-6206	Patch Budding Pecans
HLA-6207	Starting Pecan Trees
HLA-6217	Collecting and Storing Pecan Propagation Wood
HLA-6230	Four-Flap Grafting of Pecans
HLA-6232	Fertilizing Pecan and Fruit Trees
CR-6242	Weed control in pecan, apple and peach

Online Pecan Management Course

Did you know an online version of the Pecan Management Course is available? It is designed for those who are unable to attend the regular pecan course. Students can have a one-year access to use the study for a $75 fee. It is also available to the Pecan Management Class members free of charge to supplement the in-class studies.

Over the last 10 years, more than 400 people have had access to this self-study pecan webpage. People from 24 different states have enrolled in the course as well as growers from Australia, Brazil, Chile, Israel, Spain and Turkey.

For more information please go to www.pecan.okstate.edu.

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Updated August, 2014

Look for 2015 Pecan Management Class Sign-ups Coming in November

Becky Carroll, Extension Assistant

The 2015 Pecan Management Course signups will be beginning soon. The brochure will be available online at http://okpecans.okstate.edu/pecan-management-course. Reaching almost 500 students over the past 17 years, the OSU extension course is set up to teach both new and experienced pecan growers from around the state. The 2014 class had 23 participants from around Oklahoma and one lone Texan. We will have our final class on Oct 21. The emphasis will be on harvest and marketing our pecan crops. The unique mix of veteran, beginner and potential growers makes the class beneficial to all no matter their experience level. We learn a lot and have a good time too!

With expert speakers from OSU, the Noble Foundation, and the pecan industry, class members get a well rounded program of presentations and hands on activities. We appreciate all the expertise that these speakers provide. Special thanks to Charles Rohla for his help with the class again this year.

The course is scheduled so that management items can be addressed each month at the appropriate times. Class members have the opportunity to learn about growing rootstock trees by actually participating in the process. Each month students can see the progress of the growth and in October have seedling trees to take home and establish. Cimarron Valley Research Station personnel demonstrate equipment and share management techniques that are used at the site. Students learn about everything from business management to pest control to variety selection. Those class members with good attendance will receive a certificate of completion.

The fee for the 9-month course is $250 per person. The classes meet north of Perkins at the research station once a month from March through October, with the exception of June when participants are encouraged to attend the annual Oklahoma Pecan Growers' Association meeting. The meeting times are on Tuesday afternoons from 1-5pm. Students also have access to the online pecan class and will receive details during the first class on how to access. *County extension educators are welcome to attend the course at no charge. Encourage your county educator to sign up with you.*

The 2015 class will begin in March. Deadline for registration will be late February. If you would like to enroll in the class or you know someone that would benefit from brushing up their management skills, please have them contact Stephanie Larimer. Her email is stephanie.larimer@okstate.edu and phone number is 405-744-5404. If you have other questions concerning the class, please contact Becky Carroll at becky.carroll@okstate.edu.

Pecan Orchard Geometry

Walt Thrun, Claremore, OK

It all started in 1980 when we began grafting pecan sprouts growing randomly in a 40- acre river bottom pasture. The hydrologic characteristics of the pasture were great for growing pecans. The result was approximately 350 'Maramec' trees, chosen primarily due to nut size and percent meat content. Inasmuch as the tree sprouts were growing randomly, the distance between them varied greatly. Therein lays the present challenge.

This season, even after successfully controlling scab with five fungicide applications, many nut shucks darkened prematurely accompanied with a significant nut drop in August. Upon searching previously published literature for answers, I began to think the problem was very likely 'shuck die-back' or 'shuck deterioration'. Such a problem is related to tree stress caused by various factors including inadequate sun light and over crowding.

As I looked around the orchard it was obvious that trees with adequate spacing and sufficient sunlight had a very healthy crop, but those trees that were closely spaced suffered extensive damage. Actually I had anticipated the problem but hadn't had the incentive to rectify it until now.

The healthier trees have drip line diameters approaching 75 feet, are 40-50 feet tall, and have a trunk circumference averaging 60 inches at eye level. Thus, the initial question is what should be the spacing between trees?

An indication that trees are over crowded occurs when the drip line diameter to height ratio reverses, i.e. when tree height is greater than the drip line diameter. Allowing for 10 feet between drip lines of adjacent trees, spacing should be at least 85 feet. Then how many trees per acre will result?

