

Organic Pecans

The pecan's name comes from an Algonquian word meaning "a nut that requires a stone to crack." Widely consumed out of hand and used as an ingredient in baked goods and confections, pecans are a good source of protein. And the antioxidants and plant sterols they contain may improve consumers' cholesterol status by reducing the "bad" LDL cholesterol levels.

Despite only having commercially produced the nut since the 1880s, U.S. growers now provide roughly 90 percent of the world's pecans, with an annual crop of about 200 million pounds worth about \$400 million dollars.

New ARS studies in Weslaco, Texas, are showing that it may be possible for growers to boost their revenue further by growing pecans organically.

In 2002, ARS scientists—led by Joe Bradford, research leader for the Integrated Farming and Natural Resources Research Unit in Weslaco—began transitioning part of a 27-year-old pecan orchard from conventional management to certified-organic management. The 20-acre test site is located within the Adolph (Sonny) and Noreen Gebert pecan orchard in Comanche County, in north-central Texas.

Bradford was contacted by Sonny Gebert in 2001, after Gebert tuned in to a radio show during which the two hosts mentioned Bradford's research on organic crops. Gebert then phoned Bradford, and the two arranged to meet in Goldthwaite, Texas, at a Texas A&M workshop in 2002. Gebert agreed to let Bradford and his collaborators manage half of the nearly 800 pecan trees in the Gebert orchard using organic principles. ARS would manage the older portion of the orchard, which was planted in 1981. The Geberts would continue to manage the newer portion, planted in 1986.

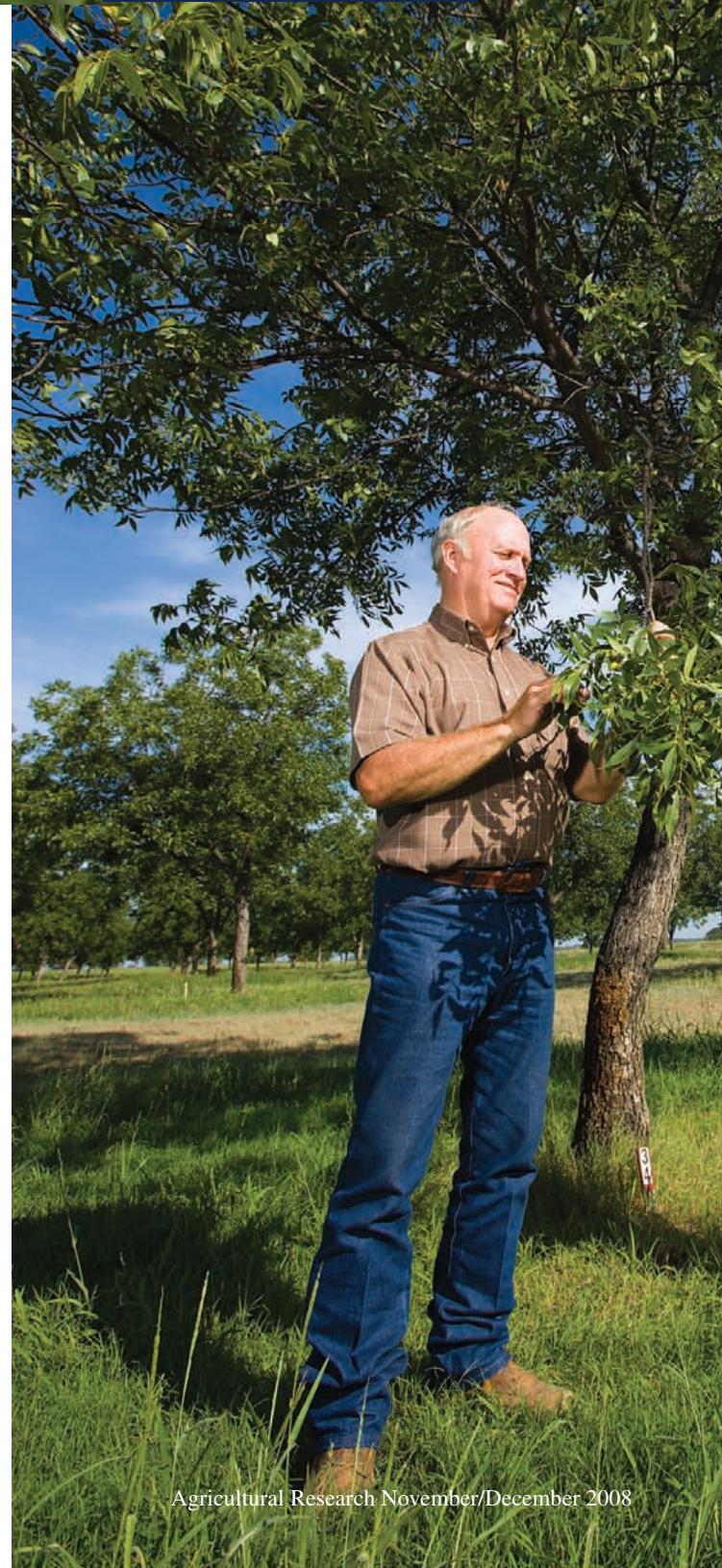
The main objective of the project is to provide pecan growers with information on how to convert to an organic system from a conventional management system that relies on synthetic chemicals. Bradford and his technicians are constantly changing the variables within the system and examining the interactions that result from those changes.

