

# Biological Management of Pecans

## Orchard Undergoes Transformation



by Dennis A. Perz & Steve Diver

After exhausting conventional growing methods, a program of organic inputs and biological treatments helped turn the tide at the Perz Pecan Orchard, transforming it into a profitable venture for owners Dennis and Marilyn Perz.

The 25-acre Perz Pecan Orchard is situated just north of Georgetown, Texas, in Williamson County — the heart of the Blackland Prairie. Most of the pecans produced at the orchard are sold at local farmers' markets and regional events and to a few commercial customers such as restaurants and food brokers featuring local and organic foods. They also ship pecans throughout the United States in gift packages.

### FROM COTTON TO PECANS

Previous owners established the orchard in 1978-80 on land originally used for growing cotton. Five varieties of bare root trees were planted at the recommendation of pecan specialists at Texas A&M University (TAMU). The cultivars included Mohawk, Choctaw, Desirable, Kiowa, and Cheyenne and totaled about 760 trees.

*A view of the lush Perz Pecan Orchard.*

The Perzes purchased the property in late 1996, even though the orchard was in poor condition. A number of trees had died and many others exhibited stunted growth. The irrigation system was in serious disrepair. Minimal attention had been given to the trees and infrastructure for several years and nut production was well below break even.

Following the pecan harvest in 1998, the Perzes assumed hands-on management of the orchard. Given the poor condition of trees growing on upland clay soils, a county agricultural agent and a TAMU pecan horticulturalist both advised that the orchard was neither viable nor worth pursuing. A local pecan grower enlisted as a paid consultant was more encouraging and provided helpful advice.

### CONVENTIONAL MANAGEMENT

A conventional management program as recommended by TAMU was undertaken and followed for six growing seasons from 1999 to 2004. The program relied on chemical fertilizers, herbicide

strips or circles around trees, and application of synthetic insecticides and fungicides to manage the trees and provide for control of pecan pests, which include pecan nut casebearer, pecan scab, pecan weevil, and on occasion, aphids.

During this time replacement trees were planted and successfully established, older trees stopped dying, the irrigation system was repaired and improved, and a new water well dedicated to tree irrigation was installed. The trees grew slowly and production increased, but financial results were still unsatisfactory.

Soil and foliar data collected annually indicated a significant mineral imbalance with deficiencies of sulfur, phosphorus, potassium, magnesium, copper, iron, manganese, and boron. This deficit level of minerals is atypical for Blackland Prairie soils and may have been a consequence of earlier cotton production. Poor fertility coupled with unsuitably shallow and tight clay soils made pecan growing seem impractical.



*Pecan tree with horse herb understory.*

### **SUSTAINABLE SWITCH**

In 2004, Dennis Perz attended a soil food web seminar held in Texas taught by Elaine Ingham with Soil Foodweb, Inc. (SFI). The biological approach she described — relying on soil food web activity to release nutrients and drive plant health — was a radical departure from the chemically-intensive, input driven methods recommended by TAMU.

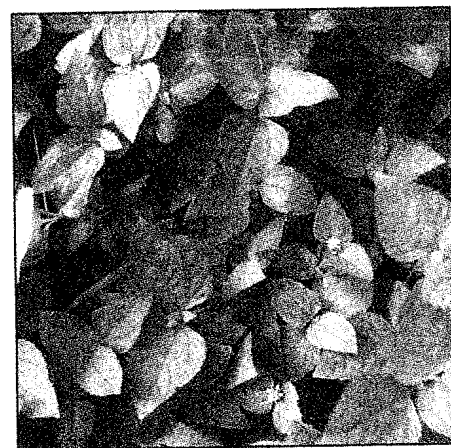
Eager to try a different approach, Perz contacted Betsy Ross, owner of Sustainable Growth Texas, LLC (SGTX), located in Granger, Texas, to get started. Ross had become a regional soil food web advisor with SFI while managing the family farm, a 530-acre grass-fed beef operation, with compost teas, liquid compost extracts and bio-stimulants. SGTX, a biological service company that manages large acreages of pastures, orchards, and landscapes in Texas with a customized bio-spray program, was an outgrowth of this experience.