The area for the drip line is *Pi* x [radius x radius] where the radius is ½ its diameter. *Pi* is a constant value of 3.142 representing the relationship between a circle's diameter and circumference. The diameter of the tree is its circumference divided by 3.142.

Tree spacing of 85 feet will result in 7.7 trees per acre calculated as follows:

3.142[42.5 x 42.5] or 5,675 sq ft per tree. 43,560 sq ft per acre divided by 5,675 sq ft per tree = 7.7 trees per acre.

The next question is what percent of an acre will be left open for sunlight? Area required for 7.7 trees with 75 foot drip line = 3.142[37.5 x 37.5] x 7.7 = 34,022 sq ft divided by 43,560 = 78% of an acre that will be shaded leaving just 22% for sunlight. That may not be sufficient. A management decision needs to be made at this point.

Another question is how much pesticide or fungicide is required per acre? Some conventional wisdom suggests that 30 sq ft of trunk area is equivalent to an acre of pecan trees. But in this particular case the average trunk diameter is 19 inches, or 3.142[9.5 x 9.5] x 7.7 = 2,183 sq inches divided by 144 sq inch per sq ft = just 15.2 sq ft trunk area per acre.

Considering 125 gallons spray solution per acre, a 500 gallon tank should cover 4 acres, or roughly 31 trees. However, the actual tree count per tank will be determined by how many gallons are required to cover the tree surface effectively. On top of all that, recommended chemical usage is typically listed in oz per acre often carried out to two decimal places. Sometimes it's a little difficult to justify restricted chemical usage to the auditor based on manufacturer's recommendations.

A major question is what is an acre? In my case the definition of an acre may be expressed as the lateral surface area covered with 125 gallons of spray solution. It always boils down to the fact that no two orchards are exactly the same and each orchard needs to be managed individually. There are so many variables to consider.

To improve orchard productivity I'm going to do some very serious tree thinning; spray by encircling the larger trees; and reduce tractor speed. Additional benefits of removing excess trees include better air circulation to assist scab prevention, better access to all surfaces of the trees for spraying, and fewer nuts damaged during the harvesting process.

Another way to reduce tree stress is to mechanically thin each tree annually, especially a cultivar such as 'Maramec', which I have not been doing diligently. That should also increase production and quality by reducing the negative affects of alternate bearing.

Late Season Pecan Pests

Jackie Lee, PhD: Fruit and Pecan Extension Specialist at OSU

I would like to provide some considerations for late season pecan pests and how their management may be related.

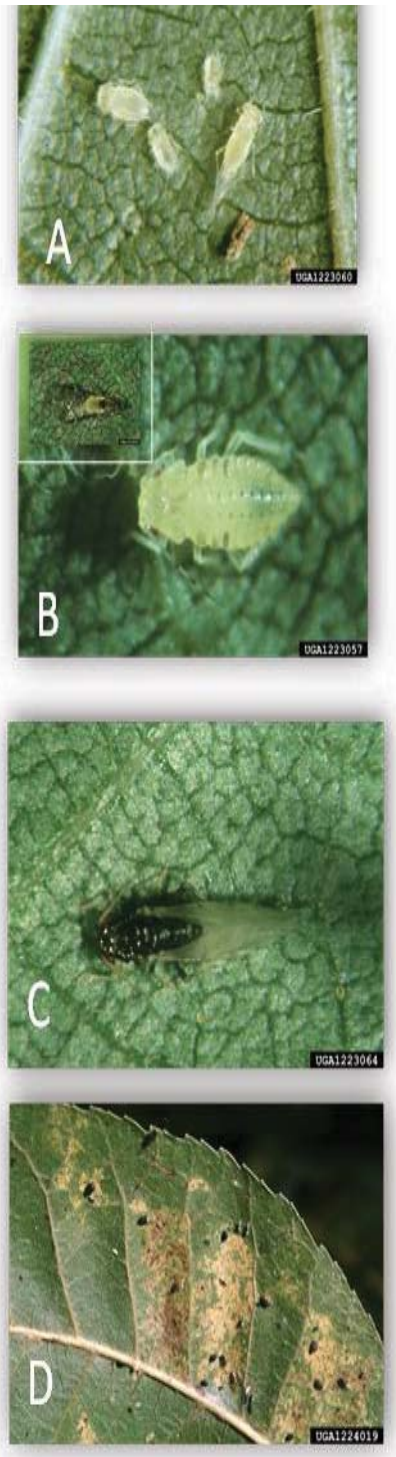
Monitoring for pecan weevil is necessary to determine presence and emergence for making management decisions. I suspect weevil emergence has occurred in most Oklahoma locations. We have had many rainfall events across the state the past 30 days.