Healthier Trees From Healthy Soil

The ARS organic management system was based on first increasing soil organic matter, balancing the nutrients and biology of the soil, and using organic pesticides only when needed. Bradford theorized that by improving tree health through improved soil health, the trees would naturally become more

Left: Midseason organic pecan clusters indicating disease-free leaves and nuts and little insect damage.

Below: Retired Extension agent Danny Phillips (left) and soil scientist Joe Bradford examine trees within the organic orchard at the Sonny and Noreen Gebert pecan orchard for potential crop yield and possible diseases and insects.





Another Option for Growers

resistant to disease and insect attack. The researchers decided to evaluate several soil treatments in the test orchard and to treat the trees aboveground using organic methods. They began applying treatments in the fall of 2002, shortly after their first summer visit with Sonny Gebert.

They studied five pecan varieties—Caddo, Cheyenne, Desirable, Pawnee, and Wichita—applying various organic amendments several times during the year, both to the soil and to the leaves. As many as 15 soil fertility and biological treatments were applied, while the aboveground portion of the orchard received a uniform foliar treatment. Treatments used include poultry litter and compost, rock minerals, mycorrhizal fungi, and nutrients such as iron, zinc, boron, copper, and manganese.

Since the death of Sonny Gebert in early 2008, management of his pecan orchard has been taken over by Danny Phillips, a retired Extension agent from Hamilton County who is employed by Noreen Gebert. The ARS scientists continue to travel to the orchard about once each month from March until the November harvest—the growing season for pecans—to apply soil treatments and compost teas.

Larry Zibilske, a soil scientist in Bradford's research unit, became involved in the project during the 2008 growing season. He is measuring changes in soil microbial properties resulting from the various treatments applied over the last 6 years. As soil fertility increases with organic treatments, microbial populations benefit greatly. Not only do they become more diverse, they also take a more active role in providing nutrients to the trees and protecting the roots from pathogens. The key is to modify the soil microbial habitat so that the beneficial organisms persist and provide a lasting, nurturing environment for the trees.

Evaluating the Results

Contrary to conventional growers' expectations, the ARS organically treated test site outyielded the Geberts' conventionally managed, chemically fertilized orchard in each of 5 years. The best ARS treatment surpassed the Gebert control by 18 pounds per tree—44.10 pounds compared to 25.85 pounds—in 2005 and by 12 pounds per tree—45.09 pounds compared to 33.39 pounds—in 2007. Because pecans are an alternate-bearing tree, both orchards' yields were very low in 2004 and 2006.

"This is the most successful organic project I have been involved with," says Bradford. "The results are especially satisfying, because we have shown that it's possible to grow nuts under the organic system that are far superior in looks and in taste."

Technician Victor Valladares (left) and welder Emilio Chavez prepare compost tea by pouring compost into an extractor. After brewing, 60 gallons of a high-microbial-populated compost tea will be extracted and ready to be sprayed on the pecan trees.

Also involved in the project are plant physiologist Nasir Malik and entomologist Allan Showler, who both work in Bradford's unit. Malik and Showler will next compare some of the nutritional values of the organic and conventional pecans harvested this fall.

But What About Pecan Pests?

Another positive result was that the ARS researchers learned how—with the help of beneficial *Trichogramma* wasps—to control the pecan casebearer. As one of pecans' major pests, the larvae of this one-third-inch-long gray moth tunnel into the small, immature nutlets, killing them. The very tiny parasitic wasps of the genus *Trichogramma* lay their eggs inside casebearer eggs, turning them black and preventing the casebearer larvae within from developing.

As a backup control, the scientists used the organic bacterial insecticide known as "spinosad," which is derived naturally from a soil-dwelling bacterium, *Saccharopolyspora spinosa*.