For the last six growing seasons (2005-10) the Perzes have collaborated with SGTX to manage the orchard with organic inputs and biological treatments although the orchard is not certified organic. Commercial fertilizers were dropped the first year and haven't been used since. The only pesticide being used is spinosad — for control of pecan nut casebearer.

During this time, SGTX provided custom blended biological treatments

and the Perzes implemented organic orchard management practices. After years of chemical use, the first task was to restore life into the soil and invigorate the soil food web. With an aim to match microbial succession to a pecan forest ecosystem, all treatments have been geared toward promoting fungal soil ecology. A regular schedule of soil analysis and orchard walks has guided the process.

The biological treatments consisted of three or four applications at critical stages of the pecan trees' yearly growing and fruiting cycle. This was done using a sequence of bio-augmentation and bio-

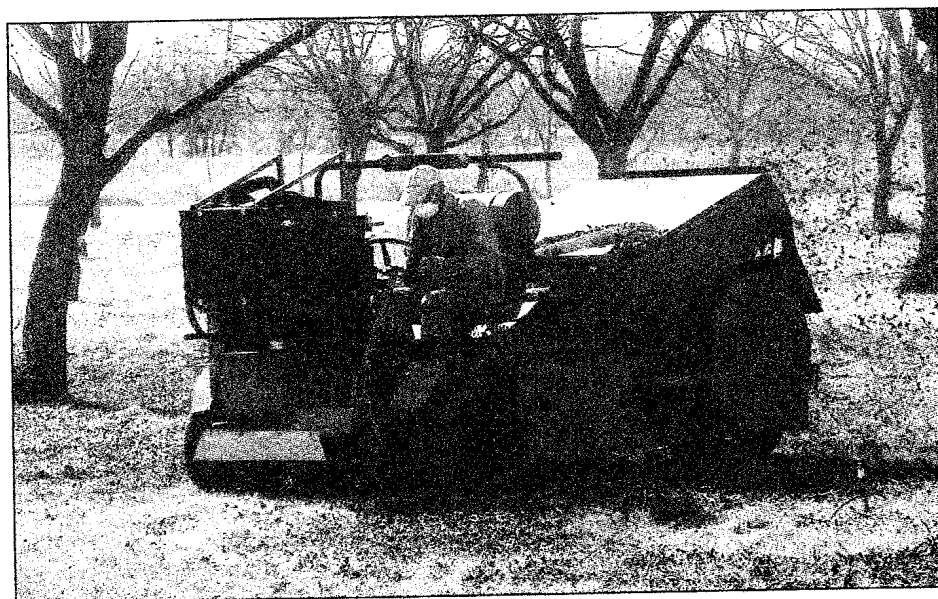


*Horse herb closeup.*

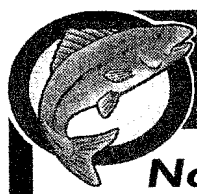
stimulation blends, applied as a liquid spray to soil and understory vegetation.

The Bio-Augmentation Mix contains a blend of liquid biological amendments (liquid compost extract and biological inoculants) as well as selected microbial strains that serve a special function. The mix includes ancillary carbon ingredients to feed the microbes when they land on new territory, trace elements, and homeopathic combinations. The goal was to add soil life, increase microbial diversity, and get more parts of the soil food web to start functioning.

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*Dennis Perz harvests pecans in Williamson County, Texas.*




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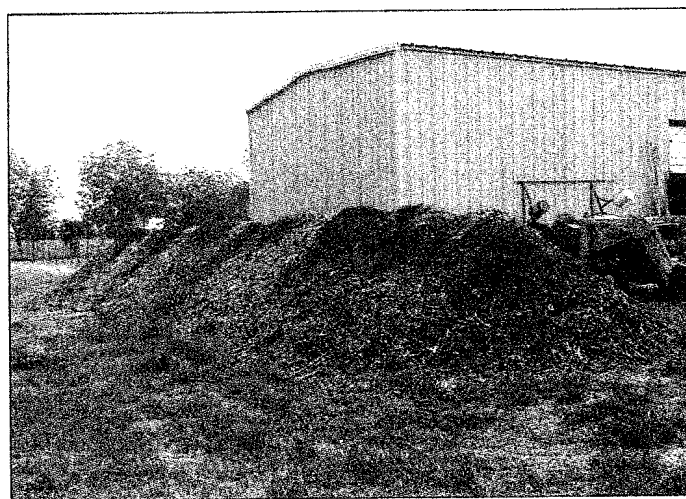
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soil food web functioning and to provide a boost of energy at critical times in the orchard year.