What you choose to control pecan weevil can dictate what pests you may be controlling later in the season. If you spray a pyrethroid for pecan weevil control, you will also control other insects that may be present including stink bug, but also, all the beneficial insects that generally keep our aphid populations in check: Lacewings, predatory mites, lady beetles, and lacewings. This can cause aphids or mites to flare late season. After a pyrethroid application for weevil, I would recommend scouting for aphids weekly by checking all compound leaves on ten terminals for ten trees from different locations in the orchard. If you use carbaryl for weevil control, you will not get added control of stink bug, but will have less chance of flaring aphids and mites. Pick the best option for the pests present in your orchard.

Stink bugs are in the order Hemiptera and are commonly called true bugs by entomologists. Pest species have long slender mouthparts that are used to suck plant juices.

There are three stink bug species that are common pests of pecans in Oklahoma, southern green stink bug, leaf footed bug, and brown stink bug (Fig. 1: A,B, &C). There are a few species that are beneficial and serve as predators, feeding on common pests of pecans.

One of the most common beneficials in this group is the assassin or wheel bug (Fig. 1: D). Stink bugs will feed throughout the season and can cause black pit before shell hardening, which can cause drop. Later in the season, their feeding will result in kernel spot that can occur after shell hardening, which causes discoloration (Fig 1: E)



If you find aphids during scouting, your primary considerations should be what type of aphid do I have and are they above threshold levels? There are 3 types of aphids commonly found in pecans: yellow pecan aphid, black-margined aphid, and the black aphid (Fig. 2: A, B, & C). Sometimes the yellow and black-margined aphid will be collectively referred to as yellow aphids. Greater numbers of yellow aphids (yellow & black margined) are required to cause economic loss when compared to the black aphid. The threshold number is the number of aphids required per compound leaf which warrants a treatment to minimize economic loss. For the yellow aphids (yellow and black-margined collectively) threshold has been determined at 25 aphids per compound leaf. The black aphid threshold is 3 aphids per compound leaf.

The magnitude of damage from these aphids differs, which is why thresholds differ significantly. The black aphid can cause significantly more damage in a shorter amount of time. The aphid injects its needle like mouthparts into the leaf in between veins and feeds on the sap. While feeding, this aphid injects a toxin that causes yellowing of the leaf (Fig. 2: D). This feeding can cause leaves to shed prematurely and lead to defoliation. All aphids produce honeydew which is a waste product that coats the leaves in a shiny sticky fluid. The honeydew residue can promote growth of a black sooty mold. This sooty mold can cause a decrease in the amount of photosynthesis reducing the amount of nutrients being produced for the tree to use for nut production and growth. Not only will this affect nut production for the current year, but can also decrease the amount of budding for the next year.

There are many labeled insecticides for aphids. Many people choose an imidacloprid (neonicotinoid) product, which works well. There have been reports of resistance in our neighboring state of TX. If you suspect that resistance has developed in your orchard please contact me. A new insecticide has entered the market this year with the active ingredient sulfoxaflor, marketed as Closer. This product is also very effective at controlling aphids and has a great residual. It is specific to sap feeding insect pests and is listed by IRAC as a separate subcategory from neonicotinoids. This product can be used as a rotational partner to combat resistance. I would not recommend spraying a pyrethroid.

Oklahoma State Pecan Show 2014

Becky Carroll

It's that time of year again! Remember to save back a couple of pounds of your best pecans to enter in the state show this year. We've made a few changes to the list of classes that we will be using this year. We removed several classes that hadn't had any entries in the last several years such as Apache, Mahan, San Saba, Sioux and Success and added some that have had more entries but were only able to participate in the Other Cultivar class. The new classes are Oconee, Lakota, Waco, Nacono and Podsednik.

There will not be any qualifying regional or district pecan shows this year. However, some county/area shows will be held at the discretion of the County Extension Educator. Winning entries from county shows will be sent to the state show. If no county/area show is available, growers may enter pecans directly by sending samples to Oklahoma State University, Department of Horticulture, Attn: Becky Carroll, 358 Ag Hall, OSU, Stillwater, OK 74078. Samples should arrive by January 23, 2015.