The researchers also found that foliar applications of compost tea—a brew made of compost, small amounts of food sources for microbes, and water—somewhat increased trees' resistance to insects and achieved some disease control when applied each



PEGGY GREB (D1282-1)

month after flowering. They think that another major pest of pecans, the pecan weevil, was somewhat controlled by compost tea applied to soil. Additional research in 2008 will verify whether this treatment will be added to the recommendations by Bradford and his team.

Currently, ARS scientists are working to better control pecan scab caused by a fungus that, if not curbed, can cause entire crops from most varieties to be lost during periods of frequent rains or extended dew. Scab is the most destructive disease of pecans in the hot, humid South.

The researchers also believe that the alternate-bearing characteristic of pecan production will lessen—or disappear—after several years of organic management. ARS data shows that pecan trees in the Hamilton organic orchard bear 40 pounds per tree in the

good years and about 4 pounds per tree in the lower yielding years—a drastic difference that can make or break some of the smaller pecan producers. Bradford thinks that the organic system will eventually even out the wild discrepancies between the good and bad yields.

PEGGY GREB (D1283-2)



Compost tea is sprayed on the organic trees once every 6 weeks throughout the growing season. Compost tea improves plant health and helps to control insects and diseases.

"This year, which is the low-yield year in the alternate-bearing cycle, the conventional orchard has few to no pecans, yet our organic orchard has a lot of pecans. The typical 4 pounds per tree measured in 2004 and 2006 could be at least 15-20 pounds this year," he says.

Dollar Value

Pecans from the Gebert orchard generally sell for about \$2.00 per pound wholesale. Using the average yield for the conventional management system of 25 pounds per tree and roughly 35 trees per acre, sale of the crop generates about \$1,750 per acre ($25 \times 35 \times \2). But the ARS best-management organic system yield of 44 pounds per tree would gross \$3,080 per acre ($44 \times 35 \times \2), for an increase in sales of \$1,330 per acre. While production costs add about \$100 per acre, the value of the pecans is increased by at least \$1.50 per pound. Thus, pecans harvested from an orchard certified as organic would generate \$5,290 per acre [$(44 \times 35 \times \$3.50) - \100]—for an increase of \$3,540 per acre above the returns from the conventional management system.

These greater dollar returns prove that adopting an organic system and obtaining certification could provide a valuable additional source of income to pecan growers, thanks to increased yields and improved kernel quality.

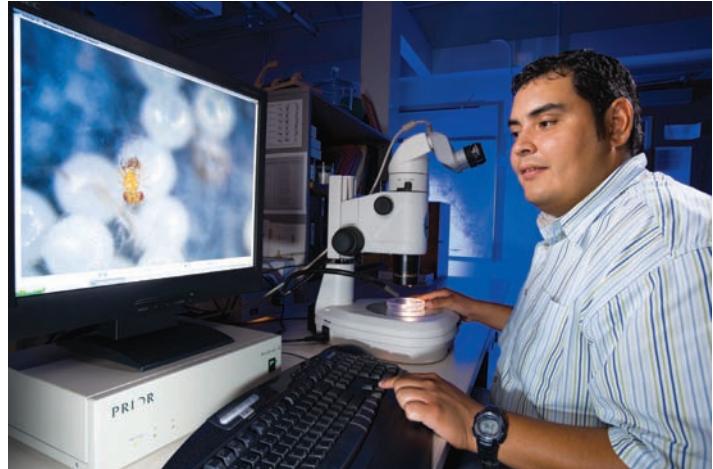
"I believe our greatest accomplishment is that we, as scientists, have shown it's possible to design a management system that growers will adopt," says Bradford. "That's really the biggest thing—to prove that this is a change for the better."

PEGGY GREB (D1284-1)



Technicians Veronica Guzman (left) and Rene Martinez process soil samples for organic matter analysis. Soils from the organic orchard have more organic matter and microbial activity than those from the conventional pecan orchard.

PEGGY GREB (D1286-1)



Using a dissecting microscope, biological science aid Jay Alejandro views tiny *Trichogramma* wasps parasitizing insect eggs. Wasps are released into the organic pecan orchard biweekly to control the pests.

PEGGY GREB (D1287-1)



Close-up of *Trichogramma* wasps parasitizing insect eggs.

He also notes that converting pecan production from conventional to organic can translate to other crops. "We think that the techniques we've tested here can apply to peaches, apricots, apples, walnuts—to all tree crops, and to plants in general."—By Alfredo Flores, ARS.

This research is part of Integrated Agricultural Systems, an ARS national program (#207) described on the World Wide Web at www.nps.ars.usda.gov.

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