*Steinernema* parasitic nematodes are amended to the bio-spray a couple times each year for suppression of pecan weevil larvae, a biological control method verified by Dr. David Ilan-Shapiro with USDA-ARS in Byron, Georgia. Ectomycorrhizal inoculant is applied in combination with soil aeration in late winter, a method promoted by Dr. Joe Bradford, retired USDA-ARS scientist who conducted pioneering research on organic pecans in Texas. The ectomycorrhizal fungi help make phosphorus and nutrients more available through symbiotic root colonization.

Orchard management practices entailed mulching with wood chips around young trees, application of poultry litter and compost, amending rock phosphate to compost windrows, foliar zinc and micronutrients, irrigation, mowing, and sowing clovers. In addition, grafting and re-working a few trees is an annual task.



Compost windrow.


### FIELD NOTES

The Perzes share their observations and practices since adopting a biological management program at the orchard:

- Horse herb (*Calyptocarpus vialis*), a native woodland ground cover which thrives in fungal soil conditions, appeared under the largest trees in the orchard. But we didn't plant any horse herb; it arrived as a volunteer. Simultaneously, KR Bluestem — a lower successional grass requiring bacterial conditions — began to naturally disappear without any herbicides. This natural shift in vegetation continues to progress across the orchard.

- Repairs to irrigation lines and tees are an annual chore. Early on, a good year meant 50 to 75 upgrades. Digging in the tight soil during summer was hot and laborious. Two years into the biological program we completed 200 upgrades in a single season. The tilth and texture of the soil became noticeably looser and easier to dig in.

- Loosening of the soil had an immediate effect on tree growth and vigor. Expansion of trunk diameter was an early indicator of improved tree health. Twelve-inch tree trunks and larger are now common. During our years of conventional



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management lateral roots were absent in the orchard. Under the biological program, with improvements to soil tilth, aboveground spread of lateral root flares has become very noticeable. The presence of these lateral roots can be seen on older and younger trees alike.

- Foliar scorch, appearing in June through August, had been a yearly problem which we attributed to a mineral imbalance. Feeding the soil with organic matter (pelletized poultry litter from 2006-08, thereafter with compost) and spraying the soil with the bio-sprays has eliminated this problem. Maintaining healthy foliage throughout the growing season has been key to sustained tree vigor and growth. We had a record nut crop in 2007.

- Each year we judge and record notes on condition of trees, foliage, and nuts several times during the growing season. These kinds of records have proved invaluable. We see improvements in leaf color, leaflet size, and stem extension as well as retention of healthy, green foliage for longer periods through the fall.

We have experienced heavy flowering and fruit set in three of the last four years. A severe drought gripped Central Texas during 2008 and 2009 and damaged many pecan trees in the area. While nut size was small in 2009, the combination of soil biology, irrigation and well-timed fall rains produced an above average crop for the area.

- The return crop in 2010 has been unexpectedly large with many of the trees appearing overloaded. Ample fall and winter rains in 2009-2010 aided the drought recovery. We are expecting a record crop of large pecans.

- Greatly increased tree vigor and growth commencing with the biological program has forced us to deal with overcrowding. Though one of the hardest tasks for a pecan grower, we've begun cutting down and removing trees to open up the middles and allow better sunlight penetration, root space, water and nutrient availability. Tree wood is chipped on-site and composted in two large windrows.