Samples should be entered in a sealed plastic or paper bag. Label the bag on the outside and place a label inside the bag. Information should include exhibitors name and address, county, and type of pecan entered. Be sure to follow the guidelines that are listed below before sending entries.

A few helpful hints: Take the time to select pecans that are all the same cultivar, or same size and shape natives – *don't send mixed pecans*. Select uniform, clean, uncracked pecans. Presentation can make the difference between two very similar samples. Make sure to send 2 pounds of pecans in a labeled and sealed bag.

General Rules and Guidelines

- All entries must be grown in Oklahoma during the current season.
- Each entry shall consist of two pounds of nuts.
- Entries deemed unworthy by the judges will not compete for awards.
- Label each entry as to exhibitor's name, address and cultivar of nuts. If more than one native (seedling) pecan exhibit is made, identify the nuts from separate trees by numbers. Only one exhibit of each cultivar or native tree may be entered by one individual.
- Each entry will compete in one of the following 26 classes:

Barton	Pawnee
Burkett	Peruque
Cheyenne	Podsednik
Choctaw	Schley (eastern)
Comanche	Shoshoni
Gratex	Squirrels Delight
Kanza	Stuart
Kiowa	Waco
Lakota	Western
Maramec	Wichita
Mohawk	Other Cultivars
Nacono	Large-Native (seedling) 60 nuts/lb or larger
Oconee	Small-Native (seedling) more than 60 nuts/lb.

- Each grower is allowed to participate at one county show of his or her choice.
- Each grower is allowed to enter one entry in each show class with the exception of Class 24 (Other Cultivars), Class 25 (Large-seedling) and Class 26 (Small- seedling)
- Each grower may enter one entry from each native (seedling) tree.
- Entries should be shipped or mailed to arrive at the show at least one day prior to the deadline.

- County pecan shows will not be affected by these rules and procedures.
- Samples will be placed in cold storage, and judged before the Oklahoma Pecan Growers Annual Meeting. At that time, the winning entries will be displayed with awards and recognitions. All entries will become the property of the OPGA.
- First, second, and third place winners in each class at the State Pecan Show will receive ribbons.
- State Pecan Show Special Awards – Plaques will be awarded for the largest pecan entry, the entry having the highest kernel percentage, the champion native and the best entry of the show.
- If a qualifying show is not available, growers may submit entries in accordance with these guidelines directly to the State Show. Entries in the state show must be received by January 23, 2015 at the following address:

Oklahoma State University
Department of Horticulture & LA
Attn: Becky Carroll
358 Ag Hall
Stillwater, OK 74078

J.D. "Scotty" Scott Horticulture Research Endowed Professorship

Thanks you to all who donated to create the Professorship and especially to Dwayne Scott for a generous donation to meet the$250 million goal. The Professorship will be named in honor of Dwayne's father. I also want to highlight Paul and Maxine Haydon contributions to start this fund and their continued annual donations. Those contributing to the Professorship are listed below.

The endowment is now a little over $1,000,000 since we received a 3:1 match from T. Boone Pickens and Oklahoma. Interest from this endowment will fund research on pecans, enhance the salary of the person holding the Professorship and a portion of the interest will be returned to the principal to offset inflation. Appointment to and Endowed Professorship is considered a prestigious position and with the salary enhancement and research funds it should attract the best and brightest candidates.

Now that the Professorship is established it ensures that any donations added to this endowment will receive a 3:1 match. A larger endowment will generate more money to support research. If you would like to contribute to this worthy endeavor send your check to Michael Smith, Department of Horticulture and Landscape Architecture, Oklahoma State University, Stillwater, OK 74078. The check must be made out to the **OSU Foundation**.

Paul & Maxine Haydon
Bert & Elizabeth Blumer
J.D. "Scotty" Scott
Dwayne Scott
G.F. Parsons
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Mike & Ellen Mayer
James Derby
Frances Aldredge
Larry & Jo Ann Lynch
Jim & Deann Smith
Darl & Andrea Mount
Harold Lester
Chuck Selman
Steven Raybourn
Al & Mary Newkirk
Scott & Janice Landgraf
Cecil & Kay Crabtree
Walt Thurn
Bill & Suzen Ihle

Research Professorship

We want to congratulate the OPGA and the Oklahoma pecan industry for reaching their goal of creating the J. D. "Scotty" Scott Horticulture Research Endowed Professorship. A sincere thanks to Dewayne Scott and all that contributed in making such a strong statement for the Oklahoma pecan industry. As long as matching funds are still available, we should not stop here. Remember every dollar raised, three dollars are matched to add to the endowed fund. Support and research from Oklahoma State University have been so important to the pecan industry not only in Oklahoma but nationwide. It is a big deal to be able to say that Oklahoma State University and the Oklahoma pecan industry will continue to have an impact on a national level for generation to come. Every OPGA member should be very proud.

Bill, Suzen and Joe Ihle

American Pecan Board Activity Report

Scott Landgraf

On September 3rd, the American Pecan Board (APB) met in Tifton Georgia. It was in conjunction with the Georgia Pecan Growers Association's Fall Field Day. The purpose for the meeting was to inform the USDA personnel assigned to write the proposed "Marketing Order" about growing pecans in the southeast US. The meeting was very similar to the APB meeting held in San Marcos Texas last July. At the Texas meeting Jim Smith and Chester Bench were ask to represent native pecans. They with other growers from Louisiana to West Texas, participated in trying to educate the USDA representatives about the diversity of pecans as their production. There was opportunity for industry leadership to ask questions or make points to improve the order.

The USDA people were taken on tours in both Texas and Georgia helping them to understand what they are writing a Marketing Order for. There have been discussions with them how the money will be collected as to how much the assessment will be. It appears that it will be collected at the "First Handler". At this time of discusion the assessment will be between 1 and 2 cents for natives and 2 to 3 cents on improved varieties.

There has been some discussion as to the framework of the governing board when the order is voted in. It appears that there will be a greater number of growers than any other entity in the pecan industry. There will likely also have some accumulators included as well as shellers. All of this will require significant definitions as description of process.

The next meeting will be in Las Cruces New Mexico on October 28. It will have a similar agenda and goal as the Texas and Georgia meetings of the APB. After this meeting, the writing of the order will begin. It will take several months and meeting for input before it can be presented to the Secretary of Agriculture. Then hearings will begin. The referendum could possibly be two years off.

Abstracts

HortScience (2009) 44:1914-1920

Effectiveness of State-level Pecan Promotion Programs: The Case of the Texas Pecan Checkoff Program

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Leonardo Lombardini, D*epartment of Horticultural Sciences, Texas A&M University, College Station, TX 77843-2133*

The Texas Pecan Board was established in 1998 to administer the Texas Pecan Checkoff Program and is financed through a half cent per pound assessment on grower pecan sales. The Board spends the assessment collections on a variety of advertising campaigns in an attempt to expand demand for Texas pecans and to increase the welfare of Texas pecan growers. This article presents an evaluation of the economic effectiveness of the Texas Pecan Checkoff Program in expanding sales of Texas pecans. First, the effects of Texas Pecan Board promotion on sales of all Texas pecans are determined using the ordinary least squares estimator followed by a test for differential effects of Texas Pecan Board promotion activities on sales of improved and native Texas pecan varieties using the seemingly unrelated regression estimator. The analysis indicates that the Texas Pecan Checkoff Program has effectively increased sales of improved varieties of Texas pecans but has had no statistically measurable impact on sales of native varieties of Texas pecans. A benefit–cost analysis determines that $35.0 in additional sales revenues are generated for every dollar invested in promotion, indicating that the Texas pecan promotion program has been financially successful. The per unit return is large but on a very few dollars available for investment in promotion implying the need for more investment for more meaningful returns.

Agricultural Water Management 124 (2013) 28– 36

Model of water and nitrogen management in pecan trees under normal and resource-limited conditions