- In 2009 we stopped buying poultry litter and have since relied on compost and winter-annual cover crops to supply organic matter and microbial food. The

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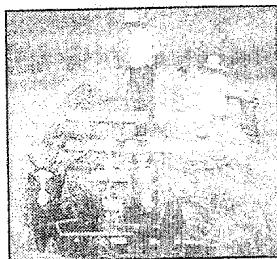
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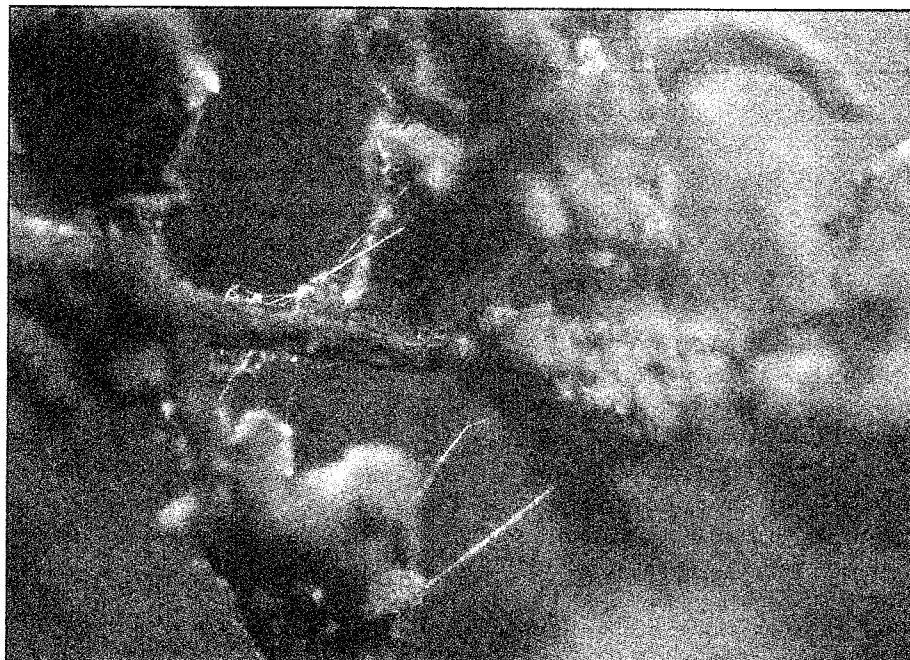
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cover crop mix includes native and seeded vetches and clovers, but the understory also includes a rich diversity of seasonal forbs and grasses, which we see as a reflection of belowground diversity. This understory, which we allowed to grow tall in the spring of 2010, serves as a source of biologically-fixed nitrogen, living biomass, soil organic matter, and beneficial insect habitat; plus it generates organic acids that aid microbial extraction of mineral nutrients in our alkaline soils.

• Insect and disease occurrence has been very manageable. We've had one significant scab event in 12 seasons, and do not plan to use fungicides. Spinosad is the only insecticide we use and only for pecan casebearers in years where IPM monitoring indicates the need. An entomologist at TAMU is using our orchard as a control site to study yellow aphids since we've never applied an insecticide for aphids. We have a few pecan weevils, but the population has not changed in the last five years. Diligent orchard floor sanitation and the parasitic nematodes added to the bio-spray mix are helping suppress pecan weevil larvae in the soil.



*Fungal hyphae colonize and link pecan roots and soil particles.*

As we make further improvements to the irrigation system, we judge that the biology continues to penetrate deeper into the soil, thereby reducing compac-

tion and aiding root growth in concert with mycorrhizal colonization.

Some questions remain to be explored. Can sufficient zinc nutrition through soil micronutrient sprays in combination with microbes be obtained? Currently the Perzes are putting on five to six foliar zinc applications per year. Can soil biology and winter legumes provide sufficient nitrogen over the long haul? Can return crops and good yields be maintained year after year, thus mitigating alternate bearing?

The orchard functions as a for-profit business and as a working model of a natural biological management system at work, and as an experimental laboratory where continuous, sustainable improvement is a long-term goal. Based on achievements with the biological approach thus far, the Perzes expect their trees will keep growing better and becoming more productive.

"All in all, our 'radical departure' from conventional pecan growing methods has been a successful and rewarding experience," said Dennis Perz.

Dennis and Marilyn Perz can be reached at 512-864-3828; Steve Diver at 512-944-8928; Betsy Ross at 512-636-3711 or visit [www.sustainablegrowthtexas.com](http://www.sustainablegrowthtexas.com).

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