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Nut production from pecans, almonds, and pistachios figures heavily in the economies of California, Texas, and New Mexico, as well as several other states, and surface irrigation water supplies have been reduced in low runoff years in the western United States. Water and nitrogen management in tree crops is constrained through lack of information and inability to provide targeted management. The goal of this research was to develop an improved management pecan model to monitor and predict water and nutrient demand and nutrient status in pecan trees, along with the interaction of nutrient and water stress on nut yield. The pecan nut tree model developed by Andales et al. (2006) had a nutrient uptake and allocation and nutrient stress subroutine added to the model to predict the interaction of water and nutrient stress (nitrogen and potassium). The nitrogen submodel presented simulates the interaction of nitrogen transformation, soil temperature, water, and nitrogen uptake to describe nitrate distribution in the root zone of a growing pecan tree for the entire growing season. The nitrogen submodel follows the nitrogen transformation equation developed by Jones and Kiniry (1986) for the CERES-maize model. The nitrogen root uptake submodel follows the approach developed by Yanai (1994), which is a model of solute uptake that accepts root growth, water uptake, and soil solution concentrations as time-varying inputs that interactively link plant and soil processes. The model was tested against a nitrogen–potassium water stress experiment conducted by Smith et al. (1985) in Oklahoma from 1978 to 1983 where the pecan trees received varying rainfall amounts, the only source of water, and four levels of nitrogen application. The measured yield response represented a water nitrogen stress response. The model over-predicted the yield by 42% compared to the measured yield, but the model under-predicted yield by 21% in 1981 with 0 kg/ha of applied N and under-predicted yield by 13% when 224 kg/ha N was applied that year. The current pecan model appears to simulate water stress reasonably well but may overestimate the nitrogen uptake by the pecan trees and underestimate the reduction in yield caused by nitrogen stress. The model also may overestimate yield through lack of an insect damage submodel.

Plant Disease (2010) 94:465-470

Insect Transmission of *Xylella fastidiosa* to Pecan

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Pecan bacterial leaf scorch (PBLS), caused by the bacterium *Xylella fastidiosa*, can cause economically significant crop loss to some pecan (*Carya illinoinensis*) cultivars in the southeastern United States. *X. fastidiosa* is typically vectored by spittlebugs (Cercopidae) and leafhoppers (Cicadellidae). Because no vector species had been reported for pecan, an attempt was made to identify potential vectors that are capable of acquiring the bacterium from infected pecan trees and transmitting to pecan. Several spittlebug and leafhopper species collected from various sources, including sorghum and pecan, were tested as potential vectors of the pathogen from pecan to pecan. When tested in groups, the pecan spittlebug, *Clastoptera achatina*; the Johnson-grass sharpshooter, *Homalodisca insolita*; and the glassy-winged sharpshooter (GWSS), *Homalodisca vitripennis*, had transmission rates to pecan of 11.4, 19.3, and 4%, respectively, following a pathogen acquisition period on infected pecan terminals. The pecan spittlebug is common in pecan orchards in the southeastern United States, and the GWSS was observed on young vigorous pecan shoots. Limited testing with the diamond-backed spittlebug, *Lepyronia quadrangularis*, and the lateral-lined sharpshooter, *Cuerna costalis*, suggested that these could be occasional vectors of *X. fastidiosa* to pecan. There is a need for studies on the identification and population dynamics of Cicadellidae that inhabit pecan orchards to determine if management of vectors is needed in commercial pecan production to reduce the spread of PBLS

Mycorrhiza (2012) 22:383–392

Mycorrhization of Pecan trees (*Carya illinoinensis*) with commercial truffle species: *Tuber aestivum* Vittad. and *Tuber borchii* Vittad

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Pecan *(Carya illinoinensis)* is an economically important nut tree native to the Mississippi basin and cultivated worldwide. In North America, species of truffles are regularly found fruiting in productive pecan orchards and the truffle genus Tuber appears to be abundant in pecan ectomycorrhizal (EM) communities. As an initial step to determine the feasibility of co-cropping European truffle species with pecan, we evaluated whether mycorrhizae of

highly esteemed European truffle species (*Tuber aestivum* Vittad. *T. borchii* and *T. macrosporum*) could be formed on pecan seedlings. Seedlings were inoculated with truffle

spores and were grown in a greenhouse for 10 months. Levels of EM colonization were estimated visually and quantified by counting EM tips. Ectomycorrhizae were identified both morphologically and molecularly with species-specific amplification and by sequencing of the

ITS region of the nuclear ribosomal DNA (nrDNA). Both *T. borchii* and *T. aestivum* spores produced well-formed ectomycorrhizae on pecan seedlings with average root colonization levels of about 62% and 42%, respectively, whereas no ectomycorrhizae of *T. macrosporum* were formed. The anatomy and morphology of these truffle ectomycorrhizae on pecan was characterized. The cocropping of *T. aestivum* and *T. borchii* may hold promise as an additional stream of revenue to pecan growers, although, further studies are needed to assess whether this symbiosis is maintained after planting in the field and whether truffle production can be supported by this host species.

Agri. Forest Ento. (2008) 10:363-373

Movement of adult pecan weevils *Curculio caryae* within pecan orchards

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The pecan weevil *Curculio caryae* (Horn) (Coleoptera: Curculionidae) is an indigenous pest of pecan *Carya illinoinensis* (Wangenh.) K. Koch, in North America. Understanding the movement of this pest from the orchard floor to host trees could lead to pest management practices that exploit weevil behaviour and thus reduce insecticide application to the entire orchard canopy. Furthermore, no information exists on diel periodicity of pecan weevil movement. Movement of adult pecan weevils crawling and flying to the host trunk, flying to the host canopy, crawling within the host canopy and flying between host trees was studied using four types of passive traps over four seasons. Each type of trap was used to capture weevils at different locations on or near the tree and to discriminate flying versus crawling behaviour. More pecan weevils crawl to the trunk than fly and a proportion of the population flies directly from the orchard floor into the pecan canopy. The majority of this movement occurs at dusk. The vertical distribution of weevils was generally uniform throughout the canopy but more weevils were captured in suspended traps nearest tree tops, rather than traps near the ground, when flying between trees and this was significantly so for two of 4 years. The results of the present study are contrary to previous reports suggesting that most adult pecan weevils fly to the pecan trunk after emergence from the soil; however, our results did indicate that a proportion of the population flies directly from the orchard floor into the pecan canopy and thus would circumvent strategies that attempt to control weevils moving up the trunk.

Irrig. Sci. (2013) 31:69-85.

Soil water depletion in irrigated mature pecans under contrasting soil textures for arid Southern New Mexico

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Relationship between plant water stress and soil water depletion (SWD) is not investigated thoroughly for irrigated pecans of southern New Mexico. In this study, transient soil water contents, rootzone SWD, and midday stem water potential (SWP) were monitored in mature pecan orchards in sandy loam (Site 1) and silty clay loam (Site 2) soils near Las Cruces, New Mexico. Corresponding to transient variations of soil water content at different depths, daily SWD varied with soil depth but not spatially. The SWD within the rootzone (0–80 cm) was higher in the shallow depths (0–40 cm) where root length density (RLD) was also higher than in the deeper depths (40–80 cm). The SWD at Site 1 was higher compared to Site 2 due to the higher clay content of the latter. The SWD patterns at outside the tree driplines were similar to those under-canopy locations because of similar RLD at the shallow depths. At both pecan orchards, differences in SWP at 2.5, 4.5, and 7.6 m tree heights were evident particularly 10–14 days after irrigation. This was due to the stress caused by decreasing soil water contents at different depths, which were generally significantly correlated with SWP. Midday air temperature was as useful as midday atmospheric vapor pressure deficit for interpreting SWP. Combined influence of soil water content (0–40 cm) and air temperature on midday SWP was significant at both orchards, which can be used as an adjunct for the clear interpretation of SWP to help refine irrigation scheduling.

Crop Protection (2012) 36:58-64.

Evaluation of a phosphite fungicide to control pecan scab in the southeastern USA

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Received 25 July 2011, Revised 14 January 2012, Accepted 16 January 2012, Available online 14 March 2012

The efficacy of phosphite, a potential elicitor of systemically acquired resistance (SAR) was compared to the protectant fungicide triphenyltin hydroxide (TPTH) to control pecan scab caused by *Fusicladium effusum*. Efficacy was evaluated in four field experiments over a two-year period involving biweekly foliar applications of both fungicides to trees of five susceptible cultivars of pecan (*Carya illinoinensis*) and assessment of disease severity on foliage and fruit. Both phosphite and TPTH reduced

scab severity on foliage equally well compared to the non-treated control, with the exception of one of the TPTH treatments in 2010. Both phosphite and TPTH provided equally good control of disease early in fruit development (Jul/Aug). However, by the final assessment (Sep/Oct), scab severity on phosphite-treated trees was most often greater than those receiving TPTH and in 2010, severity was equivalent to the non-treated control. Despite a suggested lack of late-season protection with phosphite, there was no difference in fruit volume between phosphite and TPTH-treated plots in 2009, and no difference in nut volume in 2010, although there were treatment differences in kernel weight and fruit weight in 2010. Phosphite-treated trees showed some symptoms of phytotoxicity. Regression analysis demonstrated the effect of scab on yield loss and confirmed the value of scab control on susceptible cultivars. *In-vitro* tests showed that phosphite is toxic to scab at rates applied in the field, thus implying direct fungitoxicity. Results indicate that phosphite provides useful control of pecan scab on both foliage and fruit early in the growing season, but might not provide prolonged late-season protection compared to an industry standard (i.e., TPTH).

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